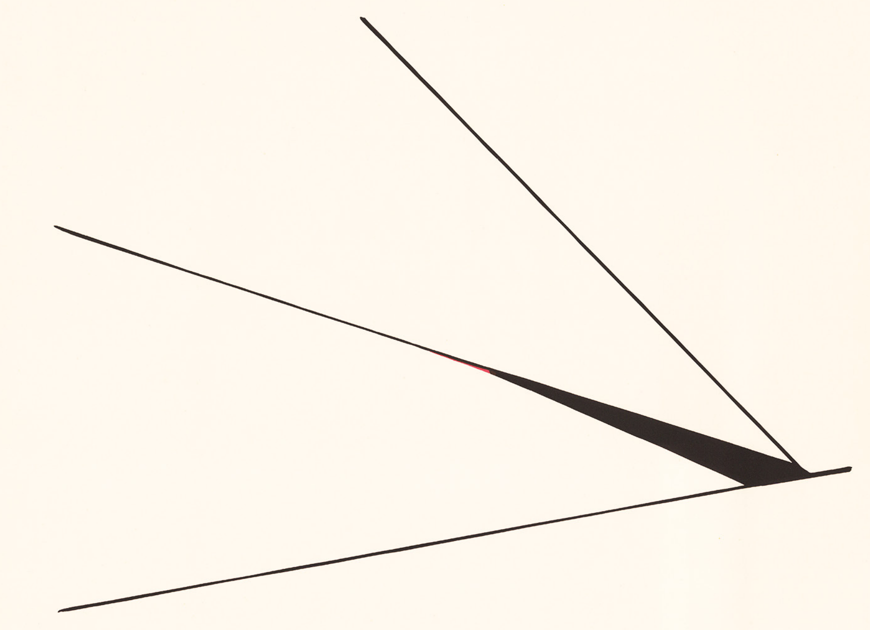
THE PANDORA SERIES

Bengt Olle Bengtsson

The Political Gene



Ideological Reactions to a Powerful Science

Arkiv

The Pandora Series

XXXIV

Books in the PANDORA SERIES focus on technology and society – possibilities, risks and uncertainties.

In Greek mythology, Pandora was given a box by the gods but told not to open it. Overcome by curiosity, she opened it anyway. Immediately, all kinds of trials and sufferings flew out over the world. The only thing that Pandora managed to keep in the box was Hope, which is why this has never abandoned humankind.

Editor: Boel Berner

THE POLITICAL GENE

Bengt Olle Bengtsson

The Political Gene

Ideological Reactions to a Powerful Science

LUND · ARKIV FÖRLAG · 2026

Arkiv förlag
Box 1559
SE-221 01 Lund
Sweden

STREET ADDRESS Stora Gråbrödersgatan 17 a, Lund
PHONE +46 (0)46-13 39 20

arkiv@arkiv.nu
www.arkiv.nu

Published with financial support from the Swedish foundations
Olle Engkvists stiftelse, Stiftelsen Längmanska kulturfonden och
Sven och Dagmar Saléns stiftelse.

This e-book from Arkiv förlag is distributed freely through open access.

The title is also available in two print editions:

ISBN: 978 91 7924 404 0
by Arkiv förlag with Swedish distribution

ISBN: 978 91 986454 3 9
by Arkiv förlag's imprint Arkiv Academic Press with international distribution

Cover design by Lars Jacobsen
Cover picture: Signed and numbered lithograph by Richard Mortensen (1910–1993)

E-book edition (PDF) 2026
Persistent link: https://doi.org/10.13068/9789179244057
ISBN: 978 91 7924 405 7
ISSN: 1404-000X

Contents

Preface

In 1973, while still a graduate student in Oxford, I decided not to continue as a molecular geneticist. I did not go on to a post-doc position in another lab in the UK or back in Sweden. Instead, I went to Paris and no particular position at all, with the aim of understanding why genetic systems evolve the way they do. (An *affaire de cœur* was also involved in this decision, as one might expect.)

I made the right choice. Definitely. I would never have become a good molecular biologist, and my choice of evolutionary genetics has given me many questions to work on and much pleasure over the years. (As has the *affaire*, which still enriches my life.) The decision came with an additional benefit. By not becoming a molecular geneticist, I have been able to follow the DNA sequencing revolution from a privileged position of part insider, part outsider.

Today, my knowledge of genetics is much more extensive than fifty years ago. So many new and interesting genetic results have been produced. There are, of course, still problems that I consider unresolved. For example, why do chromosomes sometimes change in evolution, so that we humans have 46 chromosomes while chimps and gorillas have 48?

I have also become more and more fascinated by the importance of genetics in the realm of politics. It is generally well known that questions concerning race, IQ and genes have been hotly debated during the last few decades. Still, such conflicts have been characteristic of genetics from its very start. Most political questions – whether they concern parliamentary democracy, gender relations or the future of humankind – have at one time or another been discussed in terms of genes.

My interest in this phenomenon lies not so much in the fact that conflicting interpretations arise over genetic results. This is not surprising – science and politics are fundamentally different in their nature and function. What has stimulated my curiosity has instead been the *richness* of ways in which the political ideologies have reacted to new genetic results – the mix of the foreseeable and the unexpected in their responses.

Interestingly, it would not have been possible to study these ways and processes some years ago. A reasonably trustworthy description of genetics as a politics-attracting science could not be written until the results of the first large-scale genome analyses had come in. Today, when such results are amply available, the past has become much better illuminated and more informative. Therefore, a comprehensive characterization of the political reactions to the science of genetics – and with a hint about what the future may bring – is now both possible and opportune.

Here is my account.

Lund, January 2025
Bengt Olle Bengtsson

1. Introduction: Genetics and ideologies

New genetic results easily gain political meanings. The associations may be direct or indirect, but they are almost always there. It is as if it were impossible to discuss an interesting fact about biological inheritance without associating it with some ideological standpoint.

Exactly what meaning will be associated with a particular genetic result is not automatically determined. Contradicting conclusions are often drawn from one and the same result. After having read a splashy news item on genetics in the morning paper, I have sometimes based my teaching later in the day on this result by showing what range of interpretations it may be given. For example, an article showing genetic differences between Swedes from the north and the south of the country can also be used to illustrate the opposite: how extremely *similar* these populations are. The example is innocuous but given the tension that adheres to all identity discourses, it illustrates how genetic results may easily lead to unforeseen controversies.

Processes that charge genetic results with political meaning have existed since the very start of genetics. To approach this phenomenon, it is helpful to turn to anthropologists and political scientists who argue that the formation of meaning is not a haphazard procedure. Instead, meanings are formed in relation to already existing *networks of meaning* – networks that make it possible for humans to navigate in our world. It is through them that we know what things around us stand for and how they are related to each other. The American anthropologist Clifford Geertz has called such networks 'cultural systems'.[1] We can think of them as world views, and they are often shared among people with similar economic backgrounds and social positions. In such world views one finds all kinds of knowledge about oneself, one's neighbours, society and the world-at-large, making it

1. Geertz (1973); see in particular pp. 3–33.

possible – to use a common metaphor – to walk around in life at reasonable ease without having to think where exactly one's feet are and how they best should be moved.

No socially shared world view is so complete that it covers all aspects of human life. Instead, following Geertz, it is better to think of us as moving in and out of such systems depending on the tasks that confront us. Clifford Geertz was an anthropologist of modern societies and when asked to name the cultural system with the strongest influence on our daily existence, he pointed to the political ideologies.[2] They provide the integrated meanings that structure most of our approaches to social life. Or, as the British political scientist Michael Freeden expresses it: 'We produce, disseminate, and consume ideologies all our lives, whether we are aware of it or not'.[3] Yet another important organizer of everyday meanings is religion; however, in contemporary Western society and with respect to the results and theories of genetics, its role is much less important.[4]

Thus, the political ideologies are fundamental in their function of explaining the world and providing recommendations for actions – individual and communal. They also expend considerable effort on updating their world views with topical facts.[5] This is why the political ideologies are so interested in new scientific results, particularly when these appear to support their fundamental tenets, not least the facts and findings of genetics. This situation provides the background and rationale for my analysis in the chapters that follow.

* * *

The outline of the present book is simple. I begin by situating genetics in a nineteenth-century tradition of using biology to explain social phenomena. I then follow in several chapters the history of how the knowledge of genes – as identified by Gregor Mendel in some carefully planned plant-crosses – entered the Western intellectual scene at the start of the twentieth century. To charter the political responses to this new knowledge, I

2. Geertz (1973), pp. 211–251.
3. Freeden (2003), p. 1.
4. Geertz (1973), pp. 93–135. Christianity will be touched upon a few times in the present book, though only briefly; see in particular the chapters on conservatism and Nazism.
5. They are also good at conveniently forgetting and repressing old views and interpretations by just letting them quietly wither away.

have chosen to describe the reactions of five important political ideologies: conservatism, social democracy, communism, Nazism and liberalism. I do write about how individual geneticists, or the scientific community, reacted to these ideologies, but my main focus is on the opposite process: the various ideologies' reactions to new genetic results and how these reactions changed over time. Some of these responses are well known, while others have never before been described. Or they include, as I will show, some previously unrecognized dimensions.[6]

My ambition for the book is high. Based on a structured approach to what scientific genetics is and how political ideologies function, I present a broad analysis of how dominant political ideologies have reacted to genetics since its start in the year 1900. This approach seems to me to be the most efficient one to capture the range of political reactions to genetics. Several specialist studies have investigated particular aspects of this history, while I here attempt a comprehensive overview (however incomplete it will necessarily be).

I start with a chapter that presents the origin of the notion of the gene in the early twentieth century. To understand why the gene and genetics would reach such political importance in the decades that followed, I then provide a necessary detour into nineteenth-century thinking about biology as an explanatory factor behind human affairs and the social and intellectual environment within which it gained importance. In Chapter 4, I chart the enthusiastic scientific reception of the rediscovery of the Mendelian laws of inheritance. I then close this introductory part of the book with a short discussion about the notion of political ideologies to be used in the following.

The second part presents my understanding of how the five major political ideologies of the industrialized world since year 1900 reacted to genetics. To recapitulate: conservatism, social democracy, communism, Nazism and liberalism. The chapters concentrate on different countries to avoid the impression that genetics is primarily an Anglo-Saxon preoccupation. The story is not chronological, even though I present the first four ideological families in a reasonably meaningful temporal order. Before the analysis of liberalism, however, I have inserted a chapter that discusses the advances and reorganizations of genetics that followed the Second World War.

---

6. Previous versions of Chapters 2 (The gene is born) and 7 (Communism and the rejection of genetics) have appeared in Swedish, see Bengtsson (2024 and 2022).

A broad brush is needed if the world's political and scientific development since 1900 is to be painted in a limited number of pages.[7] Technical explanations are avoided; instead, I strive to balance detailed examinations of interesting sources and events with more wide-ranging generalizations. References are occasionally given to other cultural spheres to show that the interactive processes discussed here are not unique for science. The book is neither an academic treatise nor a political pamphlet, but an extended personal essay.

In the text, I reflect continuously on the processes by which the results of genetics – with scientists striving to describe the living world in an objective fashion – become integrated into political thoughts and actions. This is not a question of a simple transfer of knowledge, as the initial analysis of conservatism will suffice to show. The ideological reactions to genetics encompass emotions as well as prejudices, brave linguistic acts as well as unquestioned self-evidences. In the final chapter I discuss the advantages that come with taking an 'anthropological' approach to the political interest in genetics – an approach that treats science and ideologies as powerful social practices – and not just seeing the duo as two conflicting truth-systems. That ideologies and sciences differ from each another hardly requires any further illustration. Instead, it is their fascinating and surprising interactions that need richer and better descriptions – in particular since the themes involved show a tendency to reappear unexpectedly. The book therefore ends with a brief outline of an old socio-political topic related to inheritance that is not covered in the discussion of the five main ideologies, but which perhaps is due for reconsideration: Will knowledge about filiation and kinship, now detected via DNA-sequence identities, affect our future feelings of attachment to and solidarity with others?

---

7. My dependence on a large number of studies in the history of genetics and eugenics is obvious, and I apologize to all authors whose valuable work I have used but do not refer to; the field is clearly too large for a complete review. Many philosophers interested in epistemology have likewise written interestingly about problems that come up in my analyses; I limit myself, however, to a small number of ideas that I consider genuinely helpful for my endeavour. I have been much aided by dictionaries, in particular Williams (1976) and Rieger, Michaelis & Green (1976 and 1991). *Svensk politisk uppslagsbok* [A Swedish Political Encyclopaedia] by Dahlberg & Tingsten (1937) has also been very useful, being written in the mid-twentieth century by a geneticist and a political scientist, who both appear in their own right later in this book. – When a quote from a non-English source has no reference in the English language, I am responsible for the translation.

I know that my high ambitions for the book will fail. My intimate knowledge of genetic research from the last half-century may be of advantage for my quest, but it is also a hindrance because of the biased stance that must follow from it. The book is perhaps best seen as similar to a scientific intervention: I gather evidence and present my conclusions based on them as best I can. I then rely on others – my readers – to disagree with my reasoning, indicate my blind spots, and complement the topics I have covered too briefly.

There is no better way to advance knowledge.

2. The gene is born

A new word

Like all other natural sciences, genetics is built around a number of keywords with closely interlinked meanings. At its centre stands the term 'gene', coined in 1909 by the Danish plant physiologist Wilhelm Johannsen in a widely read textbook written in German, the world's leading scientific language at the time.

Around this key-concept, an international research community developed, which regarded itself as creating a thoroughly modern science, soon to be called genetics. To understand its relationship to politics, it is necessary to comprehend some of its distinctive characteristics. For this purpose, we will follow the subject's early development until it had formed a firm theoretical base and was considered, by contemporaries as well as by us today, to be a well-founded natural science. Our road goes from the gene and its linguistic relatives, via the special character of the genetics community, to the formation of the subject's theoretical kernel. All as a preparation for the next two chapters' description of the intellectual environment into which early genetics entered and gained political significance.

The birth of the gene

Wilhelm Johannsen enjoyed writing, and doing so in German came easily to him.[8] After having studied as an apprentice pharmacist in various German towns, he was employed by the Carlsberg Laboratory in Copenhagen in 1881. Here, he worked on plant-physiological projects but also became known for his ability to teach, which led the University of Copenhagen to ask him to give a series of lectures on *Arvelighedslærens Elementer* [The Elements of Inheritance Analysis]. A book based on these

8. See Rosenvinge (1927/28).

lectures was published in 1905, and soon afterwards Johannsen started to write an extended version in German.

The field of inheritance studies was then in rapid development, and Johannsen saw as his task to bring intellectual precision to the field. Thus, he chose as the title for the German version of his book, published in Jena in 1909, *Elemente der exakten Erblichkeitslehre* – note the added specification!

Johannsen stressed the importance of demanding full control over the material used in inheritance studies. Such control is not always easy to achieve, since things that look the same may differ in their underlying biological make-up, a fact that only careful analyses of offspring will reveal. Using two new terms coined by Johannsen in his book, we can express the point he wanted to make by saying that an organism's *genotype* (its set of genes) can never be directly known from its *phenotype* (its observable characteristics) alone.

In his attempt to increase the logical stringency in discussions on heredity, Johannsen found it necessary to introduce a new term for that thing – '[d]ieses etwas' – which makes a cat a cat and a dog a dog and the two different from each other.[9] Most writers after 1900 had followed Mendel's rediscovered article and used his word 'Anlage' (in English normally translated as 'factor') for this purpose, though Mendel occasionally also used the vaguer word 'Element'.[10] These two words were, however, not the only terms in use for the smallest unit of inheritance. An important alternative was the word 'pangene', introduced by Charles Darwin in 1868 when he tried to formulate a theory of inheritance that would support his views of evolution.[11] Wilhelm Johannsen did not agree with Darwin's speculative inheritance ideas, but he liked the second part of his term. Thus, on page 124 in his *Elemente der exakten Erblichkeitslehre* we find the sentence: 'We will instead of "the pangene" and "the pangenes" quite simply say "the gene" and "the genes".'[12] And, so, here it was: a new term had been coined.

Johannsen was not ignorant of what normally happens to invented scientific terms: they very soon become completely forgotten. In his

9. Johannsen (1909), pp. 123–124.

10. Mendel 1866. On Mendel's choice of words, see Fairbanks & Abbott (2016) and Hall & Müller-Wille (2024).

11. Darwin (1868).

12. In German: Wir werden somit für „das Pangen" und „die Pangene" einfach „das Gen" und „die Gene" sagen.

Foreword, he therefore wrote that only the future would tell if the terms introduced in his book would find general acceptance, or not.[13] His lack of confidence was, however, unwarranted. The word 'gene' spread and would soon be found in languages all over the world.

An accepted term

What was so important about Johannsen's linguistic act?

He directly answered the question himself: 'Das Wort Gen ist völlig frei von jeder Hypothese', which can be translated as: 'The word gene is completely free from all previous associations'.[14] The exact science of inheritance that he wished to formulate needed at its base a fresh term, untainted by prior external meanings. Johannsen probably thought that if he could introduce such a new word and specify its exact meaning, it would keep its meaning unchanged for as long as the term was in use. Little did he know what the future would bring.

One could say that my book deals with all the wider meanings that have been attached to the word 'gene' since Johannsen's time. One must, however, also acknowledge that this fate is not unique for the word gene. *All* fruitful scientific terms become associated with additional meanings when their use is stretched in new and unforeseen directions.

The most remarkable fact about the word gene is instead that it still belongs to the everyday parlance of professional geneticists. The term is used in laboratories and lecture halls all over the world, and only rarely does it lead to confusion or misunderstanding. This continued terminological usefulness is an impressive feat of a word whose core meaning has changed over time – from what makes a cat a cat, to what causes a pea flower to be pink or white, to being a special place along a chromosome, to what rules development, to be a base-pair sequence in a stretch of DNA, to what affects heritable risk for a disease, to… By retaining its original meaning while constantly adding new facets to it, 'the gene' has shown itself to be one of the most productive scientific concepts ever conceived.

It was, as Johannsen noted, uncertain what would happen to the word after it had been introduced. Today we can see that its wholehearted acceptance by Thomas Hunt Morgan determined its fate. Morgan was professor of zoology at Columbia University in New York and leader of a

13. Johannsen (1909), p. iv.
14. Johannsen (1909), p. 124.

research group studying inheritance using the small fruit fly *Drosophila*.[15] He was originally interested in the development, and not in the inheritance, of variable traits, but he became fascinated when he saw what range of experiments the quick-breeding flies could be used for. With money from the Carnegie Institution, he and a group of collaborating assistants organized a well-functioning laboratory that, from around 1910, became the world's centre for genetic research.[16] Here, evidence was assembled that genes are parts of chromosomes and that genes recombine via the cellular process called crossing-over. Detailed genetic maps were produced showing where on the chromosomes the different genes – with names like white, bent, hairy and bithorax – are situated. And in 1915, Morgan, with his assistants Sturtevant, Muller and Bridges, published a highly influential textbook, *The Mechanism of Mendelian Heredity*, which together with Johannsen's more theoretical book became standard reading for all aspiring geneticists.

The expression 'Mendelian factors' is found already in the preface to the book, which shows that the authors still adhered to the old way of naming the basic heritable unit.[17] However, only two years later Morgan published a paper in *The American Naturalist* with the title 'The theory of the gene', thereby publicly announcing his conversion to Johannsen's terminology.[18]

The acceptance of the term 'gene' by Morgan and his colleagues helped spread its use and become the standard word for the functional unit of inheritance. In addition, the Drosophilists caused new meanings to be conferred on other terms by elucidating the relationship between them and the genes. Thus, the *chromosomes* were soon not just molecular threads that could be seen in a microscope; they were the physical carriers of the genes. Similarly, the cellular process called *meiosis* was not just a way to produce eggs and sperm/pollen, but the mechanism that allowed recombination between parental gene-sets to occur. In this way, a network of associated meanings, with the new term 'gene' at its centre, became spun between important biological phenomena.

15. On the importance of this research group, see Dunn (1965) and Kohler (1994). In 1933, Morgan became the first recipient of a Nobel Prize (in physiology and medicine) awarded for genetic research.

16. US philanthropic organizations have been very important for the development of genetics. The Rockefeller Foundation, for example, has had a strong influence on genetics' relationship with the social sciences; see Kay (1993).

17. Morgan, Sturtevant, Muller & Bridges (1915), p. ix.

18. Morgan (1917).

The birth and development of the 'gene' coincided with a similar but independent linguistic novelty: the introduction of the term 'genetics' for the scientific study of inheritance. This newly created word was publicly introduced in 1906 by the English evolutionary biologist William Bateson. It was based on the same language root 'gen-' that Johannsen would later use for the word 'gene'. On the global scene, it gradually came to replace the alternative terms 'Mendelism' and 'Erblichkeitslehre' [inheritance knowledge], where the latter word was used in German (and with minor linguistic changes in Dutch and the Scandinavian languages). However, in this case the process took decades rather than years.[19] While 'gene' worked well in all scientific circumstances, 'genetics' for some considerable time retained its association with the UK-US scientific environment.

The early geneticists

By 1918 and the end of the First World War, we can see that an exciting new research field had come into being. It now had its own catchy name, famous laboratories, well-written textbooks and characteristic keywords. Its practitioners often showed a post-war sense of urge, based on the feeling that genetics could be useful to society. Perhaps even more important was their belief that some of life's greatest mysteries finally were on their way to be solved.

Forcefulness

To understand this feeling of excitement, we can do no better than return to an outburst that William Bateson – the man who invented the term genetics – had made some years earlier, in 1900, when lecturing to the prestigious Royal Horticultural Society in London. His frustration over how little current biology understood about inheritance is worth quoting at length:

> How far have we got towards an exact knowledge of heredity, and how can we get further? … Let us recognize from the outset that as to the essential nature of these phenomena we still know absolutely nothing. We have no glimmering of an idea as to what constitutes the essential process by which the likeness of the parent is transmitted to the offspring. We can study the process of fertilization and development in the finest detail which the microscope manifests to us, and we may fairly say that we have now a thorough grasp of the visible phenomena; but of the nature of the physical basis of heredity we have no conception at all. No one has

19. See Dunn (1965), p. 69.

> yet any suggestion, working hypothesis, or mental picture that has so far helped in the slightest degree to penetrate beyond what we see. The process is as utterly mysterious to us as a flash of lightning is to the savage. We do not know what is the essential agent in the transmission of parental characters, not even whether it is a material agent or not. Not only is our ignorance complete, but no one has the remotest idea how to set to work on that part of the problem.[20]

We can still today feel the depth of Bateson's frustration and understand it, when we consider how long it took, and how many important research breakthroughs were needed before anything approaching an understanding of the 'essential nature' of inheritance was reached.

Still, Bateson's message to his audience in May 1900 was not altogether pessimistic. He had just read Mendel's description of his experiments with peas and thought that an interesting methodological opening might exist there. If one for the moment ignored the question of the *essence* of heredity, one could instead, he argued, 'study the outward facts of the transmission [of characters]. Here, if our knowledge is still very vague, we are at least beginning to see how we ought to go to work.'[21]

Bateson's conclusion was thus of the same kind as that of the drunkard who searches for the house-keys under the lamp-post: 'It may very well be that I ought to look for them where I lost them, but I prefer to look for them here where I at least can see *something*.' Hence, it was, according to Bateson, better to study traits among offspring from carefully planned crosses – all in the spirit of Mendel – than to fumble around with experiments the results of which no one knew how to interpret. Thus, Mendelian inheritance studies turned into a mode for understanding important questions – and *understanding them in a new way*.

The scientific revolution that came with early genetics was, thus, not so much a change in what new facts were learnt as a shift in what it meant to understand inheritance. As one may expect, this transition was not easily made. Many, both within and outside academia, rejected the suggestion that some of life's deepest and most profound mysteries could be understood from counting droves of dead flies.[22] But some saw the light, were alerted to the opportunity, and found it easy to strike up associations with like-minded souls. They were 'the Mendelians', soon to turn into 'the geneticists'.

20. Bateson (1901), pp. 155–156.

21. Bateson (1901), p. 156.

22. One of the aims of Morgan's *American Naturalist* paper from 1917 referred to earlier, was to criticize those who argued 'that Mendelian phenomena are "unnatural", and that they have nothing to do with the normal process of heredity…', pp. 513–514.

To illustrate the almost sect-like sentiment among those who shared Bateson's optimism about the potentialities of Mendelian analyses, I will give an example from my hometown, the university city of Lund in southern Sweden. In December 1910, some plant breeders, university botanists, medical doctors and interested laymen met in Lund to start a society for the promotion of scientific inheritance studies.[23] It was to be called the Mendelian Society of Lund. The young and dynamic plant breeder Herman Nilsson-Ehle was elected as its first chairman. The German geneticist Erwin Baur soon was informed about the event. He published a note about it in *Zeitschrift für induktive Abstammungs- und Vererbungslehre*, the only journal at the time specifically devoted to inheritance studies.[24] A long line of national genetics societies followed suit.[25]

The next natural step was to organize international meetings for scientists working on inheritance. The history of the important series of International Congresses of Genetics illustrates the forceful nature of the new practitioners, and of William Bateson in particular.[26] He was one of the hosts of the third International Conference on Hybridisation and Cross-Breeding of Varieties held in London in 1906 (the first had met in London in 1899, the second in New York in 1902). He managed to persuade the ongoing conference to adopt his newly invented term and change its official topic to that of genetics. Because of a wish to keep to the numbering of conferences this meant that the 1899 meeting became the first international meeting on genetics – many years before the term had even been invented![27] The following conference took place in Paris 1911; the 1914–18 war then interrupted the series. The next International Congress of Genetics was not held until 1927, when Erwin Baur organized it in Berlin. By that time, scientists were working on genetic questions in almost every country in the industrial world. The institutional basis for

23. Höglund & Bengtsson (2014).
24. Baur (1910/11), p. 292.
25. An obscure Mendelian Society existed slightly earlier in England, created for the purpose of publishing a periodical, *The Mendel Journal*; see Radick (2023), p. 480, n. 71. It disappeared, however, without leaving much trace, while the society in Lund came to be of great importance for the development of genetics in Sweden and Scandinavia; see Tunlid (2004). The well-known Genetics Society of Great Britain was founded in 1919; some later examples are the Genetics Society of Japan (1920), the Genetics Society of America (1931) and the Indian Society of Genetics and Plant Breeding (1941).
26. See Dunn (1965), p. 68.
27. See Table 1 in Haynes (1998).

their activities would, however, vary widely (being university departments, hospitals, plant-breeding institutes…).[28]

A modern science

Thus, the early geneticists were a forceful and distinctly successful group. To them, the importance of genetics did not only depend on its new results, but on it being a *modern* science. It was a science with a promising future, and a science able to act as a model for other scientific endeavours.

This brash attitude was primarily directed against – what the geneticists regarded as – the old-fashioned research practised in the classical university disciplines of botany and zoology. The geneticists saw their own science as less descriptive and more question-driven than what was standard in academic biology departments. Geneticists produced large amounts of data (all those sorted peas and flies!) and found it self-evident that modern statistical methods should be used for their analysis. They were distinctly multi-disciplinary in their approach and could, as for example William Bateson did, change from investigating animals to studying plants (and vice versa). It was also considered modern for a science to present itself as willing to help rebuild war-torn societies on the basis of hard, but applicable, scientific principles.

This sentiment of being modern infused early genetics in all its aspects. One odd effect of this view was that its practitioners afforded themselves no history. They saw genetics as a completely *new* science, born in a miraculous way in the year 1900 with the rediscovery of Mendel's analyses. There was, of course, much talk about inheritance earlier – but that was no longer of any substantial value. The science of genetics was unburdened by any historical baggage. Like a mathematical theory, it was built from new, few, and simple truths.

Associated with this feeling of representing a fresh start came a 'will to power', since being modern also meant being the ultimate winner. The early geneticists strove towards the goal of showing that *all* aspects of inheritance conformed to the rules of Mendel in one way or another. According to them, genetics did not just explain some fascinating parts of the phenomenon of heredity, like the colour of the flowers in peas

28. Subsequent congresses were held in Ithaca in 1932 (where Cornell University resides, close to New York), in Edinburgh in 1939 (after a failed attempt to organize it in Moscow) and in Stockholm in 1948. By then, all the most important countries in the early history of genetics had hosted the congress at least once.

or the wing pattern of some fruit flies. No, the effect of genes was to be seen *everywhere*, and genes could and would explain *everything* to do with inheritance.[29] Not surprisingly other biologists – those who did not see the light – found such claims full of hubris.

For our future analyses of the political reactions to genetics, these feelings among the early geneticists are worth remembering. Genetics has always been – and been seen as – a forceful science, willing to throw old, well-accepted truths overboard. And as an endeavour it has always found a legitimacy in the great things that it will achieve in the future – and not in its history. Genetics did, of course, value what had already been achieved in its name, but by insisting on it being absolutely modern, it demanded to be judged not by what had been, but by what would come.

Some of these claims were, admittedly and actually, correct. For example, the unusually high frequency of women in early genetics illustrates the subject's non-traditional nature. Bateson enrolled several women students to analyse his various breeding experiments.[30] And, similarly, though at a more advanced level, women constituted the majority in Morgan's research group on *Drosophila* at Columbia, at least up to 1915.[31]

This shows that early genetics was associated with the fresh air of a modern natural science. Typically, none of the female students referred to above became famous as research geneticists later in life – most seem to have gone into various teaching positions. There was, however, one woman scientist of international renown among the early young geneticists, the Norwegian zoologist Kristine Bonnevie. Her work on the development of germ cells was highly respected. She became Norway's first female professor in 1912, in zoology, at what today is Oslo University, where she founded an 'Institutt for arvelighetsforskning' in 1916.[32]

---

29. The Mendelians knew from early on about the deviating phenomenon of cytoplasmic inheritance (today explained by genetic material in mitochondria and chloroplasts); it was, however, considered a not very relevant special case.

30. Richmond (2001). He did this in collaboration with Edith Saunders in Cambridge, who was an early important contributor to the development of plant genetics. See Haldane (1945).

31. Kohler (1994), p. 95.

32. Stamhuis & Monsen (2007). In the Netherlands, Tine Tammes, with a career similar to that of Bonnevie, had to wait until 1919 before she was appointed extraordinary professor to a chair in variability and heredity at the University of Groningen. The appointment was made after supportive interventions by Erwin Baur, Herman Nilsson-Ehle, Wilhelm Johannsen and William Bateson, all of whom we have already met in this chapter. It shows how small the network of early geneticists was; see Stamhuis & Monsen, p. 439.

Should we then follow the development of the discipline a bit further, we encounter the young Barbara McClintock at Cornell University (where she got her PhD in 1927). She was an early expert in combining formal maize genetics with detailed cytological investigations. Hers was an impressive, though sometimes troubled, scientific career that culminated in her receiving the Nobel Prize in 1983 for her studies on transposable elements ('jumping genes').[33]

Towards a scientific theory of the gene

If genetics was an unusually modern science in its research methods, social setup and rejection of previous history, it represented something new also when it came to what objects it dealt with and what kind of insights its experiments produced. This novelty was due to many reasons, but in particular to what by now had become obvious to all: The gene is a very strange object. It took considerable time to find a position for it in a satisfying and well-founded scientific theory.

Genes are strange

Like the quantum in physics – discovered by Max Planck in 1900 – the gene differed in many ways from other objects inside and outside science. It could not be seen, not be handled, not be concentrated in test tubes and not be manipulated. Even its material nature could be questioned (as shown by the quote from Bateson above, where he wonders about the 'physical basis of heredity'). It could not be pictured – how genes functioned was, nevertheless, constantly illustrated in drawings to explain pedigrees where, for example, eyes of different colours were seen to mate with other eyes and produce offspring eyes of segregating types. It was an attempt to make the incomprehensible comprehensible – but it often failed.

Still, the gene carried enormous explicatory power. Based on the gene concept, satisfying explanations could be given as to why a pink-flowering pea plant could produce a fair proportion of white-flowering offspring when crossed with itself. Or why two healthy parents would have a substantial risk – not a big one, nor a small one, but an intermediary one of exactly 25% – of producing children with some devastating disease. It was a strong, albeit strange, explanatory factor!

The life of the German geneticist Elisabeth Schiemann is discussed in Chapter 8 on Nazism; for a discussion of the gender aspects of her career, see Stamhuis & Vogt (2017).

33. See Keller (1983) and Fedoroff (1994).

There was, however, a painful limitation to the gene's explanatory power. Knowing about it was of no help to the worried parents – there was no way of manipulating or influencing the genetic configuration that their next child would be born with. Thus, a gene was a causative factor *over which no one could have any direct control.* Strange, and unusual, indeed. With hindsight, we understand today that the gene was one of those objects that turned the natural sciences away from embracing the ideal of perfect Newtonian causation and control, towards accepting explanations based on probabilities.[34]

Genetics as a research programme

Being able to do experimental research with 'the gene' as a key-concept is one thing; having an intellectually satisfying theory of inheritance is another. From what time was there, what we may call, a true theory of genetics?

Such a theory certainly did not exist in Mendel's otherwise fundamental writings. It can be claimed – unfairly but correctly – that in many ways Mendel did not understand what his results meant.[35] The brilliant conclusions that he reached from his pea experiments did not constitute a genetic theory worthy of its name. The same goes for Bateson – his coining of the term genetics and his advocacy of Mendelian analyses did not imply that he had any genuine theory of inheritance.

Based on the philosopher Imre Lakatos's writings on 'research programmes', I would argue that early genetics did not gain a well-functioning scientific theory until the question of the gene's material status had become firmly settled.[36] This was a *sine qua non* for geneticists if they wished to claim that they represented a sound research programme within the natural sciences.

Well-functioning scientific theories are, in Lakatos's view, characterized by having an intellectual centre, a core, that their practitioners

---

34. This development, which in physics primarily occurred during in the last decades of the nineteenth century, is outlined by Hacking (1990).

35. In his book on the Copernican revolution the American philosopher of science Thomas Kuhn makes a distinction between 'revolution-making' and 'revolutionary' scientific texts; Mendel's articles definitely belong to the first kind. See Kuhn (1957), p. 135.

36. Research programmes – spelled in this way – is a key concept in Imre Lakatos's philosophy of science. The key reference to this philosophy is Lakatos (1970, reprinted in Lakatos (1978)). For an introduction to his thinking, see Larvor (1998). On his importance for understanding how science actually functions, see my discussion in Chapter 12.

regard as immune from questioning.[37] Scientists who rely on a scientific theory are perfectly ready to sidestep empirical observations that run counter to it, since they believe more in the basic theory of their science than in their own empirical results, however carefully obtained. Over time, scientists provide – in the nomenclature of Lakatos – 'the hard core' of their research programme with a 'protective belt' containing auxiliary notions that function to save the theoretical centre from unnecessary and time-consuming questioning.[38]

Genetics seems to me to have gained such a well-protected theoretical centre between 1915 and 1920.[39] Earlier, the uncertainty about the gene's material nature prevented its formation, since no one knew what strange results might turn up in the next experiment. However, with the general acceptance that genes are to be identified with material parts of chromosomes, the theoretical foundation of genetics rapidly solidified. Since then, a central core of a theory exists that all who consider themselves as geneticists have been ready to support.[40]

Around 1920, therefore, the research programme for genetics may be regarded as existing and well-functioning. From then on, it has constantly renewed itself – though always retaining the notion of 'gene' at its centre. It has shown itself able, in Lakatos's terminology, to produce a string of 'progressive problemshifts'. No one in genetics has since expected any devastating criticism to appear of its central tenet that all, or at least practically all, aspects of heredity can be explained by the existence of chromosomal genes. Thus, when I refer in the following to 'scientific genetics', it is the practice associated with this research programme that I have in mind. It is a research programme of remarkable flexibility and fruitfulness, forming the basis of a powerful science.

This brief description of the discipline's beginning provides the backdrop to how the surrounding society has reacted to genetics. No further

37. Lakatos (1970).
38. Lakatos (1970), p. 133.
39. 'The actual hard core of a programme does not actually emerge fully armed like Athene from the head of Zeus. It develops slowly, by a long, preliminary process of trial and error.' Lakatos (1970), p. 133.
40. Some of the early Mendelians, such as Wilhelm Johannsen and William Bateson, were reluctant to accept the identification of genes with parts of chromosomes. They had upheld the abstract Mendelian vision against earlier speculative inheritance notions, and this made them suspicious of all attempts at identifying genes with something material; see Dunn (1965).

details are needed to understand my analysis of the responses of the four major ideologies: conservatism, social democracy, Nazism and communism. A more extensive description of modern genetics is, however, necessary to understand liberalism's reaction to genetics; to this I turn in Chapter 9.

Before we arrive at the ideological analyses, the world into which genetics sprung must be characterized. This I will do in two steps: In the next chapter, I outline the development of biological thought and its application to human problems during the nineteenth century. And then, in Chapter 4, I describe how the early geneticists at the beginning of the twentieth century presented their new science to the world; they did so using a mixture of revolutionary insights and well-established prior thought patterns.

3. A world explained by biology

Human affairs in need of guidance

As we have seen, the brand-new geneticists preferred to ignore earlier attempts at explaining heredity. Still, the role played by genetics in society after the start of the twentieth century can only be understood from history – that is, from the importance that biology had gained in the preceding century. One may say that genetics entered a world already accustomed to the use of biology for conducting its social affairs.

In the first part of this chapter, I outline the development leading up to this situation, while the second part gives a brief introduction to eugenics, the most ambitious project formulated for creating a better human life based on biological knowledge.

The growing use of biological explanations

Let us start with an important truth about the nineteenth century: Discussions about human life then, of necessity, involved a certain moral unease. Ever since the *United States Declaration of Independence* (1776) and the French *Declaration of the Rights of Man and of Citizen* (1789), enlightened men and women had recognized that all humans were at some fundamental level equal. But how could this be reconciled with a world full of glaring inequalities of all kinds, and, in particular, when considering the slave-trade from Africa to the Americas?

This unease did not decrease with the approach of the twentieth century. If anything, it became more acute. True, slavery had by then been abolished in the USA. This instance of oppression had however been so grotesque that its formal removal just made other cases of inequality more noticeable.

I am here not talking about an abstract moral conundrum but a problem that went to the heart of the economic realities of the day. Industrial capitalism, which by the mid-nineteenth century dominated Western Europe and Eastern North America and which colonialism and imperialism helped spread over the world, was a wealth-creating system that by its very logic tended to *increase* human inequalities. So, many asked, were these inequalities to be regarded as fair? And more specifically: Were the efforts of those without power in the economic system – the workers and the colonially oppressed – to organize themselves and get a say in society, in any way morally wrong?

Obviously, this unequal world required to be *explained*. How could one otherwise relate to the various suggestions as to how it should be changed – or left unchanged?

Paradoxically, this need for explanations was by now more difficult to satisfy. The standard Western provider of explanations, Christianity, had, in a parallel historical development, run out of steam. A belief in God's design could formerly answer difficult moral questions in socially acceptable ways that were helpful for calming passions. Christian dogmas could be referred to, and Christian texts be quoted; furthermore, there was a special group of experts and administrators – the bishops and the clergy – who could disseminate trustworthy answers. During the nineteenth century, however, these institutions gradually lost their efficiency. Even before organized religion was seriously questioned, there was a widespread interest in other ways to explain why the world was as it was.

Biology then came in handy. Around the year 1800 this scientific field had become separated from general Natural History. It went through a rapid development under the influence of Enlightenment rationality, flavoured with a romantic fascination with nature. A wealth of new biological knowledge soon became a valuable source from which explanations of social affairs could be mustered. Thus, over the nineteenth century more and more understandings of human life became entangled in networks of biological facts and arguments.[41]

This process, which occurred in pre-genetic times, will not be detailed here, but a few conceptual themes must be discussed in order to assist the understanding of future developments.

41. It is interesting to follow how the moves towards realism in literature and the visual arts implied a parallel increase in attention to biological details. Two examples: Madame Bovary's gruesome suicide from poisoning as described by Gustave Flaubert in 1856, and Gustave Courbet's explicit depiction of a woman's private parts in his painting *L'Origine du monde* from 1866. Both say: Look – this is how life is; here are the actual biological facts!

Explaining races

It is fruitful to start with Immanuel Kant, the enlightenment philosopher in Königsberg, even though this takes us back to the eighteenth century. He gave courses on geography and anthropology. In one of his lectures, 'Of the different races of human beings', printed in 1775, he wanted to sort out – *to explain* – the origin of human diversity. Interestingly, his attempt shows us what form such biologically based explanations would take also in the future.[42]

To Kant, it was obvious that 'all human beings on the wide earth belong to one and the same natural species'.[43] When a species separates into units that are different in their hereditary make-up, these subspecies are called races; their distinctive differences remain so also after 'transplantings' and 'transpositions'.[44] This differentiation is caused by a process of degeneration [*Ausartung*] of their inner capacities. Thus – according to Kant – at the beginning of the species' history, all humans carried the potentialities of, for example, different skin colour; only with time and under the influence of external factors was the range of possibilities reduced.[45] This process of degeneration was accompanied by a parallel increase in local adaptation, which would be more pronounced in some races than in others. Kant reached the conclusion that what had happened to the human species could be summarized in a table of four distinct races, together with the environmental causes of their specificities. The first of these races was the one he himself belonged to: the 'High blondes (Northern Europeans) from humid cold'.[46]

Kant's speculations are typical of what future biological explanations would look like. Already here we have the confident professorial tone, the 'scientific' facts, and the presentation of the arguments as evident – even though, on closer inspection, they turn out to be, at best, merely plausible. For example, everything related to the proclaimed process of degeneration of heritable capabilities was at the time unknown, obscure or invented. There was hardly any substantial explanatory power in Kant's arguments despite his attempts to give the impression that there was.

42. The focus here is on Kant's explanation of human races, while the various meanings of the word 'race' are discussed in later chapters.

43. Kant (1775, 2007), pp. 84–85. The prior writings of Linnaeus on humans were an obvious source for Kant's article and the two authors agreed on this crucial point.

44. Kant (1775, 2007), p. 85.

45. Kant (1775, 2007), p. 85.

46. Kant (1775, 2007), p. 95.

These manoeuvres will be recognized in many future texts attempting to explain the world based on biology. Kant's lecture nevertheless comes out sounder than most similar writings from the coming century because of its relative lack of gross racism. He and his readers shared – but of course! – many of the common prejudices against people who looked different and came from other parts of the world. Kant, however, appears genuinely interested in the diversity of human beings. He does not engage in disrespect and hatred of the kind that so many later authors would do. This is important, because it tells us that turning to biology for explanations of why the world is the way it is, does not *necessarily* lead to racial or other kinds of oppression. We can have biological arguments about the nature of human divergence without it directly leading to structural violence. (It is, on the other hand, difficult to see how systematized racism can exist without a, more or less hidden, biological explanation at its base.)

Degeneration

It is interesting to note how Kant – almost automatically – when addressing the race question latches on to the notion of 'degeneration' – a word that would become increasingly important during the following hundred and fifty years. But in Kant's text the notion, actually and originally, at least makes *some* sense.

It is well-known that the term comes not from the German word 'Ausartung' but from the French verb 'dégénérer', which according to the classic *L'Encyclopédie* from 1757–80 was a gardening term referring to impure seed. However, under 'Race' in the same source, one finds a quote from Madame de Lambert: 'If the achievement of the parents increases the fame of the children that imitate them, then it shames them when they degenerate'. And it was with this sense – as a loss of human qualities, particularly moral ones – that the notion of degeneration became common in medical and social writings around the 1840s. Particularly influential elaborators of the concept were the French psychiatrists Bénédict Morel and Valentin Magnan.[47]

Degeneration was seen as *the* perfect term for biological explanations. It was applied to individuals as well as to families, social classes, nations, races and species. Its explicatory range seemed unlimited. Sometimes it was used to explain severe inborn idiocy, at other times it was applied to the 'morally rotten centre' in apparently normal individuals. There was a kind of latent degeneracy in women and always more than a dash of

47. See Pick (1989).

it in aristocrats. From today's perspective, we can see that 'degeneration' was a half-scientific notion that never obtained a solid, theoretically based meaning. Instead, so many partially inconsistent meanings were added-on to it that it is surprising that anyone would care to use it at all.[48]

Difference biology and biological determinism

What Kant most interestingly did in his text was to mark the beginning of an important intellectual tradition that I will call 'Difference biology'.

Let me explain: Biology diffused into nineteenth century society via many different routes. There was an increase in general knowledge about the 'facts of life', which led to a reconsideration of many aspects of social existence.[49] This was also a time of important scientific breakthroughs, for example in microbiology and immunology associated with Louis Pasteur and Robert Koch.

In addition, another trend in the development of biology took form. During the nineteenth century, a large part of biology became devoted to *differences between organisms of the same species* – the difference between races, the difference between females and males, the difference between the sick and the healthy, the difference between the mad and the normal, and so on. Wherever a difference was seen or suspected, an eager biologist or medical doctor was there to analyse, categorize, name and explain it – as famously described by the French philosopher and historian Michel Foucault.[50] Above all, they wanted to record the salient facts.

This was, after all, what many scientists at the time did: they measured humans with increasing exactness in order to pin down the differences that 'everyone knew' were there but that were difficult to grasp. The American biologist Steven Jay Gould quite rightly named this phenomenon *The Mismeasure of Man*, since this was often the result.[51]

48. Freud summarized his critique of the concept as follows: 'The attribution of "degeneracy" to inversion [homosexuality] is subject to objections against the indiscriminate use of the word in general. It has become commonplace to attribute any manifestation of illness not due to trauma or infection to degeneracy. Magnan's classification of degenerates has allowed for the possibility that even in cases where the nervous system is functioning at the highest levels, the applicability of the concept of degeneracy need not be excluded. Under the circumstances, it may well be asked whether the ascription of "degeneracy" is of any use, and whether it adds any new content.' Freud (1905, 2016), p. 4.

49. For a description of the transformation in gender relations that took place in the later part of the nineteenth century and to which biological reproductive knowledge contributed, see the chapter on 'The New Woman' in Hobsbawm (1987).

50. See for example his *The Birth of the Clinic* (1963, 1994).

51. Gould (1981).

For my purpose here, it is not so much the sometimes-poor methodological quality of these investigations that interests me as is the ardour with which they were performed.[52] This diligence only makes sense if one understands what the results were to be used for: knowledge about biological differences was expected to inform about the true structure of the world. If it could be shown in a scientifically impeccable manner that the world was ordered in a particular way, then one had come more than halfway towards explaining *why* it was so, and *how* one ought to relate to it being so.

A long tradition in European thought finds explanations and justifications coming out of existence itself. If something exists, it does so because it *must* exist. And if it must exist, it should not be worked against. Accordingly, it is important to be certain about exactly how the world is. Hence the at times obsessive interest in collecting verified facts.

This tradition is, for example, deeply ingrained in Christian thought. God is the Creator, and since God is good, so must his creation be – even if we humans do not always understand how and why.

With Darwinism – rapidly developing after the publication in 1859 of *On the Origin of Species* – 'Nature' to a large extent took over this role from the Creator.[53] The argument went like this: Natural Selection has by its own force developed the world that we live in; thereby it explains why things are as they are. We may not like it or approve of it based on our moral principles, but evolution does explain the world and stabilizes its meaning. Furthermore, the evolved state of the world is resilient – nothing is gained by trying to change the current state of affairs. Any intervention from our side concerning the way things are would just run counter to the selective force of nature, which will restore everything to how it naturally is supposed to be. Darwinism's explanatory and legitimizing power would be of far-reaching importance in the latter part of the nineteenth century. It would provide the dominant frame of thought for the intellectual milieu into which genetics then emerged.[54]

52. For example: Theodore Porter's *Genetics in the Madhouse* (2018) describes the enormous effort that went into classifying and cataloguing the mentally ill in the nineteenth century.

53. For the development of Darwinism, see Greene (1981), pp. 128–151.

54. The strength of Darwinism as a source of political legitimation is described in Richard Hofstadter's classic text *Social Darwinism in American Thought* (1944). To quote but one sentence (p. 5): 'Understandably Darwinism was seized upon as a welcome addition, perhaps the most powerful of all, to the store of ideas to which solid and conservative men

Still, we should not ascribe *all* legitimizing power of explanation to the Christian or Darwinian visions of life. Given the increasing amount of factual knowledge and the development of some trustworthy chains of causality, biology could *by itself* explain and legitimize the world. A tradition of 'biological determinism' was formed, in which neither God nor Natural Selection was required to explain why the world is the way it is. The various measurable biological details seemed to contain the relevant answers to why Africans, or women, or the feeble-minded, or whoever, were the way they were and how others rationally ought to relate to them.

This explanatory principle of biological determinism became strong in the decades preceding the year 1900, despite its structural weaknesses. It relied on recorded differences – made them into fetishes, one could say – and only rarely took an interest in the *magnitude* of the differences found. Reasonable questions were therefore never far away: Are the measured differences really so large as to warrant the causal interpretations that they are made to carry – particularly when these interpretations are reformulated into societal recommendations? To take an explicit example: Is the ascertained smaller average muscle mass of women really of such a magnitude that it warrants the exclusion of girls from higher education?

Questions like these made it clear that there was something unsatisfactory about explanations based on difference biology. Obviously, a better structure for biological explanations was needed – a stronger theoretical basis. Biology was too broad a discipline and contained too little of deterministic theory to provide explanations on which trustworthy social recommendations could be based. In other words, the focus on differences required a framework that could deal with the central notion underlying all its investigations: *inheritance.* Only with a better understanding of this mysterious phenomenon could biology have a true social impact.[55]

appealed when they wished to reconcile their fellows to some of the hardships of life and to prevail upon them not to support hasty and ill-considered reforms.'

55. It is today difficult to grasp the lack of a structured understanding of heredity before Darwin, Galton and Mendel. An overview of earlier Western thoughts on this topic is given by Müller-Wille & Rheinberger (2012). For a history of the study of inheritance in a very long perspective, see Jacob (1973, 1993).

Francis Galton and biologized politics

The most serious attempt at the time to bring scientific order into the phenomenon of inheritance was made by the British gentleman scientist, Francis Galton. I find him truly enigmatic. He showed great scientific creativity but also some definite mental limitations, in particular in the understanding of other people's modes of life.

Galton was born into a well-to-do family in 1822. He studied medicine and mathematics before he settled down, after some travelling, to a rich social life in London.[56] The major event in his life, as he himself saw it, came when reading Darwin's *On the Origin of Species*.[57] From then on, his (married though childless) existence gained a purpose and a cause: to learn more about inheritance – the necessary basis for all effective Natural Selection – and to scientifically systematize this knowledge.

Human variation measured

To Galton this endeavour meant collecting data and then using statistical analyses on the data to reach general conclusions. He started with what today appears like a Monty Python sketch from Victorian London – he tried to *prove* that his friends from Cambridge and from the Royal Society in London belonged to a superior race of humans.

In 1865 Galton published an article on 'Hereditary Talent and Character' in the popular *Macmillan's Magazine.* He later expanded it into a book, *Hereditary Genius*.[58] His argument relied on two approaches which were new for their time. The first was to study human mental faculties, in this case 'talent', as if they were measurable biological traits. The second was to retrieve information about inheritance from pedigrees, i.e. from knowledge about various family members. Galton realized that first-degree relatives (fathers, brothers, sons) should have more heritable material in common than would higher-degree relatives (uncles, cousins, …). Therefore, he concluded: if the similarity among members in the first group is greater than that in the latter, all other things being equal, then heredity must affect the trait under investigation. Or, to make the conclusion appear more precise and scientific: the trait must

56. For Galton's life, see Gillham (2001).

57. Darwin (1859). Francis Galton and Charles Darwin were first cousins; they were in contact – sometimes close – throughout their lives, but they normally developed their research interests independently of each other.

58. Galton (1869, 2006).

in part be *determined* by inheritance. Thus, the fact that lawyers often come from families of lawyers should, according to Galton, be due to biological inheritance. (He acknowledged the potential role of maternal inheritance, but since women only rarely were 'illustrious', their role was not further considered.)

So far, so good. But the continuation – when Galton started to investigate the relatives of famous politicians and judges, painters and mathematicians with respect to 'talent' – borders on farce.[59] It will not surprise us that he reached the conclusion that talent is heritable. Nor that he found that his own well-educated social stratum turned out to be of the highest worth. True, he did mention that, if there is a correlation between relatives in their *social opportunities* to reach prominence, this would limit and possibly endanger his conclusions. Still, he consistently chose to downplay all non-biological influences on the traits he investigated.

The same mixture of sharp theoretical insight and shocking naivety with respect to how people live is seen in Galton's further attempts to get a scientific grasp on the heredity of human traits. His declared wish was to describe the relative importance of 'Nature' relative to 'Nurture' for various physical and mental qualities – referring to that long-lived dialectical pair for which he formulated the modern standardized opposition. It must be understood, though, that Galton's constant underlying desire was to stress the particular importance of nature, meaning inborn heritable qualities.

For this purpose, he organized collections of human data of all kinds. He often showed great ingenuity in getting individuals and institutions to provide him with measurements. In parallel, he worked at establishing a theoretical framework, named 'biometry', within which the collected data could be treated and analysed. His astuteness is illustrated by how he – when struggling with his various measurements – contributed two important concepts to modern statistics, namely correlation and regression.

59. Galton goes through the list of British Chancellors from the time of Henry VIII and finds, for example, about Charles Talbot that 'father was bishop, consecutively, of Oxford, Salisbury, and Durham; had sons, of one of whom there were great hopes, but he died young; the other "succeeded to his father's virtues".' Galton also carefully points out that 'Men of remarkable eminence are almost always men of great powers of work … The Alpine Club contains a remarkable number of men of fair literary and scientific distinction … Most notabilities have been great eaters and excellent digesters …' Thus, there is no reason to suppose that 'in breeding for the highest order of intellect, we should produce a sterile or a feeble race.' Galton (1865), p. 162 and p. 164.

We should not rush our story, however, even though Galton himself was getting impatient. He was full of enthusiasm and wanted to see his practical and theoretical achievements come to use. In 1873, eight years after his article on the inheritance of human talents, we find him ready to move on to the next level of his quest. He now wanted to use the amassed knowledge about inheritance and human differences for a much more important task: the improvement of humankind. From now on, the development of his promised science of human inheritance, biometry, became less interesting to him. It was overshadowed by its applied intellectual cousin, eugenics, to which Galton now devoted most of his efforts.

In the preceding chapter, I claimed that it would be misleading to say that Gregor Mendel created the theory and science of genetics. Here the reverse is true: Even if biological arguments were commonly used in political circumstances in Galton's time, and the idea that humans could be improved by biological interventions appealed to many, the intellectual origin of the eugenics movement in its full breadth is undoubtedly to be found in the writings of Francis Galton.

Difference biology applied: Eugenics

Again, Galton first turned to the popular press and sent an article about 'Hereditary Improvement' to *Fraser's Magazine*. All the important elements that came to characterize the eugenics movement can be found there.[60]

He starts by describing why a move towards improving humans must be made. He reminds the reader of the negative effects of 'civilization' on the 'race'. Health has declined, which shows that its heritable basis has deteriorated – why else should one 'at the health-resorts of the South of France' see so many fellow-countrymen 'who are afflicted with wretched constitutions'?[61] Indeed, there are 'many ways in which the forms of civilisation, which have hitherto prevailed, tend to spoil a race'. As to mental qualities, we are, according to Galton, in a situation where 'the average intellect of modern civilised races [is unable] to cope with the requirements of the mode of life which circumstances have latterly imposed upon them'.

60. Galton (1873). Only the name of the new activity was still missing. The term 'eugenics' was introduced by Galton in 1883, referring to what is 'good in stock, hereditarily endowed with noble qualities'. Quote taken from Gillham (2001), p. 207.
61. Galton (1873), p. 117.

After this dramatic introduction, Galton draws his conclusion:

> So far as we can interpret her [= Nature], we read in the clearest letters that our desire for the improvements of our race ought to rise to the force of a passion; … [indeed, at] some future time, perhaps not very remote, it may come to be looked upon as one of the chief religious obligations. …
>
> The precise problem I have in view, is not only the restoration of the average worth of our race, debased as it has been from its 'typical level' by those deleterious influences of modern civilisation to which I have referred, but to raise it higher still.[62]

This is all very clear and logical, though riddled with deep scientific, political and moral problems.

Galton was not the first to recommend changes for the long-term benefit of humankind in how humans conventionally procreate; ever since Plato, philosophers have expressed such thoughts. And just as the proponents of this idea found its implementation to be 'natural', 'rational' or 'necessary', other thinkers have always existed to whom the idea had only limited appeal. Personally, I like the comment Kant made, one hundred years before Galton's suggestion, in the text on race discussed earlier in this chapter. Referring to a suggestion by the French enlightenment scientist Pierre de Maupertuis, Kant explained why he did not find it a good idea to try to raise

> … a naturally noble sort of human being in which understanding, excellence and integrity would be hereditary. In my opinion, this plan … is just as well prevented by a wiser Nature because the great incentives which set into play the sleeping powers of humanity and compel it to develop all its talents and to come nearer to the perfection of their destiny, lie precisely in the intermingling of the evil with the good.[63]

Thus, for Kant it is from *diversity* that humans obtain value and strength – not from the limited social base of the educated upper middle class, the ideal one in Galton's view.

Actually, Galton is remarkably unclear about exactly *whom* he wished to improve. Sometimes he talks in grand words about 'humanity' and 'the race of man', at other times it is clearly Britain or 'the nation' that he is interested in.

How should this improvement come about? Galton answers by outlining a sociological myth-story: A small number of individuals will understand

62. Galton (1873), p. 120.
63. Kant (1775, 2007), pp. 86–87.

the necessity of human improvement and will for this purpose start measuring themselves and others and then pool their information on relative worth. In the course of time, this process will escalate as more and more individuals will understand the importance of eugenics and spontaneously form 'societies', 'castes' or 'guilds' for its promotion.[64] These associations will be important, not just in collecting and analysing information on human differences but also for promoting marriages and childbearing among members and their children.

In the end, the eugenically favoured part of society will become dominant and gain full political power. This situation – when humanity finally has found the right way to continuously improve itself – Galton depicts like this:

> I do not see why any insolence of caste should prevent the gifted class, when they had the power, from treating their compatriots with all kindness, so long as they maintained celibacy. But if these continued to procreate children, inferior in moral, intellectual and physical qualities, it is easy to believe the time may come when such persons would be considered as enemies to the State, and to have forfeited all claims of kindness.[65]

Galton's myth ends here. When his eugenic vision has reached its fulfilment, it has become practical and political, with the State, the ultimate source of power in society, ready to wield its eugenic terror. Thus, biology does not only explain the world but has turned into politics where promoting a better life means repressing existing life.

With this manifesto, Frances Galton formulated the programme of eugenics but also wrote himself out of civilized company. There is no need here to refer to the atrocities of the twentieth century to recognize the deep contemptibility of Galton's ideas.

Great Britain was the natural home for Galton's efforts to develop biometry and eugenics. It is therefore not surprising that *class* was the social dimension that he concentrated on. British capitalist society has always had the question of class at its centre. Typically, Galton took for granted, in his mythical description of how eugenics would develop, that the future eugenic associations would be different for the different classes.[66]

64. All these terms were used by Galton.

65. Galton (1873), p. 129.

66. 'My proposition certainly is not to begin by breaking up old feelings of social status, but to build up a caste *within* each of the groups into which rank, wealth, and pursuits already divide society …' Galton (1873), p. 123, italics in original.

Even if 'talent' from now on was to be promoted, it was impossible for him to imagine that talent from the upper middle class could join with talent from the working class (for 'join', read 'marry and raise children'). This implies that changing humanity by exterminating its miserable strata – by one method or another – was a reasonable endeavour, but altering class society was inconceivable.

A rich mix of biology-inspired thinking

Galton's writings in 1873 on how biology could – and should – be used to tackle the class question corresponded to many other similar suggestions made at the time in the European intellectual sphere. Difference biology had become ripe for political use. Thus, the Italian physician and founder of criminal anthropology, Cesare Lombroso, claimed in 1878 that those who committed crimes did so due to their inborn nature; naturally, legal and political suggestions followed from this proposal. Other schools of thinking flourished, which linked cranial morphology to personality traits, of which Gall's phrenology was the most common. Several authors treated the 'race question' with a mixture of biological theory and political recommendations, among which only two are remembered today: Arthur de Gobineau, who published *An Essay on the Inequality of the Human Races* in 1853–55 (which at its centre has a defence of the biological superiority of the aristocracy) and Houston Steward Chamberlain, with his *The Foundations of the Nineteenth Century* in 1899.[67] Also Otto Weininger's then widely read 1903 study *Geschlecht und Charakter* [*Sex and Character*] with its violent diatribes against women, belongs to this family of work that transferred the results of difference biology into the political arena. Just like the two preceding authors, Weininger put some strongly anti-Semitic arguments into his book.[68]

The common theme of these biology-infused writings, of which only the most influential and infamous are remembered today, was a justification of the position of the well-to-do, white, western male. The

67. One could include here Paul Broca, the famous French anatomist, who extended difference biology to the extent that he explained present-day human variation as being due to crosses between different primate species.

68. Anti-Jewish feelings have a long tradition in European societies, being rooted in differences in religious and cultural practices. The connection between Jewishness and *biological inheritance* was, however, a relatively late development. Or in the words of Jean-Paul Sartre (1948, 1995, pp. 37–38): 'We must not be deceived: explanations on the basis of heredity and race came later; they are the slender scientific coating of this primitive conviction. Long before Mendel and Gobineau there was a horror of the Jew…'

liberating force of the Enlightenment, together with the enormous economic development that followed from the Industrial Revolution, had by now turned the world into a frightening and dangerous place for those who saw their privileges – or perhaps worse, their self-esteem – threatened. The Angst that came with this feeling did not express itself in tones similar to those of the genuinely curious Immanuel Kant. Instead, the moral unease that I referred to at the beginning of this chapter had, by the end of the nineteenth century, been converted into some strongly conflictual standpoints, ready – one could say – to be picked up by political ideologies.

My overview of how biology came to explain the world in the decades before the year 1900 ends here. We have seen knowledge produced, explanations presented, theories promoted that all show how biology – as the new century approached – had become increasingly, not just interesting and relevant, but urgent and *political*.

Still, what no one could foresee then was that some, hitherto forgotten, results about artificial pea-crosses would suddenly transform the intellectual landscape of the world.

4. Genetics enters society

A trendy science

So, what happened when scientists found that their experiments conformed to a logic outlined decades before by Gregor Mendel?[69] And how did the early geneticists present their new science to world already replete with biological explanations?

The answer will take some effort to sort out. The process by which early genetics became integrated into society was not a simple or straightforward one. To begin with, Mendelism had to be presented in a generally understandable way. I will argue that scientists did so by mixing what was new in Mendelism with ideas carried over from earlier notions of inheritance. They had a – to us today – surprising willingness to mingle newly certified facts with old unverified presuppositions; they thereby managed to project an inspiring image of a new powerful science. Very soon, the political ideologies would understand that genetics was a topic of interest and importance also for them.

Before we turn to how the socially attuned ideologies reacted to this new science, let us consider the effects of early Mendelism on the intellectual and literary scene.

Mendelism makes a splash

In 1909, the British author H. G. Wells published his novel *Ann Veronica*. It follows a young woman trying to build a life containing both satisfying love and interesting professional work. In the book, Ann Veronica's husband, Mr Cape, relates a recent conversation with his wife's father, an amateur scientist:

> '… I said I hadn't been at the Royal Society soirée for four years, and got him to tell me about some of the fresh Mendelian work. He loves the Mendelians because he hates all the big names of the eighties and nineties.'[70]

69. Mendel (1866).
70. Wells (1909, 2005), p. 284.

That Wells brings up Mendel and his results is perhaps not surprising since the book centres on relations among biologists (partly based on Wells's own experiences) for whom it was natural to discuss the latest scientific news. Still, the mention is interesting, as it testifies to the powerful effect of the Mendelian breakthrough in scientific circles of the time.

The second quote is more surprising. When Marcel Proust's narrator has reached the part named *At Mme Swann's* in his epic *In Search of Lost Time*, he describes how Swann – a key character of the novel – came to choose his wife:

> In any case, the idea of engaging in one of those cross-breedings common to Mendelian experiments and Greek mythology, and of joining with a creature of a different race, an archduchess or a good-time girl, someone of blue blood or no blood at all, might well have titillated the artist, if not the pervert, in Swann.[71]

Marcel Proust wrote this sentence well before the start of the First World War in 1914 (though the novel was not published until 1919). By referring to the *mendelistes* at this early date, Proust obviously wanted to show off his up-to-date-ness in modern science. This implies that not only did he know about Mendel and his modern followers – but he could assume that his readers did, too.[72]

Hence, there was something new and exciting about genetics in the early years of the twentieth century. There had been literary treatments of inheritance before, of course.[73] But they had lacked what the quotes hint at: the freshness that the Mendelian genes brought to the ever-ongoing discussions on heredity.

---

71. Proust (1918, 2003), p. 44. In French : 'Peut-être, d'autre part, en artiste, sinon en corrompu, Swann eût-il en tous cas éprouvé une certaine volupté à accoupler à lui, dans un de ces croisements d'espèces comme en pratiquent les *mendelistes* ou comme en raconte la mythologie, un être de race différente, archiduchesse ou cocotte, à contracter une alliance royale ou à faire une mésalliance.'

72. The only person who could not have heard of Mendel at the moment of relevance for the sentence was Swann; his decision to marry Odette was taken long before year 1900 and the arrival of the Mendelists.

73. One example: the always-topical Émile Zola chose in 1893 to end his series of twenty novels about the Rougon-Macquart family with a volume called *Doctor Pascal.* Here, he treats notions like atavism and degeneration and includes – suitably – a large, folded pedigree.

Same same, but different

As we saw in a preceding chapter, it took about two decades for genetics to evolve from just reproducing Mendelian crossing experiments to become a fully-fledged natural science with a trustworthy theoretical core and a well-established research programme. With its new set of concepts, far-reaching theories and high-flying ambitions, genetics came to stand for an integrated view of inheritance and life – for what I earlier called a complete 'network of meanings'. This development occurred, as we have seen, in a social and intellectual environment already saturated with ideas about inheritance and politics. The effect was that genetics came to be perceived in two contradictory but often intermingled ways.

On the one hand, genetics was seen as the natural continuation of all earlier writings on inheritance. Degeneration, pangenes, contagious factors, atavism and eugenics had for decades provided material for discussion; intellectuals worth their mettle were expected to have views on these topics and include their key terms in their writings.[74] The results of Mendel and his followers were regarded as adding more data and complications to what, after all, was already known.

On the other hand, genetics – often summarized in the form of 'Mendel's laws' – contained a *precision* that made its results stand out from all prior knowledge.[75] Genetics did not just add something to old knowledge – it introduced something completely new. My point can be illustrated by what today seems trivial: It had been left unclear in all earlier discussions on inheritance how much of the 'hereditary principles' was transferred to offspring from males and how much from females. With Mendelism this question was settled, once and for all: Equal genetic contributions are transmitted from the two sexes during fertilization – be it in peas, flies, mice or humans – the one-to-one principle.[76] This highly

74. Noteworthy are the plays from the 1880s by Henrik Ibsen, the portrayer of contemporary bourgeois life, which often centre on some biological phenomenon. This is most obvious in *Gengangere* [Ghosts] (1881, 1964), where the plot derives from the transmission of syphilitic dementia from father to son.
75. The history of 'Mendel's laws' as a pedagogical construct is outlined by Marks (2008).
76. When exceptions later started to appear, such as the sex-determination mechanism in mammals via distinct X and Y chromosomes, they only helped to strengthen the *fundamental* truth of the one-to-one principle. Nothing is more satisfying in science than rearranging potentially discordant facts so that they fit already established patterns, even when slight modifications of the preceding theory have to be made. Scientists have an acute sense of which modifications fit the crux of their earlier views, and which do not; see the discussion of a theory's 'core' and 'protective belt' in Chapter 2.

structured way of looking upon life was something altogether unique; at least according to the early geneticists.

Genetics in action

The network of meanings that grew up around genetics was gradually accepted by the world at large. Three observations are worth retaining from the complex process by which this occurred, and given the paradox, outlined above, about its similarity as well as distinctness relative to earlier thoughts on heredity.

From its very beginning, genetics became associated with ideas with which it – as a research programme – had very little to do.

The genes – the fundamental objects of genetics – were explained and discussed at the start of genetics in terms of already existing knowledge about inheritance, notably so when the importance of genetics for future human life was under scrutiny. In this way, the hard and precise facts produced by the early Mendelian experiments became embedded in a web of old meanings concerning heredity. While the Mendelians stressed the new and unique specificity of their scientific approach, they were often comfortable with using an existing inheritance jargon when it came to describing the importance of inheritance studies for society.

Thus, the history of genetics from its start became closely associated with the history of eugenics, particularly when the early geneticists went beyond their experimental organisms and started to relate to humans. Their interests and visions were often identical to those of the eugenicists who continued with Galton's biometrical approach. Still, the degree of identification with eugenics differed between geneticists. Some, like R. A. Fisher in England and Harry Federley in Finland, encountered eugenics early in life and took to its zeal, as we will see in the next chapter; others, like Wilhelm Johannsen in Denmark, were sceptical of its high-flying ambitions and shaky ethical ground.[77]

Already in the title of his classic history of the eugenic tradition, *In the Name of Eugenics: Genetics and the Uses of Human Heredity*, the American historian Daniel Kevles shows how intimate the relationship was, in his view, between eugenics and genetics.[78] Almost all later studies of eugenics

77. Thus, when Johannsen wrote about *Eugenik* in a prominent Danish encyclopaedia, he expressed his ironic disdain for British eugenicists of the 'better-dead type', who so trusted the positive effect of natural selection that they opposed social interventions to reduce childhood mortality. See Johannsen (1918).

78. Kevles (1985).

follow suit: they generally aim at showing the close integration between eugenics and genetics, from 1900 until today.

These observations are true, and the rich literature on sterilization, euthanasia, marriage prohibitions due to race, and similar interventions, have added much to our knowledge about the history of genetics. In the present book I choose, however, to treat genetics as an intellectual tradition distinct from eugenics. My reasons are manifold: genetics deals with a much greater scope of organisms than just humans; many geneticists have fought vehemently against the tenets of eugenics; genetics has often influenced politics and society via other routes than eugenics. Insisting on the specificity of genetics does not imply, however, that I distance myself from the studies linking genetics and eugenics. Still, upholding a distinction between genetics and eugenics, despite their long and combined history, seems to me to be necessary to understand their relationship. Only if the specific nature of scientific genetics is taken seriously can we grasp the currents of inspiration and legitimation between these two intellectual traditions. That is what this book tries to do.

Some authors, regarded by themselves and colleagues as legitimate scientific geneticists, often – and as it seems seamlessly – moved between positions with varying degrees of scientific underpinning.

The early practitioners of genetics were keen to stress the scientific side of their work, but that does not mean that everything they presented was true or trustworthy – far from it! Their brashness was evident. They did not obey, did not care about or did not believe in any strict demarcation between the factual nature of their experiments and the value-laden interpretations of their results. Their seemingly natural and proud participation in translating scientific facts into politics is worth analysing one step further.

The French Marxist philosopher Louis Althusser wrote an interesting essay in the 1970s about the spontaneous philosophy of scientists.[79] The specific target for his criticism was the Nobel Prize winner Jacques Monod, but his analysis was more general.[80] Althusser's dilemma was that while he very much admired and respected scientists he also often found their official speeches, public declarations and popular presentations full of stupidities (read: fluffy, highfalutin, bourgeois humanism). To come to grips with this situation, he outlined a theory of how prominent scientists

79. Althusser (1974, 2011), pp. 69–165.

80. For more on Monod, see Chapter 9.

function as *public intellectuals*. As such, they present a 'spontaneous philosophy' that melds together their objective scientific experiences with political influences that have affected their personal life. Based on this spontaneous philosophy – and feeling themselves secure in their public positions – such scientists easily pontificate on all kinds of topics, ranging from their experiments and precise scientific theories to the nature of human beings and the existence of God.

I find Althusser's analysis to the point. It is fascinating to see and, with the distance in time easier for us than for their contemporaries, to recognize how ideological many of the early geneticists were in their writings for the general public. Already in the analysis of Kant's text I noted an unquestioning professorial tone that linked together statements of facts and of values. More than a century later it was, if anything, heightened among his academic descendants. (Two illustrative examples will be described in my next chapter.)

For thinkers and writers of all kinds it became important, next to necessary, to refer to genetics to gain support for their ideas. The alternative – to ignore or reject the results of genetics – carried a substantial cost.

Anyone who at the beginning of the twentieth century wished to present an integrated view of life, science and society, would have great difficulty in ignoring recent genetic advances. They appeared in both likely and unlikely circumstances – see the quotes from Wells and Proust above! They were talked about, and they carried with them great claims, especially about the important applied results that they would lead to in the future. The early geneticists were very literate; many of them wrote with great enthusiasm about the origin and future of their science.[81]

It was, of course, possible *not to react* to the facts and ideas of genetics. One might object to the increasing use of biological explanations of the world. Or one may have thought that some other newly described phenomena, such as hormones or psychoanalysis, were of greater importance for understanding human variation.[82] During at least one or two decades,

81. A small book that would be particularly important was *Mendelism* by Reginald Punnett, biologist in Cambridge (UK). It was published in many editions and translations. I take my quotes from its second edition, published in 1907; the first came in 1905.

82. There are interesting similarities between psychoanalysis and genetics in their rapports with society. Still, geneticists have almost never related directly to psychoanalysis, and contacts in the other direction have also been few. In Freud's substantial oeuvre, there is no reference to 'genes' or 'genetics' and no mention of Gregor Mendel (but Charles Darwin and Francis Galton are named); see Freud (1974). This absence is significant, given Freud's general interest in biology and his early training in cytology; see Sulloway

it was thus possible to avoid taking notice of genetic findings. Still, this meant that one limited oneself with respect to the topics discussed.

Finally, a small minority of thinkers felt it necessary to fight against the claims of the geneticists. This could be done from the scientific flank in order to give greater weight to other systems of inheritance.[83] Or it could be done from a more political perspective – as we will see in more detail later when we consider communism as an ideology. However, even those who reacted in a negative way to genetics, did so – though unwillingly – acknowledging the importance of this new science.

Ideologies and their wish to relate to genetics

Thus, with its brash and modernizing practitioners and its strong and hope-inspiring scientific concepts, early genetics had a strong impact on contemporary society. To round off this introductory part of the book, a few words will be said about the cultural systems on which I base my further analysis: the political ideologies. They felt the vitality of this new scientific endeavour and wished to relate to it.

Much effort has been devoted to characterizing what ideologies actually *are*, and how *exactly* ideology and science differ from each other. I will not delve into these discussions. Instead, by keeping my analyses close to what in political science is called the conceptual historical approach, I will just accept the five political ideologies to be discussed here as empirically existing entities and follow their historically evolving reactions to genetics.[84]

Five political ideologies and their differentiated responses

I have chosen to analyse conservatism, social democracy, Nazism, communism and liberalism, five ideologies that dominated the Western political field during the twentieth century. The *names* of the traditions are somewhat arbitrarily chosen; this will be discussed later. It is helpful to

---

(1979). In his 1905 essay on infantile sexuality Freud states his principled lack of interest in heredity/genetics thus: 'It is noticeable that writers … have … ascribed so much more influence to heredity than to the other primeval period, which falls within the lifetime of the individual person – namely, to childhood.' Freud (1905, 2016), p. 36.

83. Sapp (1987) describes the alternative tradition that stressed the importance of cytoplasmic rather than chromosomal inheritance.

84. This approach is associated with the British political scientist Michael Freeden; see for example Freeden, Sargent & Stears (2013). An excellent introduction, and a good read, is given by Freeden (2003).

regard these ideologies as 'families' of thought, since, in the political scientist Michael Freeden's words, '[f]ar from being monolithic, the standard structure of an ideology was a jigsaw of components that furnished it with considerable flexibility'.[85]

The five ideologies have in different times and societies taken different material shape. Political parties have often represented their views, while at other times they have found expression in media of various kinds. In whatever form they have manifested themselves, they have provided their adherents with consistent meanings and values. They have functioned as organizers of explanations: they have said how the world is, why it is as it is, and how one best should relate to it. My chosen methodology will not, of course, cover the full spectrum of political interest in genetics. Still, I hope to give an overarching picture of the complex relationship between politics and science, of a kind not attempted before.

In the following we shall see that the five ideologies responded in characteristic ways to the stream of revolutionary results produced by genetics after the year 1900. Their reactions did not follow any organized pattern, and this is not to be expected. In a conceptual historical approach such as mine, ideologies are considered as 'furnished rooms' for people to find themselves at home in, where prominent parts of the interior may change over time and what is of relevance in one ideology may not be so in another. No one should therefore expect my analysis to evolve towards a neat summarizing table, where different aspects of genetics are plotted against different ideologies: 'With respect to this particular genetic topic, this ideology thinks like this and that ideology like that…' My analysis will instead take the form of reasoned narratives of developments in historically specific social settings. Finding a lack of a definite standpoint may sometimes be of greater interest than registering a lukewarm point of view.

Ideologies compete with each other and fight to attract new adherents. They all – with the exception of conservatism – saw themselves as *modern* and therefore found a bonus in presenting science and new scientific results as supporting their views. Still, conservatives, too, as upholders of certified truths, were attracted to results coming out of science. Accordingly, their reaction to the new science of genetics was spontaneously enthusiastic. It is only natural to start with their views.

85. Freeden (2003), p. 44.

5. Conservatism and the stability of genes

A society for humans as they really are

Conservatives do not normally see themselves as adhering to any specific ideology. What unites them is a distrust of modernizing ideas more than any specific notion of what society's future should look like. Some feel it was better in earlier days and try to return to them – the reactionaries. Most conservatives, however, just want to defy 'those with ideologies' who try to 'improve' today's world. Their adversaries may have the best of intentions, but with their flawed knowledge and unrealistic ideas, they threaten to make the world worse. Society should function in accordance with the way human beings actually are.

Thus, the majority of conservatives do not wish to rewind society towards some earlier state. They know that this is impossible, just as they know that all attempts to *improve* society are doomed to fail. However, neither do they like the current state of affairs. Things are seen as going in the wrong direction, and unless action is taken – in some suitably moderate way – what is valuable in today's society will soon be lost.

No other major ideology became as attracted to the new science of genetics as did conservatism. Mendelism's basic tenets suited the conservatives' political project. By studying this rapprochement, we will reach a first understanding of how ideologies incorporate scientific achievements.

My analysis proceeds as follows: After a short characterization of conservative thought, I describe how early genetics was used in non-technical discussions. The 'hardness' of the genes and the essential nature of their associated traits were important, but also the genes' explicatory strength, combined with their unknown mode of action. Early arguments involving genetics can be found across a broad intellectual spectrum, but the affinity between genetics and conservatism was always predominant. I illustrate this by describing how two well-known conservative geneticists in the interwar years used their science to argue against parliamentary democracy. Nothing much was wrong with their genetics – but their arguments were strongly influenced by preconceived ideas, common at the time, about the magnitude of human heritable differences.

To complicate matters, I then take a 1930 Encyclical from the Pope to illustrate how the expected scientific support for an ideology sometimes does *not* occur; this is where genetics' specific characteristics as a science put obstacles in the way. The results of genetics have not always suited conservative ideas. Still, conservatives have on the whole remained close to genetics, as I will illustrate at the end of the chapter with a recent, almost farcical, example.

On human nature

Throughout history, one can find examples of a pessimistic attitude towards the way society evolves, but the conservative ideology – as we know it – finds its roots in the reaction against the French Revolution. By the end of the nineteenth century, it had reached its current form, with well-defined antagonistic relationships vis-à-vis its major ideological alternatives, liberalism and socialism.

Conservatives are close to liberals in that they normally believe in market forces, free enterprise and capitalism. Towards liberalism's other fundamental ideas – its belief in freedom, human rights and liberation – conservatives are more sceptical, if not outright opposed. One of the most important tensions in contemporary politics is found here. Towards socialism and its wish to overturn capitalist society, conservatives have always, and almost by definition, been very critical.

Even if I here cover many countries over a long period of time, I have normally found it easy to recognize conservative ideas, be they in newspapers or in political parties. This observation holds up to the end of the twentieth century when modern neo-liberalism starts to blur the boundary between liberal and conservative standpoints; this development will be touched upon later in the book. In my chapter on Nazism, I will also discuss those who left the non-activist conservative stance in the 1930s to support policies promoted by nationalist and fascist movements. Here, I concentrate on the moderate conservative ideology.

Conservatives believe that most attempts to change society are based on erroneous assumptions about human nature. They do not regard themselves as callous or heartless in their responses to other humans – they are as thoughtful, idealistic and well-wishing as others, perhaps even more so. But they refuse to let good intentions deceive them about how the world is. And how the world is, the conservatives know for certain, in particular with respect to what characterizes humans.

In a handbook of political ideologies based on the political scientist Michael Freeden's way of looking at ideologies, I find the following list of views on humans that conservatives typically disagree with.[86] To them it is *not* true that:

– Human nature is malleable.
– Humans can refashion history in whatever way their ideals suggest.
– Society is the product of a contract between autonomous individuals.
– Evil is an eliminable feature of human existence.

Since these erroneous ideas threaten to lead society astray, conservatives see it as their task to invalidate them and fight their proponents. For this purpose, they look for support from all kinds of suitable sources and find the strongest objections to the listed ideas in everyday experience. To those who see with unblinkered eyes, it is clear that people are *different* – different in their very essence. This essential difference lies behind the lack of human malleability and limits what social change is possible. It explains the absence of any foundation of equality on which society can be built and also why it is impossible to reach an end to what is 'evil' in society. In other words, it refutes *all* the ideas listed above that conservatives accordingly will fight against.

Many in society, however, do not see what the conservatives find obvious. To convince those misled and ignorant, conservatives have over time turned to philosophy – and to science.

Human inequalities and social harmony

The idea that there are deep essential differences between humans can be followed back in history to the philosophers of classical Greece. Here, Aristotle asked whether the existence of slavery was *natural*, despite its leading to some humans being treated not much better than animals. His answer was yes. This affirmative stance had a theoretical basis that went something like this: Slaves exist everywhere, and they play a necessary role in making the world go round. Their existence is therefore natural

86. This list is based on O'Sullivan (2013), p. 293.

and should not be changed. Or, as Aristotle expressed it: 'It is clear then that by nature some are free, others slaves, and that for these it is both just and expedient that they should serve as slaves.'[87]

Two millennia later, the same logic was evoked – as we saw in a previous chapter on biology in the nineteenth century – to legitimize an unequal and repressive society: differences between humans were indeed considered an integral and natural part of the existing world. Therefore, the argument went, they are to be respected and any attempts to interfere with them would be both harmful and futile. Difference biology came to be of great importance to conservatives since it underpinned the crucial role of human variation. A biological difference that over time had been built into the functioning of society could be seen as having a *natural* basis and thus constitute a reason for *not* changing the situation, even if some of those affected considered it unfair.

We should, however, not see only the oppressive side of this argument. In a conservative world view, there is often a feeling for – and a longing for – a harmonious state of society where each individual has found his or her rightful place, and all play their appropriate roles for the communal good. Human diversity should be seen as a source of societal richness, not as a cause for agitated strife. 'The removal of just some of the social classes would infallibly lead to irreparable damage to the whole, and retaining only one or a few classes would equal the death of the species', was how the conservative Finnish geneticist Harry Federley expressed this view in 1919 (more about him later).[88] By rejecting radical suggestions for social change, conservatives argue, they will *decrease* rather than increase tensions in society. Such tensions and break-up of social harmony would instead be the fault of those – like the workers' unions or the feminists – suggesting what conservatives consider as futile changes.

The attraction of Mendelism

Given what has been said so far, it is not surprising that conservative thinkers felt attracted to genetics when it appeared at the beginning of the twentieth century. It is worth analysing in some detail how they reacted to the two central tenets of Mendelism: the existence of stable genes and the associated reality of trait differences.

---

87. Aristotle (1981 edition), p. 69.
88. Federley (1919b), p. 54.

Genes are stable – but suitably unpredictable

The stability of the Mendelian gene was, unquestionably, of prime importance. A particular version of a gene, say for white petal colour, can be inherited over many generations without expressing its 'true nature', given that it is always combined with a gene version for pink petals – until the day a plant is formed with *two* white gene versions and no pink version. Then the white colour becomes visible, unaffected by the long time the gene version has spent combined with the pink alternative. The stability of genes is, thus, remarkable. Nothing in the inner or outer environments of their carriers will affect them; their specificity seems almost God-given.

For the conservatives of the early twentieth century, this fixity became a soothing antidote to the then dominant Darwinian thought-mode, which taught that all biological phenomena are under never-ending change. Such stability was attractive to the conservatives, and this even after it became clear that Mendelian genes sometimes *do* change via mutation. Such changes are, after all, so rare, and normally so deleterious, that they hardly affect the notion of fixity and unmalleability associated with genes. And when facts started to accumulate about the occurrence of gene mutations (mainly in Morgan's *Drosophila* laboratory), they arrived with a nomenclature that fitted the conservatives perfectly. The normal gene version was considered 'the wild type', to distance it from 'the mutant' that was a deviant. From here on runs a tradition to classify all genetic phenomena into those that are sound and normal, and those that are abnormal and wrong.

By being stable in their differences, the genes were – of course – excellent to use in causal arguments. Genes were trustworthy, like axioms in deductive thinking.

Still, the genes also had a fruitful *unpredictable* side, originating in Mendel's observation of recessivity. This insight was highly thought-stimulating. It is the recessive nature of the gene version for white petals that explains why the plants in which it occurs in only one copy have a pink colour. Two copies of this gene version are needed for the trait to be expressed, and the plant to have white flowers.[89] This implies that

89. In his influential little book, Punnett (1907) summarized the effect of recessiveness with the quip (p. 29): 'Not always does the plumage proclaim the fowl.' Johannsen would have expressed the same idea by saying that the phenotype is not always immediately informative about the genotype.

Mendelism can explain inheritance in several different ways. The transmission of a characteristic trait caused by a dominant gene variant can be followed through generations in human pedigrees: like begets like. Genetics can, however, *also* explain why a particular trait that is not seen over a long stretch of generations suddenly appears when the appropriate recessive gene combination is formed.

The gene is therefore a marvellous explanatory device. Based on its empirical and scientific reliability, it can be used to explain the direct inheritance of a trait and also explain why a trait is *not* inherited. For example, genes explain both the Bernoulli family's long history of mathematical excellence and Beethoven's unexpected musical geniality. By showing itself able to control all of reality's complexities, gene-thinking thereby earned a powerful position for itself.

Trait differences are real

Conservatives were attracted to genetics not only by the stability of genes. Also the second key aspect of elementary Mendelism, namely the fundamental nature of trait differences, suited conservative thinking. Its visceral feeling that the differences seen between humans were of an *essential* kind needed to be expressed in some convincing way. Here, too, genetics became helpful.

Galton's biometric tradition shared the conservative interest in human differences. Its focus, however, was on measures of quantitative and continuously varying properties – such as height or weight or intelligence – while the differences important to conservatives often were of a different kind. This was better reflected in the Drosophilists' dichotomy based on Mendelian thinking. between normal 'wild types' and deviant 'mutants'. For the support of a world view based on 'us' *versus* 'them', discrete traits were, therefore, more relevant than continuous ones. If someone was different, it was a fact not worth discussing since a trait difference was a trait difference was a trait difference. What could be discussed, however, was the best way to characterize and name this difference.

I will use an example from American eugenics to show to what lengths such a wish for dichotomous classifications of humans could go.

The idea that humankind needs to be biologically improved was strong in early twentieth-century USA. The philanthropic Carnegie Institution became an important sponsor of research and propaganda in the field; it helped start a 'Eugenics laboratory' in 1910 at Cold Spring Harbor outside

New York. Its director was the well-known zoologist, Charles Davenport. While questions of class dominated British eugenicists' thinking, their American colleagues centred on race, but also on what was considered socially deviant families. Widely disseminated were their gruesome accounts of the so-called Jukes and Kallikak families, to illustrate the supposedly deleterious effects on society of a combination of degeneration, feeble-mindedness and high fertility.[90]

The Cold Spring Harbor laboratory planned large campaigns to gather information about variation within and between families. For this purpose, relevant traits needed to be identified and standardized. Davenport compiled a list, named *The Trait Book*, published as Bulletin No. 6 from the Eugenics Record Office.[91] Every human trait worth considering was here given a code number according to its position in the scheme, so that, for example, Nervous indigestion had code 304 and Myopia 5615. Around three thousand traits were identified, all supposedly useful for classifying humans.

Which are then the traits of such interest as to be included in the investigation? Well, Paranoia (3165) and Idiocy (3131) are listed, as are Cleft nails (1813) and Fatty liver (673). Less expected, maybe, is Efficiency (4401), Strategicalness (4433) and Dreaminess (44621) under 'Movements in relation to productiveness'. And when, under 'Feelings', we come to Love of form (42112), Philosophical tendencies (42141) and Fear of dependent old age (42271), we may start to wonder in what universe we have landed. The consecutive entries for Juvenile running away (31851), Fugues (31852), Stay at home (31856) and Wanderer (31857) make us believe that we are in a mad-house – or is it a prison as Treason (35208), Piracy (3548) and Train-wrecking (316363) seem to indicate?

I could quote even more fantastically named yes/no traits to investigate, but these entries suffice. The list is like a medieval bestiary – but it is more informative about the inner life of the compiler than of what traits actually exist in the world. Davenport describes his philosophy behind the catalogue in its preface:

> In the study of human heredity it is necessary, first of all, to study one trait at a time. … The modern science of heredity indeed seeks as the element of study the 'unit character'. … The first step in the resolution of human traits, is a primary rough analysis into fairly simple traits … It is the purpose of this book to afford a list based on such a rough analysis.[92]

90. For a critical discussion, see Smith & Wehmeyer (2012).
91. My description is based on the second edition printed in 1919.
92. Davenport (1919), p. 1.

Davenport here explicitly states the influence of 'the modern science of heredity', i.e. Mendelism. It is strange, but interesting, that Mendel's experiments – planned with very well-characterized pea-varieties – shortly after being rediscovered would be used to suggest that Train-wrecking (to take but one example) was a potential unit character. All in all, the *Trait Book* illustrates the strong influence of early Mendelian thought-patterns on contemporary approaches to the study of humans, and that far outside genetics proper.

Allegories and explanations before the facts are in

In these weird reactions to Mendelism, what had happened to that quality of genetics that I praised earlier – its remarkable precision? Was there no reliable science of human genetics in Davenport's time? The answer is both yes *and* no, which helps explain the confusing ways in which genetics was used in political arguments.

Very early on, it was realized that some human differences do indeed follow a Mendelian mode of inheritance; this holds for example for the blue-brown variation in eye colour (at least, as a first approximation). But just one year after the rediscovery of Mendel's work, the British physiologist Archibald Garrod, after discussions with William Bateson, suggested that some rare human metabolic diseases were due to non-functioning, recessive gene variants; a suggestion prompted by the observation that diseased children tend to concentrate in sib-ships born to consanguineous marriages.[93]

This was enough to underwrite the idea that some human variation can be interpreted as being due to Mendelian genes, but hardly much more.[94] It should be remembered how extremely little knowledge the early Mendelists had about the inheritance machinery. Nothing was then known about the nature of genes, or by what mechanisms they function.[95] The unquestionable strangeness of genes, combined with their obvious power, instead made them amenable to speculative uses that few other scientific concepts would allow.

An interesting rhetorical device was to treat genetics in an allegorical manner. With its technical concepts, theories and results, genetics could

93. He summarized his findings in Garrod (1909, 1963).

94. It is noteworthy that Punnett (1907) has nothing to say about Mendelian factors in humans in his popular introduction to genetics.

95. Garrod's reaction to his own revolutionary findings was therefore understandable – he never made genetics an important part of his research career but continued as a clinical biochemist with an interest in the uniqueness of individuals; see Bearn (1993).

be referred to as a kind of well-established myth of high verisimilitude that should be relied upon even when precise details were wanting. One could, for example, talk about the gene for this and that, where the listener should absorb the message allegorically, no matter its surface facticity. It was of no use, for example, to ask on which chromosome the gene for 'staying at home' resided (to take yet another example from the eugenics *Trait Book*), or by what inner biochemical mechanism it functioned; such futile details belonged, according to this account, to the future and not to the early twentieth-century story. Instead, the reference to genetics was meant to convince the listener of the *fundamental* truth of the explication. This projection towards the future – that truth is certain even if the details are not yet worked out – is a constant feature in attempts to make gene-based explanations trustworthy.[96]

Another way of using genetics was to present it as an extra powerful factor in otherwise standard explanations based on biological determinism. An illustration can be found in the writings of the Swedish psychiatrist Herman Lundborg. He got help from the German geneticist Wilhelm Weinberg to analyse family data on the inheritance of a particular and rare kind of epilepsy.[97] A recessive mode of inheritance was indicated, similar to what Garrod had found for his metabolic diseases. But to Lundborg – unlike Garrod – the story did not end there. He wanted his study to emulate the American eugenic family investigations, and to him, therefore, the Mendelian nature of the disease was an indication of the family's general biological rottenness. In a popular summary of his results, he described how the family, whose origins were traced back to the eighteenth century, had a 'founder' who probably carried the unfortunate gene version in heterozygous form. At that time, according to Lundborg, the family 'stood high above head relative to other families in the region'. But then 'the signs of degeneration started to be seen'. In addition to the inherited epilepsy, Lundborg mentions a number of other factors involved: 'the extremely common consanguineous marriages', 'alcoholism', 'the high consumption of coffee among women', and the emigration to the USA of more able family members. Some mixing between dark foreigners and blond Swedes had also occurred, and 'there is a lot to

96. As expressed, for example, during the 'gene-hype' at the turn of the current century; see Chapter 11.
97. Lundborg (1913). For more on Lundborg, see later chapters on social democracy and Nazism. Weinberg's important contribution to population genetics is described in the chapter on Nazism.

indicate that this racial mixture has been definitely disadvantageous'. The result was 'an obvious degeneration', indicated by the commonness of alcoholism, criminality and various nerve and mental diseases.[98]

Thus, to Lundborg, this extensive background information did not become irrelevant with the realization of the Mendelian nature of the investigated disease. Instead, the disease-causing Mendelian gene became like a materialization of all the negative biological indications. The analytical precision of Mendelism was transformed by Lundborg into a powerful pimento for the traditional stew of biological factors used by some to denigrate other human beings.

The thought-modes that I have now exemplified and that commenced a long history of 'gene talk' with only loose links to actual genetic insights, were not restricted to conservative writers; thus, eugenics in the USA constituted a movement that attracted people from a wide political spectrum. The conservative ideology was, however, the one that most closely associated with genetics, and the aspect of genetics that conservatives found most attractive – the hardness of the genes – did not change much with further knowledge about the nature and action of genes.

To make this analysis more concrete, let me now turn to how two prominent conservative geneticists used their science to discuss the central political question of the early twentieth century, that is, every citizen's right (or not) to have a say in the running of society.

Conservative geneticists make politics

The start of the twentieth century saw the conflict between labour and capital at its height. The most important struggle concerned who should take part in governing society, if only by having the right to vote. That is, democracy.

In this historical conjuncture, the conservatives knew on whose side they were. The intellectual situation at the time has been described by the German-American political economist Albert Hirschman as follows:

> From the last third of the nineteenth century to the First World War and beyond, a vast and diffuse literature – embracing philosophy, psychology, politics, and belles lettres – amassed every conceivable argument for disparaging the 'masses', the majority, parliamentary rule, and democratic government.[99]

98. Lundborg (1920), pp. 27–29.
99. Hirschman (1991), p. 5.

Biology could very well have been included in this list of sources for conservative arguments against democracy. To show this, I will follow the conservative and anti-democratic writings of two excellent geneticists. They illustrate how genetic arguments were used to combat those in society whom one did not trust. I will start in Finland, with Harry Federley.

Against democracy

The Finnish Civil War was a short and nasty affair at the end of the First World War. The country, which until then had belonged first to the Swedish then to the Russian empire, was granted independence by the Bolshevists after the Russian Revolution in the autumn of 1917. Soon thereafter, a civil war broke out between socialist 'Red' and conservative 'White' forces. There was an international aspect to the conflict, with the Reds getting help from remaining Russian Bolshevik soldiers, while the Whites obtained aid from Germany and Sweden.

After months of heavy military fighting, with atrocities and war crimes committed on both sides, the Red forces lost the war. Here is an example, noticeable only because it left a record expressed in the biological parlance of the day. A Swede fighting as a volunteer for the Whites and belonging to an execution patrol after the decisive battle of Tampere [Tammerfors], afterwards wrote in this way about his Red prisoners:

> We strolled around and waited. Glanced at the condemned, and [found that] mankind would definitely not suffer any loss from the disappearance of these degenerate types.[100]

Slightly less than nine thousand soldiers died in combat, while the number of executed or murdered was somewhat higher. In addition, more than eleven thousand Red soldiers died of infections, starvation and maltreatment in prison camps after the military campaigns had ended.[101]

When the Whites held their victory parade in Helsinki in May 1918, the national as well as the international situation was exceedingly complicated. How the country, so miserably torn apart, should now be ruled was highly unclear.

At this moment, the 'Father of Finnish genetics', Harry Federley, outlined his political views in a two-part article with the title 'Democratic ideas in the light of biology' (published in Swedish in 1919).

100. Berglund & Sennerteg (2017), p. 22.
101. Berglund & Sennerteg (2017), pp. 468–469.

Federley had studied zoology, first at the University of Helsinki and then in Germany, and was a highly respected expert on butterfly chromosomes; he was also known as a convinced eugenicist with many international contacts.[102] He belonged to the socially dominant Swedish-speaking minority in Finland, which makes it possible for me to read his writings.[103] Earlier in this chapter, I quoted from the second part of his article, named 'The social levelling'; here I concentrate on its first part, devoted to 'General suffrage'. (Remarkably, Finland had given equal voting rights in local elections to all – including women – already in 1906.)

Federley does not beat about the bush that he found equal voting-rights wrong. After a few introductory sentences, he goes straight to the point:

> In the following, an attempt will be made to examine critically the democratic ideals from a biological viewpoint, and evidence will be presented that the presuppositions from which these ideals gain support are just not valid.[104]

With a 'biological viewpoint', Federley obviously means from the viewpoint of modern genetics. He argues that earlier scientists, relying on Enlightenment philosophers, erroneously thought that all new-borns were like unwritten pieces of paper on which text was to be added by subsequent external influences. Modern-day geneticists had, however, proven this to be wrong; in addition, we know today that 'individuals are by birth very different' – indeed, 'Homo sapiens is one of the most polymorphic species known to natural science'.[105] It is therefore, he states, no exaggeration to claim that the difference in mental capacity between 'one of modern culture's leading personalities and the Australian savage is much larger than the step between these and any of the human-like apes.'[106]

This substantial genetic difference between humans does not only exist between people from different parts of the globe – it occurs also in the midst of Finnish society. The problem with democracy, Federley argues, is that 'there is among the civilized people in Europe a not negli-

102. On Federley as a eugenicist, see Mattila (1996). Federley's name appears again in Chapter 9 in connection with the 1948 International Congress of Genetics.
103. His article was published in two instalments in the highly respected magazine *Nya Argus*, which – together with most of the Swedish community in Finland – generally supported the White side in the civil war.
104. Federley (1919a), p. 43.
105. Federley (1919b), p. 53.
106. Federley (1919a), p. 44.

gible stratum of people who, not at all or only slightly, raise themselves above the level of the savage'.[107] This leads him to his main conclusion:

> The democratic viewpoint demands, nevertheless, that these inferior elements should be given the same right to influence the organization of society as its ablest and most prominent citizens. Should not, according to common sense, the more talented and discerning receive greater possibilities to assert himself than the substandard? The latter is not, as taught by the socialist agitation, a product of the capitalist social order …, he is the result of a disadvantageous combination of heritable units.[108]

In other words, modern genetics, which asserts that there are hard and substantial differences between humans, makes democracy unacceptable.[109]

As to the 'substandard'– who due to their deficient genetic make-up would plague even a socialist society – Federley finds the 'only way to get [them] eliminated, is to hinder them from reproducing and thus prevent them from transmitting their bad *Anlagen* to new generations.'[110] Which is just a Mendelized rewording of the assertion by the member of the White execution patrol quoted above.

The genetic threat to civilizations

Harry Federley was a good geneticist, but a not particularly subtle advocate for his conservative ideas. Let our second example be of an intellectually more ambitious kind.

When R. A. Fisher in 1930 published his book *The Genetical Theory of Natural Selection*, he devoted its last third to questions about human civilizations and evolution.[111] Fisher was, undoubtedly, one of the greatest scientists of the twentieth century – he singlehandedly developed much of current statistical theory. He was also a strong proponent of eugenics. While still young he wrote a mathematically difficult paper on how the correlations between relatives can be explained by Mendelian

---

107. Federley (1919a), p. 44.

108. Federley (1919a), p. 44. I have added the question mark to the penultimate sentence of the quote.

109. When his Swedish colleague and friend Herman Nilsson-Ehle a few years later discussed the same question in front of an audience of young nationalist conservatives, he ended with the battle-cry: 'A renewed aristocracy is what the future needs' – an aristocracy built upon the genetically best members of current society. Nilsson-Ehle (1928), p. 20.

110. Federley (1919a), p. 44.

111. Fisher's first names were Ronald Aylmer, but he preferred to use just his initials. The same holds for some other individuals discussed in this book, for example his erstwhile friend and later bitter scientific and political enemy J. B. S. Haldane.

inheritance, if one assumes many small independent genetic and environmental influences.[112]

In 1930, Fisher worked as a statistician at the Rothamstead Experimental Station in England and was ready to summarize his insights about the evolutionary effects of genetics. The book is a highly inventive discussion of the way selection interacts with inheritance mechanics to produce the evolutionary outcomes that can be seen in the world today. To me, it is the most inspiring book on genetics that I know – that is, its first seven chapters dealing with phenomena like the particulate nature of genetic inheritance, the stability of the sex ratio, and the evolution of dominance. The last five chapters on humans and civilization seemed to me – when I first came to the book forty years after it had been written – irrelevant and strange, as they did to most other geneticists after World War II. But what, in fact, did the extremely sharp Fisher have to say about humans and their evolution?

It is easy to get lost in Fisher's convoluted arguments, but the aim of his endeavour is clear: to outline a genetically based explanation for why all human civilizations eventually fade and collapse. The phenomenon is truly perplexing, Fisher claims, since one would expect that civilized life should have a selective advantage over barbarian life. It should therefore show strong evolutionary staying power and continue to develop, once it had been invented.[113] Underlying this question's generality was, of course, the anxious query: What is happening to *our* civilization, identified by Fisher – just like Galton some decades before – with the British Empire?

Fisher's argument for the limited lifespan of civilizations was that there is a tendency under civilized life for positive abilities to assemble in the upper classes of society. A genetic gradient is produced with the best gene variants at the top and the worst below: 'Social classes thus become genetically differentiated, like local varieties of a species'.[114] Unfortunately, other processes – biological and environmental – act concurrently, contributing to making the fertility of the top layers in society lower

112. Fisher (1918). I agree with the British sociologist Donald MacKenzie's conclusion that '[Fisher] sought not to *reconcile* Mendelism and biometry, but to *use* Mendelism to vindicate biometric eugenics.' MacKenzie (1981), p. 189. This can be interpreted at yet another instance of genetic imperialism – all prior knowledge on inheritance should be subsumed under the Mendelian heading.

113. 'Such a civilized society, once organized and established, how is it possible to imagine that it should fail in competition with its uncivilized neighbours?' Fisher (1930), p. 175.

114. Fisher (1930), p. 226.

than that in other layers (exemplified for example by the small number of children produced by academic families). Civilized life thereby implies a selection against what is heritably good and valuable in society, a selection that normally takes the invisible form of a reduced fertility.[115] With time, this negative effect, involving a weakening of the leading forces of society, leads to the collapse of the civilization.

Again, eugenics is proposed as the only method by which this catastrophe can be avoided. For civilization to survive, a strong and conscious effort is needed to decrease the fertility of the lower strata in society and increase it among the higher strata – and Fisher acted personally in accordance with this idea as much as he could. He supported all initiatives and organizations promoting eugenics, and with his wife he produced eight children.

One of his daughters, Joan Fisher Box, describes him as 'a patriot, a political Conservative, a member of the Church of England, always a scientist …', and much in Fisher's 1930 book conforms to the standard conservative outlook.[116] Its reader senses the approaching doom due to the gradual disappearance of valuable traits from society and feels the text's anti-democratic mistrust of society's uneducated lower classes. There is, in fact, no great difference between Federley's explicit Mendelian-based anti-democracy, and Fisher's more statistical reasoning. Federley wrote in the aftermath of a terrible armed conflict, while Fisher tried to take a more abstract view of human social evolution. But both used their genetic knowledge to express a conservative distrust of their lower-class co-citizens.

Thinking based on presuppositions

At this point, it is necessary for the sake of my wider purpose – to charter the ideological reactions to genetics – to take the analysis one step further. I have detailed how two good geneticists argued when they wished to support conservative ideas. It is important to note that they also were scientifically wrong.

Federley and Fisher trusted alleged facts that they took for true – but actually were false. Federley stated, as quoted above, that humans are highly polymorphic, meaning that they are highly genetically variable.

115. 'The evidences examined leave little room for doubt that the most powerful selective agency in civilized man is that acting upon the mental and moral qualities by way of the birth-rate', p. 209.

116. Box (1978), p. 11.

Today, we know from genome studies that this is actually *not* the case. Due to humankind's very recent increase in number, our degree of DNA variability is low for being a numerous species. In addition, the genetic differences between humans of different kinds (including Neanderthals and other such ancient groups) are *much* smaller than the differences between us and the chimpanzees or gorillas. Federley's statement that some 'savage' humans were more closely related to the apes than to other humans is therefore *completely* incorrect.

Similarly, *none* of the substantial genetic differences between different social strata that Fisher took for granted, exist.[117] (And this is why I have never been impressed by Fisher's reasoning. Even if his selective scenario was correct, it would have taken a very long time for any significant genetic contrast to develop between different parts of society, given the extended parental mixing and the very low heritability of the traits he posits – a time that has never existed in history.)

I do not write this to argue with my older colleagues – they may even have had good reasons at the time for believing what they did – or to criticize the conservatives' approach to genetics in general. No, the important conclusion to draw from Federley's and Fisher's errors is the realization that even the best geneticists may occasionally be so influenced by their ideological presuppositions that they take erroneous positions as certified facts. To the minds of Federley, Fisher and many of their colleagues, there *are* strong differences between humans, and they take this 'fact' to imply that there *must* exist significant genetic differences between social groups and strata in their contemporary society.

This is a clear example of how scientists' 'spontaneous philosophy' – as discussed in the preceding chapter – may affect their conclusions. These two prominent geneticists used their science in a misleading way when they based their arguments on incorrect presuppositions influenced by their personal ideological leanings. Had they been liberal or socialist via upbringing, father-revolt or personal inclination – we will meet such examples later – their way of handling genetic arguments would most likely have been different.

117. To Fisher, 'distinctions of social class are distinctions of relatively permanent biological entities'; at the end of the same paragraph, he writes about groups with 'genetic contrasts'; Fisher (1930), p. 211.

A problematic transfer of knowledge

One thing should be clear after this analysis of the relationship between the new science of genetics and the conservative ideology – such interactions do not take the form of a simple transfer of facts from the scientific sphere into the ideological realm. Presumed facts *do* play a role in these interactions, but so do scientific theory, preconceptions, language praxis, personal experiences and other elements that may enter into the arguments.

Resonance, not transfer

The metaphor that comes to my mind is therefore not one of transfer, but of *resonance* between the separate meaning-systems constituted by an ideology and a science. It is like playing piano in a room where a violin hangs on the wall – some notes struck on the piano will make the violin's strings vibrate. Some notes, but not all. The relationship between scientific genetics and the conservative ideology seems to me to be comparable to this musical example. At certain moments, there is an affinity between their separate meaning-systems, which makes the ideology respond positively to something presented by the science.

Obviously, a harmonious reverberation is most easily produced when the science presents a result that corresponds to what the ideology already considers as true – what it already takes for granted as self-evident. Louis Althusser, the French Marxist philosopher whom we met in the preceding chapter, describes in his very special rhetorics, this pleasure of recognizing some new information as being in harmony with what one already knows:

> [I]t is characteristic of ideology to impose self-evident facts as self-evident facts (without in the least seeming to, since they are 'self-evident') which we cannot *not* recognize and before which we have the inevitable and eminently natural reaction of exclaiming (aloud or in 'the silence of consciousness'): 'That's obvious! That's right! That's true!'[118]

This is a good description of how science often is utilized by ideologies – some newly detected scientific fact is used to defend the continued belief in what one already always has 'known'.[119]

118. Althusser (1970, 2014), p. 189.

119. Althusser's contemporary Roland Barthes expressed a similar idea in a more literary context, when he wrote that his aim in writing his famous *Mythologies* was to criticize some common everyday myths and 'to reclaim from the decorative descriptions of *what is self-evident*, the ideological misuse which, in my understanding, is hiding there'; see Barthes (1957, 2014, p. 9), my translation.

Ideologies, on the other hand, are rarely keen on capitalizing directly on real and surprising scientific breakthroughs, since the unexpected has no role to play in a well-established ideology. This is the difference between science and ideology that Althusser wants to make clear. Implicit in his writings is his fidelity to the ideas of the French epistemologist Gaston Bachelard, who stressed that good science is recognized by saying something *different and unexpected*, even if it thereby contradicts what 'always' has been known.[120]

This special characteristic of good science – sometimes to reaffirm existing beliefs and at other times contradict them – leads our analysis towards a discussion of how the trust that an ideology puts in a science may turn into a problem if and when the science threatens to lead the ideology astray.

Sometimes genetics gives unwanted answers

By calling the conservatism's positive reaction to genetics 'a resonance', I wish to avoid the impression that their bond is absolute. An ideology and a science are two different things, and their developments follow different rationalities. With respect to our present interest, this means that a science will not always produce the results expected by a positively attuned ideology. An informative instance is given by the Catholic Church's reaction in 1930 to some genetically based eugenic suggestions.

We have seen how geneticists like Federley and Fisher turned to eugenics to propose how the world should be improved – or at least be made to deteriorate less rapidly. Their principles were simple: the better parts of society ought to produce more children, the less fortunate parts ought to produce fewer children, and the unsuitable in society ought to produce no children at all. Everyone, at least if they had a conservative inclination, could agree with this goal. How to achieve it was, however, less clear. Some more harmless proposals were directed towards increasing fertility in 'good families'. It was, for example, often stressed that women from

120. The standard reference to Bachelard's epistemology of science is *La Formation de l'esprit scientifique* from 1938. In his analysis of Lakatos's historically informed philosophy of science, Larvor (1998; p. 107) makes an interesting – and in no way self-evident – association between Lakatos's ideas and the writings of Bachelard (and his students George Canguilhem and Michel Foucault). Bachelard's importance for Althusser makes the choice of philosophers that I use in my analyses less eclectic than first may appear. Thomas Kuhn, referred to in several of my chapters, belongs to the same epistemological tradition; see, in particular, his *The Structure of Scientific Revolutions* (1962, 1970).

such families should not waste their time with academic careers but ought to marry early and raise many children. Another standard suggestion was to recommend couples with genetic predispositions for heritable diseases not to have children. Then there were many versions of how sterilizations should actually be performed: on males only or on both males and females; with legal constraint, or by free will alone; in combination with castration, for rapists; as a necessary prerequisite for abortion in women with weak health; and so on.

The discussions about eugenic interventions were generally held within the confines of rational discourse, which – in fact – from a conservative standpoint was not always innocuous. What would happen if this rational reasoning, supported by the laws of genetics, came into conflict with some, even more fundamental, value within the ideology? Maybe somebody then would have to say Stop!

One who did react was Pope Pius XI (in office 1922–1939). He was interested in science (he re-founded the important Pontifical Academy of Sciences), which may explain why he felt a particular responsibility for clarifying the boundaries between scientific rationality and religious values. In the encyclical *Casti connubii* (On Chaste Wedlock) from 1930, he formulated the Catholic Church's unease over modern biological knowledge and the recommendations of its advocates.

To the Pope, sexual mores were in rapid deterioration, and it was necessary to remind the faithful of some elementary rules. Thus, sex was only allowed inside marriage, and all means of birth control were rejected. Abortion was also forbidden, even when justified by eugenics: 'Some wish [abortion] to be allowed and left to the will of the father or the mother; others say it is unlawful unless there are weighty reasons which they call by the name of medical, social, or eugenic "indication".'[121]

This is where things became complicated for the Pope and interesting to us. There was obviously a conflict of interest here *within* the conservative mode of thinking. The encyclical outlined it like this:

> For there are some who … put eugenics before aims of higher order, and by public authority wish to prevent from marrying all those whom … they consider … would, through hereditary transmission, bring forth defective offspring. And more, they wish to legislate to deprive these of that natural faculty by medical action despite their unwillingness … [A]gainst every right and good they wish the civil authority to arrogate to itself a power over a faculty which it never had and can never legitimately possess. …

121. Pope Pius XI (1930), Section 63.

> Those who act in this way are at fault in losing sight of the fact that the family is more sacred than the State and that men are begotten not for the earth and for time, but for Heaven and eternity.[122]

Thus, eugenics is fine if the partners in a marriage of an unfortunate kind decide to live chastely with each other – but all other suggestions would go against the values of the Church. And reasons of State can never be more important than the values of the Church.

Underlying these conclusions are two deep convictions. The first is theological and relates to the Christian belief that child-creating can never be regarded as an altogether positive process. Ever since Eve's bite of the forbidden fruit, sex and reproduction carry a bitter flavour. (We may note with interest that the conservative conviction that 'evil' is not eradicable from society, as discussed at the beginning of this chapter, here appears in its theologically most fundamental form.)

The second conviction concerns what the essence of conservative politics ought to be: 'whatever things have deviated from their right order, cannot be brought back to that original state which is in harmony with their nature except by a return to the divine plan.'[123] In the present context this statement means that eugenics is too 'progressive'; it tries to fix by some rational social means what, at heart, is a problem concerning man's relation with God.

In summary, the Pope's argument boils down to: 'let the faithful … be on their guard against overrated independence of private judgement and that false autonomy of human reason.'[124] A true catholic – and thereby conservative – must understand how to subjugate the rationality of science under the dominant values of religion.[125]

Thus, there is within the conservative world view and in its relation to eugenics and its scientific underpinning a structural contradiction – and not just some slight differences of opinion – originating in its foundation in Christianity. This situation can be generalized: Adherents of an ideo-

---

122. Pope Pius XI (1930), Sections 68 and 69.
123. Pope Pius XI (1930), Section 94.
124. Pope Pius XI (1930), Section 104.
125. The sentiments expressed by Pope Pius XI were not unique to the Catholic Church but also existed elsewhere within the conservative religious sphere. One finds, for example, that when the Danish parliament in spring 1929 debated the country's first eugenic law (allowing sterilizations but only under quite restricted circumstances), the strongest opposition came from a group within the Conservative Party led by a clergyman belonging to the Evangelical Lutheran Church of Denmark. See Hansen (1996), pp. 37–38, and Koch (2014), pp. 93–102. More background to this event is given in the next chapter.

logy cannot be expected to be undivided in their response to some new scientific development, particularly if it concerns issues deemed central to the ideology. Such internal disagreements may play a role in the continued adaptation of the ideology to changes in the world – a structurally similar debate among socialists will be described in the next chapter.

The example shows that ideologies do not take scientific facts as automatically given – but neither do they find themselves defeated when a cherished science produces uncomfortable results. Ideologies have a pragmatic and emotional, and never an absolute or deterministic, relationship to scientific knowledge.

A long-lasting affinity

The conservative affinity for genetics was deep and sincere already from the start. When tensions of interpretation arose, they were debated. Scientific results were not just paper-flags hung at the High Street Party Office carrying a bright message but signifying nothing.

Such debates could modify but not decrease the attachment that conservatives felt towards genetics. The hardness of the genetic material and the fundamental nature of human traits have remained central to conservative arguments also in later times. I will finish my analysis of conservatism's trust in genetics with a recent, almost humorous, example.

In June 2019, the Conservative Party in Britain made Boris Johnson its leader and the country's Prime Minister; when in power, he appointed a (then) close collaborator, Dominic Cummings, as his Chief Advisor. The super-active Cummings immediately sent out a call for individuals with non-traditional backgrounds to help improve the performance of the Conservative government. Among those recruited was a young man whose chief merit seems to have been his strongly expressed views on the existence of significant genetic differences between classes and races. The subsequent media storm, ending with the man having to leave his position, is not relevant here. Worth remembering is only that when conservative ideologues look for original thoughts to further their politics, they are even today prone to fall for the very same ideas about inborn human differences that fascinated their predecessors more than one hundred years ago.[126]

Conservatism is, indeed, strongly attracted to genetics.

126. The facts in this paragraph are taken from articles published in British news media during the first months of 2020.

6. Social democracy and the irrelevance of genes

Socialism and Lamarckism

We have seen that the conservatives reacted favourably to Mendelism from the start. The question then arises: does that mean that the socialists reacted negatively towards the same ideas?

Were it so, my book would soon end. I would only have needed some illustrative examples of socialist writings against genetic determinism, plus some concluding remarks. In that way, I would have covered the traditional view of 'the Right' versus 'the Left' and confirmed standard preconceptions about where genetics belonged ideologically.

However, this would have been misleading. I would have given an incorrect picture of how ideas on inheritance *actually* have been used in ideological thinking. That is something I wish to avoid. I would also have given a faulty impression of how ideologies work. Just because one ideology is strongly positive towards some phenomenon, it does not follow that its ideological opponents would be against that same thing. Michael Freeden, the political scientist whose approach to ideologies I follow in my analysis, argues that ideologies have 'argumentative depositories' from which they pick whatever suits their present needs best.[127] Each element that an ideology takes out of the depository is given its full meaning by the links it forms with the other argument-objects of the ideology. Therefore, if an element is of key importance in one ideology, it need not necessarily be so also in competing ideologies, neither positively nor negatively. What is important in one ideology may be *irrelevant* in another – it may be a non-issue.

My task in the present chapter is, therefore, not to play out the socialists' conception of genetics against the corresponding conception among

127. See the discussion in Freeden (1996), pp. 85–91.

the conservatives. Instead, I want to analyse how various socialists reacted to the increased knowledge about inheritance and in the process understand more about how real-life ideologies may react to science.

Socialists come in all kinds

The history of socialism is even more complex than that of conservatism. It, too, has links to the French Revolution, but for the present purpose it is more natural to start with the writings of two nineteenth-century German expatriates living in England, Karl Marx and Friedrich Engels, the first as a political refugee, the second as the manager of a branch of the family business. Together, they published a pamphlet in the spring of 1848, just before the revolutionary upheavals that shook the European continent. Their *Communist Manifesto* outlined ideas that have been central to socialists ever since.[128] Communists too, of course – though a clear distinction between these two ideological families did not exist at the time. There were many different socialist traditions in the nineteenth century, and communism, as we know it, did not become clearly demarcated until after the Russian Revolution in the autumn of 1917.

Here, I will focus on the tradition that came to dominate twentieth-century socialism, the branch called social democracy. It is characterized by its acceptance of the parliamentary representative system and a conviction that the best way to ameliorate the situation of the working classes is to use the power granted them by equal voting rights in nationwide elections.[129]

It is true that social democrats also carry a wish to abolish capitalism. At least in principle; though perhaps only to reform it; perhaps only gradually; and, in the end, perhaps only to curb its most deleterious effects. This hesitancy over the urgency with which capitalist society needs to be overturned has always been a constitutive part of the social democratic tradition – together with an attachment to the utopian vision of a future classless society.

Social democratic socialists have existed in all the countries covered by my analysis. The ideology has played its historically most important role in Scandinavia. Socialists across the world have looked with admiration to the Nordic countries and their reform policies. In this chapter, most

128. Marx & Engels (1848, 2017).

129. 'Socialism in the West became dominated by social democracy – moderate, parliamentary socialism – built upon consolidating the welfare state.' Giddens (1998), p. 4.

examples will therefore be taken from Sweden and Denmark.[130] Other stories could have been told if I had concentrated on other countries, but the conclusions about the ideology would nevertheless have been similar.[131]

Fighting unfairness is primary

Nothing is – self-evidently – said in the *Communist Manifesto* about genes or genetics. Neither is anything said about evolution or Darwinism, even though the authors reacted favourably to these ideas when they later became known to them. The 1848 pamphlet was, indeed, written a very long time ago.

Still, its introductory outline of humankind's history up to the dominance of capitalism makes powerful reading even today – with its verve, striking ideas and poetic language. Interesting also is the complete absence of biological notions in its sweeping historical panorama.[132] While the different modes of production are given detailed and astute descriptions, the agent behind these processes is always the same: 'man'. A masculine noun is used in the English translation, but the German original, *Mensch*, makes clear that the authors refer to a general man, covering all members of the human species. A man living anywhere in the world and belonging to any sex, race or creed. In fact, a man similar to the man in the Bible or in the writings of idealist philosophers – for example the authors' flawed hero, Friedrich Hegel. No distinction between individual men or women was worth making in this context. If anything, such differences were to be ignored and should not be allowed to hide the basic unity of humankind. Thus, what characterizes humans in history is not their biological differences but the fact that they live in societies where most of them are oppressed because of their structurally determined position. An oppres-

130. 'Swedish Social Democracy has occupied a position of parliamentary power … without parallel in the history of modern democracy. … What has been exceptional is the combination of these components of political power: government leadership, majority rule, and number of votes.' Therborn (1992), pp. 1–3.

131. Another advantage of concentrating on Denmark and Sweden is that eugenic discussions in these countries normally took place within and between political parties with well-established links to the major ideologies. In France, the UK and the US, for example, a host of intermediary organizations and institutions would have had to be included in the analysis of eugenics, without necessarily clarifying the issues.

132. One of the few instances when a biological word is used in the *Manifesto* is the following, which I here quote in German while an English translation is given in Chapter 8: 'Die Kosten, die der Arbeiter verursacht, beschränken sich daher fast nur auf die Lebensmittel, die er zu seinem Unterhalt und zur Fortpflanzung seiner Race bedarf.' Marx & Engels (1848, 2017), p. 26.

sion that has become even more acute with the advance of the capitalist mode of production.

From this reading of Marx and Engels follows the main point of the present chapter: Socialists in general, as well as social democrats, are against the capitalist system and its unfairness. In this perspective, any differences between humans with respect to innate qualities are uninteresting. What genetics may teach about human variation is therefore not of any particular relevance for socialists – rather the reverse. An interest in biological differences between people may become a way to belittle what is important. Thus, worrying about heritable differences is, in this view, a task for bourgeois ideologists wanting to hide the structural unfairness of life under capitalism.

Lamarckism, a natural ally

Why, then, should socialists worry about biological differences among humans? Socialism, given its roots in early nineteenth century, instead quite happily associated itself with the idea that heritable differences do not constitute barriers to progress, since all such differences may with time become transformed by environmental interventions. In this respect, Lamarckian theory became a useful intellectual companion.

Jean-Baptiste de Lamarck was an outstanding French biologist at the beginning of the nineteenth century.[133] We owe the use of the word 'biology' to him, and his writings were important in getting Charles Darwin and others to think about evolutionary change. He made careful taxonomic studies and wrote large systematic overviews involving many ideas – some of which we today consider rather strange. They have later – scrambled together with ideas from Darwin and the German zoologist August Weismann – been reorganized into new conceptual entities; in addition, some now talk about 'neo-Lamarckism' and 'neo-neo-Lamarckism'. Thankfully, we do not need to deal with these complexities here.

I will instead stay with the following simple formulation: Lamarckism teaches that what happens to an organism during its lifetime may directly affect its progeny. Or with the use of a standard phrase: Lamarckism believes in the inheritance of acquired characteristics.

According to this definition, Lamarck was a Lamarckist. So was Darwin, to whom domestication, for example, constituted an important

133. For more on Lamarck and Lamarckism, see e.g. Jordanova (1984) and Buican (1984), pp. 17–72.

source of heritable variation. Mendelians, on the other hand, have always been opposed to Lamarckism. To them, truly heritable differences are *hard* and impossible to change by external, environmental means. Genetics therefore teaches that it will always be better to breed from an old, lame and badly fed stallion than from a young, hot and strong one, if the invisible genotype of the first is better than that of the second – a good example of how scientific knowledge may run counter to spontaneous knowledge.

Lamarckism was popular in American evolutionary thought. It also lived on as an interesting alternative idea in German biology up to World War II (in particular regarding heritable phenomena in unicellular organisms), but it retained its strongest academic base in France. True, there were French experimentalists who were interested in Mendelism – such as Lucien Cuénot who performed crosses with mice at an early date – but he remained professor of zoology at provincial Nancy, while all the prestigious positions in Paris went to Lamarckists.[134]

Nineteenth-century socialists, who had many other questions to deal with, were not particularly interested in early genetics. To them, heritable differences between humans were irrelevant, and Lamarckism gave such natural support to their political designs that they did not pay any particular attention to the emerging new 'principles of inheritance'.

To see how a biologically knowledgeable social democrat reacted to these early genetic results, I find it interesting to follow Bengt Lidforss, a colourful Swedish professor, who – even though he died young (in 1913 at the age of 45) – greatly influenced the Scandinavian socialists' views on science.

134. The first professorial chair in genetics at the Sorbonne was not created until 1945, when the position went to Boris Ephrussi; see Buican (1984), pp. 281–282. Buican also explains why the International Conference of Genetics was held in Paris in 1911 despite the weak position of the Mendelists there. The answer lies in the early history of these conferences as meeting places for breeders and horticulturalists. Thus, it was not someone from academia who organized the event in Paris but the prominent plant-breeder Philippe de Vilmorin; see Buican (1984), pp. 237–239.

Uninteresting and interesting genes

Bengt Lidforss, botanist and social democrat

Bengt Lidforss was a prominent experimental botanist, and a charismatic intellectual.[135] He joined the Swedish Social Democratic Party in 1902 as its first academic teacher and became professor of botany in Lund in 1911 (after official hesitancy over his supposedly questionable morals). He was as famous for his venomous attacks against bourgeois society as for his brilliant popular science articles, all printed in the socialist newspaper *Arbetet*. It was via this unlikely channel that the Swedish general public received its first introduction to Mendel's results.

In a two-part article published in 1902, Lidforss describes, using personal experience, how confusing the outcomes of plant-crosses can be, but notes that 'a catholic clergyman, Abbot Gregor Mendel' has 'brought order to this apparent chaos'.[136] Mendel's results had been ignored for many years but had recently been rediscovered by Hugo de Vries and Carl Correns. Lidforss regretted that he could 'only give a brief résumé of the wonderful things that these researchers have brought to light.'[137] The new results were very interesting theoretically, but they may also 'become of great importance … with respect to practical matters, not just for horticulture, but for agriculture in general.'[138]

Thus, Mendel's results could become important for plant breeding, but what about their effect on humans and on social policy?

Children first

Lidforss tackled this topic in an article in 1908.[139] He begins there by accepting the existence, also among humans, of 'hard' genetic differences of a Mendelian kind. This immediately leads him to the question of what to do when someone carries an obviously 'bad' genetic factor. Lidforss differs on this point from his conservative colleagues, since he prefers the condom to the scalpel. Instead of advocating sterilization, he recommends individuals with heritable deficiencies to use 'preventive means' to

135. See Beyer (1968) and Bengtsson & Broberg eds. (2013).
136. Lidforss' results from his extensive crossing experiments with blackberries were edited and posthumously published (1913) by Wilhelm Johannsen.
137. Bengt Lidforss (1904), p. 58. Lidforss collected his newspaper articles on science and republished them later in books. It is from these more easily accessible sources that I quote.
138. Lidforss (1904), p. 63.
139. Reprinted in Lidforss (1908), pp. 38–45.

avoid producing children.[140] There are, however, more questions involved in Mendelian inheritance than the risk of genetic diseases. For example, the conservative view that genetic differences put a brake on what social progress is attainable – is that something that socialists should accept? Is there, in other words, a contradiction between the facts of biology and the reforms advocated by socialists?

Lidforss refuses to rise to this bait. Instead, he focuses on the emotional centre of the socialist creed – the promise of a better life for children. He argues that recent research has shown 'that it is possible with abundant nutrition … to produce – in a short time – a much more vigorous race than "natural selection" can produce over many generations.'[141] To him this is of great importance, since when living standards improve, a number of beneficial effects follow:

> If – to make a brave thought-experiment – we assume that the living condition of the lower class suddenly was raised to the level at which a professor's family now lives, then we would experience that the *number of true geniuses would multiply within a short time in Sweden*. This is not a fantastic utopia, but a simple biological truth.
>
> Far from being contradictory, this part of evolutionary theory instead gives strong support to the fundamental principles of socialism.[142]

With its reference to nutrition, the argument undoubtedly reads like a version of Lamarckism (Lidforss is not very lucid on this point, perhaps deliberately so). What becomes clear, however, is that the author – himself born into a professor's family – wants to improve the conditions for working-class families and is convinced that this will lead to substantial benefits for society at large.[143] Whatever the problem, socialism is the answer. And this irrespective of any genetic differences. The unfairness of society is so obvious that not attempting to change it would not only be morally wrong but *irrational* – something which to the scientifically attuned Lidforss is almost worse.

In this text, Lidforss – not surprisingly – shows the socialist's intellectual resistance to the conservatives' instinctive attachment to the use of

140. Lidforss (1908), p. 45. This suggestion was less innocuous than it appears today. In 1910, Sweden adopted a law that made it illegal to spread information about contraceptives.

141. Lidforss (1908), pp. 41–42.

142. Lidforss (1908), p. 42. Italics in the original.

143. Lidforss's father was a professor of modern languages. He was also the editor of a conservative newspaper. As could be expected, Bengt Lidforss's relationship with his father was often very strained.

genetics in politics; he would never have accepted Federley's biological arguments against democracy that I outlined in the preceding chapter. This should, however, not make us forget the primary use for genes that Lidforss hinted at in his first, 1902, article on Mendelism: They were an important resource for plant breeding.

Plant breeding as a meta-ideology

Organized plant breeding – where someone produces seed of improved quality and sells it to farmers for profit – developed during late nineteenth century in many parts of the world. In Sweden, in 1886, a group of large landowners in the agricultural South started a plant breeding institution, called Svalöv from the village where it was situated. With its early use of scientific breeding methods it came to play an important national and international role.[144]

The person who introduced Mendelian principles to the practical breeding work at Svalöv was Herman Nilsson-Ehle. We have already met him a few times in this book. He made crosses in oats and wheat and showed that many gene differences with small effects will, when randomly recombined, produce what at the population level looks like a continuous variation. A synthesis, in other words, of the Mendelian interpretation of variation as caused by different versions of discrete genes and Galton's continuously varying traits. Based on these results, Nilsson-Ehle proposed more efficient methods for plant breeding. He himself produced some wheat varieties of great agricultural importance.

Nilsson-Ehle was a right-wing nationalist, later close to Nazism, and very far from social democracy.[145] He nevertheless has a natural place in this chapter on socialism, since his view of genetically informed plant breeding as a science for national welfare gained wide ideological appeal.[146] Thus, a 'meta-ideology' – as one could call it – developed around plant breeding in Sweden, to which all social forces adhered. *Everybody* wanted to alleviate the food crisis that followed the First World War, even the Social Democrats, the main social critics at the time. They never hesitated to support

144. The older spelling of this institution was Svalöf. Noel Kingsbury's book *Hybrid* (2009) gives an overview of the global history of plant breeding. Tunlid (2004) describes the history of genetics in Sweden, while Olsson ed. (1986) provides a brief summary of the breeding work done at Svalöv.

145. Gustafsson (1972). For more on Nilsson-Ehle, see Bengtsson (1999), pp. 49–64.

146. He summarized his views on genetics as a science for all aspects of society in Nilsson-Ehle (1919).

Nilsson-Ehle and Svalöv when their suggestions reached Parliament. In other words, they chose to prioritize this new hope-inspiring applied science over challenging the wealthy landowners and their economic interests. Based on this meta-ideology, and on its own reformist views of societal change, the Swedish Social Democratic Party continued to support all kinds of plant-breeding activities throughout the period it led or dominated Swedish governments (i.e. from the 1930s until the 1970s).

Genes suited for socialists

For a more explicitly *socialist* reaction to genetics as a tool for plant breeding, I will turn to one of Nilsson-Ehle's students, Åke Gustafsson.[147] He was an innovative scientist, a political radical and an able poet, who with time became a prominent figure in the international genetics community. In Swedish political history, he is mainly remembered for his role in the successful fight against proposals to arm the country with nuclear weapons.

Gustafsson early on latched on to reports from H. J. Muller and others in the US that genes can be changed by radiation. Normally, such induced mutations are just as bad as spontaneous mutations. But Gustafsson believed that careful screening could pick out induced mutations of practical interest and started a large research project for furthering the development of such 'mutation breeding'. The first results were obtained before 1939 but were not widely disseminated until after the war.

This is the background to a popular science article that the British geneticist J. B. S. Haldane – a prominent left-wing intellectual, and someone who will play an important role in the next chapter – wrote for the British communist newspaper *The Daily Worker* in autumn 1948. His aim was 'to describe a very fundamental piece of research which has just been published in Sweden, and which will certainly be imitated in all countries where agriculture is practiced scientifically.'[148]

Haldane had attended the World Congress of Genetics, held in Stockholm in the summer of 1948, where he met Åke Gustafsson. Their

147. Gustafsson supervised my undergraduate project in genetics at the University of Lund in the late 1960s. I have met and known a number of the geneticists mentioned in this book but have chosen to identify only those who in one way or another were my formal teachers/supervisors.

148. Haldane (1949), p. 96; again, I quote from a book of reprinted articles. The published work that Haldane refers to is Gustafsson (1947).

discussions on induced mutations and plant breeding are summarized by Haldane as follows:

> Gustafsson in Sweden has at last got results of practical importance in barley. He subjected seeds to high doses of X-rays … and then found abnormal types in the progeny… Hundreds of thousands of plants were grown, and among them were several thousand mutants. … The large majority of these new forms gave worse yields than the parents, a few were as good, a very few were better. Gustafsson thinks that about one mutant in several hundred is of any real value in agriculture.[149]

Haldane was attracted to Gustafsson's vision and reported that 'Gustafsson's most important discovery may be that he can control the direction of mutation to some extent. … He is now working on a large scale to find out under what conditions mutants with increased vitality are produced.'[150]

This is in essence what Haldane saw in Gustafsson's work: Science – in the form of a fascinating combination of advanced physics and modern genetics – can be harnessed; its deep biological processes can be used for the benefit of humankind. Thus, genetic knowledge is a positive force for the development of the means of production. To a socialist, like Haldane, this was something altogether laudable. One should, however, never forget the politics of how the resulting benefits are distributed across society. Or as Haldane expresses it: 'Whether this [Gustafsson's results] will mean cheaper beer and higher agricultural wages in Sweden or only higher rents and profits, is for the Swedes to determine.'[151]

Haldane's article illustrates how genes may function as objects of relevance and hope also for socialists – but only if the genes are in the right place, of the right kind, and under human rational control (plus leading to cheaper beer). The text also shows that the socialists' lack of interest in human genetic variation, so often decried by conservatives, did not follow from a general lack of respect for modern scientific knowledge. On the contrary, the socialists' problem was that they did not live in a world of their own definition and choice. Still, they needed to come up with reasonable and trustworthy responses in the ever-present ideological discussions about human variation.

---

149. Haldane (1949), p. 97.
150. In the film from the 1948 World Congress in Stockholm, to be referred to in Chapter 9, Haldane and Gustafsson can be seen in lively discussion.
151. Haldane (1949), p. 98.

So, how *did* later generations of socialists respond when human heritable differences became an increasingly salient political issue? When their natural reliance on Lamarckism faded as that theory became scientifically outdated? When ideas about social reform became increasingly technical rather than visionary, being expressed in terms such as school systems, housing allowances and family size?

The welfare state and its children

An ideology competent to govern society

To answer these questions, it is useful to go back to what Freeden writes about ideologies:

> The requirement of competing over public policy reminds us that we are dealing with *political* ideologies. Ideologies are aimed at the public arena, and they usually are in contention over drawing up macro-programmes … for social and economic policy and for effective administration.[152]

An ideology is not *just* a world view. Certainly, a full-fledged ideology must say what the world is like. But that is not enough. A political ideology must also present convincing recommendations for how society should be ruled and changed. It must propose ideas for what, in Freeden's words, constitutes not only reasonable 'economic policy' but also 'effective administration'.

Ideologies differ with respect to how necessary they have considered this part of politics to be. For the Social Democratic parties in Scandinavia after the First World War, this aspect was extremely important. It was vital for them to show that they were reliable alternatives to the destructive chaos that armed proletarian revolutions would bring (following the experiences of Russia in 1917 and Finland in 1918). They had a strong wish to demonstrate that they not only had utopian visions for society but also the competence to rule – starting here and now.

This implies that even though the social democratic ideology found genetic differences among humans of limited interest, to be a serious political alternative it had to provide answers to questions deemed relevant in the contemporary political debate. We therefore find a number of instances in the 1920s and early 1930s where prominent social democrats promoted ideas typically associated with eugenics. I will consider them

152. Freeden (2003), p. 34, italics mine.

in the next section. The final part of the chapter then deals with a debate in the late 1930s and early 1940s among Swedish social democrats about what control society should exert over the reproductive rights of humans differing in ability and responsibility.

Social democratic policy initiatives

Soon after the end of the First World War the Swedish Social Democrats supported a cross-party motion in parliament to create a national Institute for Race Biology.[153] The mission for the institute was to use modern biological science to promote society's future welfare (the word 'race' in its title should, thus, not be taken in our modern sense but as referring to all kinds of human heritable differences). The similarity to the Social Democratic Party's response to plant breeding, as discussed above, is obvious. The motion was passed without any substantial debate in Parliament. The socialists had toned down their internationalist rhetoric from the beginning of the First World War and had become more nationalistic, and no other political force voiced any criticism in principle against the proposal. The Swedish Race Biology Institute therefore began its activities in 1922; its first director was the psychiatrist and eugenicist Herman Lundborg.

We have already seen, in a previous chapter, how confused Lundborg's ideas about inheritance were, and he and the institute did not bring any further glory to Swedish genetics. Lundborg was an unhappy person, obsessed with the gradual disappearance of 'the Swedish peasant stock'. He came to side with the Nazi movement but feared its anti-Semitism since he believed it would damage his institute's reputation. He also spent more and more time with senselessly detailed anthropometric investigations of the Sami people. In short – he became a liability to modern eugenic and genetic ideas in Sweden.[154] When he retired in the mid-1930s, the Social Democratic party was in power. It appointed the medical doctor and competent population geneticist Gunnar Dahlberg as Lundborg's successor.[155] This decision can be seen as a case of social democratic 'effective administration' (to return to Freeden's words). Dahlberg was close to the party and known to be firmly anti-Nazi.[156]

153. The establishment of this institute is described by Broberg (1988); for its general history, see Broberg (1995).

154. For more on Lundborg, see Hagerman (2015).

155. Broberg (1995), pp. 69–70.

156. For more on Dahlberg, see the end of the chapter on Nazism.

One important political issue in the Interwar years concerned how society should (or should not) regulate the fertility of those who presumedly could not take care of themselves or their offspring. Many European countries introduced sterilization laws and regulations.[157] Scandinavian social democrats were highly involved in enacting such laws. This was originally seen only as a matter of unifying existing regulatory procedures; sterilization, as such, was not considered particularly morally sensitive, at least not as long as it was limited to medically certified cases.

In Denmark, the Social Democrat Karl Kristian Steincke – a social reformer with great administrative capacity who on and off for twenty-five years held important ministerial posts – took the initiative for the first such law in Europe. It was passed in 1929.[158] In a similar vein, Alfred Petrén, a physician, parliamentarian and childhood friend of Bengt Lidforss, initiated the first sterilization law in Sweden. It was approved by parliament in 1934.[159] Petrén was registered as a Social Democrat in *Riksdagen* but was not particularly active in the party; instead, he seems to have used his parliamentary position for what he considered to be his main individual, medical and patriarchal duty: to organize a decent treatment of the 'abnormal' in society.

I cannot find any specific social democratic political principles involved in these legal efforts. Neither in Denmark nor in Sweden did the laws make sterilization compulsory for any particular social group, and no coercive legal means were involved to force operations to be performed. In both countries, the necessary requisite for sterilization was the opinion of medical doctors – no purely social indicator was sufficient for allowing the procedure to take place. In Denmark, some militant conservatives expressed doubts about the legislation on Christian grounds, while in Sweden no ideological discussions took place about the issue, at least not within the socialist ideological family.[160]

157. 'Only in some of the Swiss cantons was it accepted that eugenic sterilizations and castrations could be regarded as a part of the doctor's individual responsibility.' Hansen (1996), p. 23.
158. Koch (2014), pp. 74–102.
159. For more on the 1934 law, see Broberg & Thydén (2005).
160. For the reaction of the Swedish radical left to various sensitive biological questions, see Svensson (2001).

Genetics discussed – and then re-ignored

Social democrats nevertheless would have debates of their own about inheritance, sterilizations and the parenting possibilities for individuals of different qualities. They came somewhat later, between 1933 and 1945, when the spontaneous socialist creed: 'Capitalist society is unfair for the large majority of the population – let's change it!' no longer sufficed, even when combined with paternalistic reforms for society's most unfortunate members. The surrounding international political/ideological environment was now dramatically changed.

Biological questions activated

The *Machtübernahme* by the Nazis in Germany in 1933 had a direct effect on political debates all over Europe. The shock it generated was not so much over what the Nazis did, as over the fact that they really got things done. Nazism was not just words, but action.

The historian Edward Ross Dickinson points out in an interesting analysis of the development of modern biopolitics that, as late as 1930, 'eugenics was still not really *politikfähig* – not really a viable basis for actual policies', even though 'the institutional framework of social welfare, public health, and social insurance had been under construction for well over half a century'.[161] This hesitancy about politicizing biology changed with the resolute activism of the Nazis in power. In 1935, they passed the anti-Semitic Nuremberg Laws of harsh severity and introduced draconian sterilization measures. This prompted radicals of varying political hues in other countries to start pushing for – or against – reforms relating to biological questions. I find two responses from Scandinavian social democracy worth discussing in this context: The first was fairly near the German example, the second had an agenda much closer to central socialist values.

The recently passed laws regulating sterilizations in Scandinavia came under renewed debate in the late 1930s. Many now considered them 'insufficient'. In Denmark, the sterilization law from 1929 was revised. Of greater importance, however, was the introduction of special legislation concerning the mentally retarded.[162] According to this law, 'all the

161. Dickinson (2004), p. 15. Dickinson's article is about Germany, but the quoted statement is valid for most parts of the industrialized world.
162. Again, this legislation was promoted by the Social Democrat K. K. Steinke.

mentally retarded could be forcibly confined from the age of puberty and then sterilized because sterilization might facilitate their release'. This was a procedure very close to compulsory sterilization.[163]

In 1941, a reformulated sterilization law was discussed in the Swedish parliament. The bill was presented by the war-time coalition government led by the Social Democrats.[164] Still, the lack of unanimity it met with in parliament is noteworthy.[165] The original bill was amended in various ways. The final wording of the law was not determined until after several ballots had been held in the two parliamentary chambers; in these, individual Social Democratic members were free to vote as they wished.

The key question was whether the law should be extended to include sterilization of those deemed medically healthy but living 'asocial' lives. The Communists were against this extension, while the Social Democrats were split in their reactions, with some for, some against the change. In the end, the enlargement to include also such 'non-medical' cases won. Still, an amendment proposing stronger compulsion in the sterilization of asocial individuals was defeated, which meant that the conditions for using the law were in fact limited.

Children-based politics

The split within the Social Democrats in *Riksdagen* between those for and against the sterilization law was, essentially, a spill-over from a more important debate at the time. It concerned what was then called 'The Population Question'.

The Great Depression had hit Sweden hard in the beginning of the 1930s. It coincided with a nadir in the nation's rate of child production. In 1933/34, Sweden had the lowest birth rate in the world.[166] In this situation, Alva and Gunnar Myrdal, a married couple of radical reformers, claimed that all aspects of society's reproduction needed to be rethought from a modern social democratic position. Their 1934 book, *Inlägg i befolkningsfrågan* [*Crisis in the Population Question*] soon became widely spread and debated.

For the Myrdals, the situation was actually very simple. A modern and socially just society needed a level of reproduction sufficient to produce a working population of fair size and quality, and with a balanced distribu-

163. Hansen (1996), p. 40; see also Koch (2014), pp. 103–145.
164. On this law, see Broberg & Thydén (2005), pp. 107–108.
165. Svensson (2001), pp. 30–35.
166. Hatje (1974), p. 8.

tion of age-classes. But old-fashioned, moralistic and conservative standpoints hindered all serious treatment of the acute fertility problem. In the Myrdals' view, contraceptives should be freely available; sexual education should be taught at school; women should be able to choose abortions. Restrictive policies only added to the burdens of the working class – and were unimportant to keep the fertility rate up.

Instead, they argued, the modernization of reproductive patterns and rights should be driven by substantial societal investments in the production of healthy and educated children. Society should have as one of its main goals that its children should grow up in well-housed and stable families of limited size, with both parents involved in meaningful productive (or reproductive) work.

With these views, the authors distanced themselves from existing conservative thinking on demographic questions. Their disdain for Herman Lundborg and his old-fashioned race biology was absolute. Still, they did not flinch from accepting the need for sterilizations in their struggle for well-functioning families of suitable size, because *the children* were central in their thoughts. All children should have a right to be born into acceptable circumstances, to be welcomed by their parents, and to know that they had a meaningful future. The necessary increase in fertility in society should come from many families having a moderate number of children – and not by a few families having many children and therefore being poor. *This* situation was what social democracy should fight for. Society should also oversee and guide the parents in their rearing and upbringing of children. Thus, the necessary increase in the productive role of women in society could only be reached via a stronger communal effort for child-care.

Alva and Gunnar Myrdal were to influence generations of political reformers and welfare workers across the world. In Sweden, their book received a very positive response from young intellectual social democrats, while less enthusiasm was heard from the working class itself. Within the political left, there was a strong reaction against talk about the necessary production of more children; such arguments were seen as propaganda for a Nazi-inspired population growth policy, aiming at the production of human cannon fodder.[167]

167. The last sentences summarize Hatje's assessment of this critique; see p. 16 in her book.

The ideological space reorganized

I interpret the debate that followed the publication of the Myrdals' book as one over where different conceptual objects should be placed within socialism's ideological space. Biological issues did not have any prominent position in the political room originally built by socialists – something that I have summarized by saying that genes were irrelevant to them. But by 1933–45, many important genetic breakthroughs had occurred, and the international political landscape had changed. Thus, the position of human heritable differences in the ideological network of meanings was up for reconsideration.

If we limit our attention to the question of greatest relevance for genetics, namely sterilization, two sets of opinions stand out. On the one hand, and as Alva and Gunnar Myrdal stated in their 1934 book: 'These individuals, against whom compulsory sterilizations ought to be performed … normally offer their children a clearly unsuitable milieu for upbringing and could therefore not fully count on society to uphold their "right" to have these children.'[168] On the other hand, there were Social Democrats in Parliament who claimed that sterilizations should only be performed under full and proper consent and with no moralizing judgements being allowed to overrule the respect for individual human rights.

Two important principles here opposed each other: The right of every child to be born into a well-functioning world of parental and social care versus the right of every individual to have a sexual behaviour and family life determined by his or her own free will.

Neither of these two views won the debate among the Swedish social democrats. This was to be expected. Both views were reasonable, and both views therefore needed to be considered. Children, parents and society will always have contradicting rights, claims and duties that never can be fully resolved by law. The conflict thus, predictably, ended with it gradually losing importance and becoming marginalized. The only surprising aspect was the *rapidity* with which this fading occurred. A few years after the end of the Second World War, nobody any longer discussed sterilizations as a potential ingredient of socialist politics.

I find several reasons for this development. First, the international situation had completely changed – all Nazi-tainted ideas were now bankrupt. Then, there was an unexpected but welcome post-war boom in nativity in

168. Alva Myrdal & Gunnar Myrdal (1934), p. 219.

Sweden; suddenly the acute fertility crisis had disappeared. Most important, however, was the force and the principles with which a post-war Swedish welfare state was constructed. Broad economic reforms – including child allowances, unemployment pay and free schooling – were introduced and left little scope for the testing and judgement of individual citizens' circumstances or personal qualities. Thus, genetic differences between humans were, once more, regarded as irrelevant and this time in concrete economic politics. As succinctly characterized in a subheading in a detailed history of Swedish sterilization policies: 'The sterilization question: From the centre of social politics to its periphery'.[169]

This ideological change did not mean an end to actual sterilizations. Such operations continued to be performed within the Swedish health system (as in almost all other countries' health systems). Their use was, however, not strongly advocated – nor was it questioned until the 1970s; then the legal basis for these procedures was revised.

All in all, the observation that genetics was of relative irrelevance for socialism is valid for most of the post-WWII era. This goes for socialists of different kinds and in most countries, and not just in Scandinavia.[170] If new genetic facts were discussed at all, it was in connection with advances in plant and animal breeding. Or, when politicians or scientists wanted to give support to genetics and geneticists in eastern Europe against the onslaught of communist Lysenkoism. But that story belongs to my next chapter.

169. Tydén (2002), p. 100.

170. Nothing of relevance for the present chapter is found, for example, in the advocacy for social democracy published by the British sociologist Anthony Giddens in the late 1990s; see Giddens (1998).

7. Communism and the rejection of genetics

Revolutionary socialism

Out of trade unionism, syndicalism, anarchism and Lenin's interpretation of Marx grew a particular strand of socialism, soon generally to be called communism.[171] It was a powerful ideological family that rapidly became dominated by what happened in Russia after the Bolshevik revolution in 1917.

Some idealists in the West, too, believed in its truths. My analysis of communism starts with the life of one of these idealists on his road to fame as a geneticist (and to political disillusionment). By following his story, I can give a concomitant picture of communism's hesitant, but interested, response to genetics up to 1948. What happened thereafter is well known but still worth recapitulating, since it helps spread light on the unexpected configurations that ideological reactions to a science may take.

From New York to Moscow

Hermann Muller Junior was born in 1890 to middle-class parents of mixed German and English descent in New York, with his mother belonging to a partly Jewish family.[172] Herman (as he preferred to write his name when he did not just use his initials) was clever at school. He then – at the same time discovering 'science, sex and socialism' – studied zoology at Columbia University with some of the foremost chromosome researchers

171. The word also had other and earlier connotations, some of which were associated with Christianity; they are of no relevance here. See Williams (1976).

172. For Muller's life, see Carlson (1981). Muller's father died young; Muller Jr claimed that he 'did much to imbue in me a strong sympathy for the working class, for oppressed peoples, and for internationalism'; Carlson, p. 15. The rhetoric is exaggerated (since Muller wrote this for a Soviet audience), but the content is probably correct.

in the world.[173] When he came in contact with T. H. Morgan's *Drosophila* laboratory at the university, his specialist knowledge made him an important member of the fly group.[174] Muller's experience of cytology (the anatomy and function of cells and chromosomes) was helpful to their work and he strongly promoted chromosome mutations as informative experimental tools.

Muller obtained his PhD in 1916. He probably considered that all first-generation problems of genetic transmission by now had been solved; the known genes had become securely positioned in linear arrays along the chromosomes. Instead, scientific attention should be oriented towards understanding how genes function. Muller left Morgan's lab, and by 1920 he had been recruited to the University of Texas in Austin, where he built his own research group, married and started a family. His interest was in mutations and what they said about the functioning of genes. His great breakthrough came in 1927 when, at the International Congress of Genetics in Berlin, he was able to present convincing evidence that X-rays induce mutations.[175] Muller became instantaneously famous – but also got embroiled in many scientific and academic conflicts.

Muller was a hard-working experimentalist, though with broad interests. One of these was eugenics. He wanted to understand how the many new inheritance results – about which he probably knew more than anyone else – could be used for the advancement of humankind. Charles Davenport, whom we have met in Chapter 5, invited him to the Second and Third International Congresses of Eugenics (both held in the US), which turned out to be weird assemblies of first-class experimental geneticists and anti-immigrant race ideologues. Muller reacted by starting to write a book on how *he* thought genetics could be of true social use.[176]

Another of Muller's interests was left-wing politics. Muller's sympathies were with the labour movement. He reacted against the high level of unemployment and social misery in the wake of the Great Depression; he was also sensitive to the structural oppression of women that even

173. The quote comes from Muller's lifelong friend Edgar Altenburg; see Carlson (1981), p. 33.

174. For more on this research group and its fundamental importance for genetics, see Chapter 2 above.

175. Carlson (1981), p. 150.

176. On the eugenics congresses, see Carlson (1981), pp. 124–126, 175, 178–180. On Muller's work on the book, see pp. 139, 174, 186.

affected his own family.[177] He received guest researchers from all over the world in his laboratory – of special importance were two enthusiastic communist visitors from the USSR, Solomon Levit and Israel Agol. Muller also tried to assist radical undergraduate students but ran into problems with the university authorities when he supported a student paper published by a local communist-influenced group.[178]

In the end, life in Texas became too complicated for Muller. He had already suffered from one nervous breakdown, and when he realized that his professional, political and family life had reached an impasse, he took a drastic decision: He went into exile.

Together with his flies – but without his wife and son – he left for Berlin in September 1932.[179] He had friends there, but when Hitler soon thereafter came to power, Muller understood that he could not stay in Germany. An invitation from the plant-geneticist Nicolai Vavilov in Leningrad was then perfectly timed. Vavilov offered Muller a move to the Soviet Union. An excellent idea, Muller thought, and went to Russia, full of scientific and political hope.[180] He soon had a large *Drosophila* lab running with many assistants and students, first in Leningrad and later in Moscow. Alongside his many engagements in the USSR, he took time off – because he found it so important – to finish the book on socialist eugenics that he had started years before. *Out of the Night: A Biologist's View of the Future* was published in 1935 in the US and a year later in the UK.[181] Muller also had it translated into Russian, because there was one person he hoped would read his book and take to its ideas: Joseph Vissarionovich Stalin.[182]

But before we see what eugenic propositions Muller made and what Stalin's response turned out to be, some further background must be given to this possible encounter between two very different communist minds.

177. Muller's first wife, Jessie Marie Jacobs, was an instructor in the mathematics department at Austin. When she became a mother, the university forced her to leave her job. See Carlson (1981), pp. 131, 133.
178. Carlson (1981), pp. 175–178.
179. Carlson (1981), pp. 183–185.
180. Carlson (1981), pp. 190–192.
181. Muller (1936). The American edition was published by Vanguard Press 1935 and the British by Victor Gollancz 1936, both well known for their radical agenda. The quotes I give are taken from the British edition.
182. Carlson (1981), p. 233.

Genetics in the USSR

Before the revolutions in 1917, the Russian Empire was a paradoxical society with deep social backwardness in most of the country and modern urban life in the big cities in the west. Here one could find good universities and excellent science with well-established links to the international scientific community. Some of these cities were lost after the period of wars, but Moscow, Kiev (Kyiv) and Saint Petersburg (renamed Petrograd in 1914 and Leningrad in 1924) remained important scientific centres.[183]

A golden age for Russian science commenced around 1922 with the arrival of a more peaceful external and internal situation.[184] Academically trained professors and researchers, who often came from the overturned elites, were looked upon with political suspicion by the Bolsheviks; still, they were now given privileges and good working conditions.[185] Large investments in research were made, and the Soviet state was keen on inviting foreign scientists to join the country and help with its revolutionary development.

The field of biology was strong, with leading zoological research institutes in Moscow, Leningrad and Kiev. The young Theodosious Dobzhansky, for example, got an excellent education in Kiev and Leningrad before he was sent on a scholarship in 1927 to Morgan's research group in New York. After much hesitation he chose to stay in the US (though keeping close contacts with his colleagues back home), where he became of great importance for incorporating genetics into Darwinian evolutionary thinking.[186] His studies on *Drosophila* in the wild form the basis for our current understanding of genetic variation within and between individuals, populations, races and species, and his book from 1937, *Genetics and the Origin of Species*, became a world-wide scientific classic.

183. For Soviet science, I use information from, among others, Zhores Medvedev (1978) and Simon Ings (2016).

184. This period lasted 1922–28 according to Medvedev (1978), pp. 13–21.

185. Michael Bulgakov gives a hilarious description of the tensions this could give rise to in his satirical novel *A Dog's Heart* from 1925. Bulgakov also makes fun of the loosely formulated ideas around evolution and development common at the time and also showed what may happen if one believes that an individual has a 'true inner nature' (even though it is here placed in the pituitary gland rather than in the genotype).

186. See Adams (1989). Dobzhansky came to play another important role: 'As a public intellectual, from the 1930s to the '70s he was one of the strongest voices for a nonracist, noneugenist, nondeterminist vision of genetics that would explore and value human genetic diversity.' Panofsky (2014), p. 50.

In botany, too, there was much of scientific value in the USSR. Nicolai Vavilov had been sent to England for one year, in 1913. There he met William Bateson in Cambridge and became incorporated into the network of early geneticists. Back in Russia, he built a large institute in Leningrad devoted to the collection and study of genetic variation in natural plants; the goal was to use such variation for breeding purposes. Vavilov was supported by Lenin and was highly regarded by the communist authorities.[187] In 1933, he had such a powerful position that he could invite Muller on favourable terms to the USSR and arrange for him to be integrated into the Soviet research system.[188]

In general, genetics was seen as important to Soviet society.[189] The medical doctor and party member, Solomon Levit, who (after a youthful period as a Lamarckist) after his year with Muller in Texas had become a fervent adherent of modern genetics, was given resources in the early 1930s to organize a strong Medico-Genetical Institute in Moscow.[190] It was perhaps the largest in the world of its kind, housing many research projects. Muller's move to Russia at this very time meant a tremendous intellectual boost for Soviet science – where Muller was, new genetic ideas were constantly being introduced and investigated.

Genetics challenged

Let me remind the reader of the aim of the present chapter. We are looking for the reactions of communism to genetics during the first half of the twentieth century. This means that it is historically necessary to search for the answer in the Soviet Union, since it was the ideological beacon for communists all over the world. But we are forced to proceed via a winding path because the times were confusing.

---

187. For the support of Lenin, I refer to Crow (1993), p. 1.

188. Carlson (1981), pp. 190–203. Vavilov had become a member of the USSR Academy of Science in 1929. He had organized the Lenin All-Union Academy of Agricultural Sciences and become its first president the same year. He was a member of the USSR Central Executive Committee, formally the highest ruling body of the Soviet State; see Borinskaya, Ermolaev & Kolchinsky (2019), p. 3.

189. On this, see also Krementsov (1996), p. 230.

190. For information on eugenics and human genetics in the USSR, I rely on Adams (1989) and Babkov (2013).

Muller's communist eugenics

By 1935, Muller had outlined the shape of a scientifically based and truly communist eugenics. The title of his book, *Out of the Night*, refers to the rational clarity that genetics would bring to the planning of humankind's future.

Eugenic ideas were, of course, not new to Soviet society. All kinds of biologically based suggestions had been discussed since the revolution. But Muller wanted to rise above the local mêlée. His ambition was a socialist/communist programme for eugenics. New social goals were worth striving for when communism had secured social fairness and fulfilled all necessary material needs. Humankind should be made happier, with less disease, depressed moods, and unfortunate deaths. But the fulfilment of this goal – based on the true genetic value of individuals – relied on a *sine qua non*: a fair and classless society. Individual conditions during early development and upbringing must be the same. Proper eugenics not only wants socialism; it requires it.

Muller's arguments were founded on a belief that the human species is gradually declining due to deleterious mutations not being weeded out effectively enough by natural selection. This will necessarily lead to a loss in quality that may not be noticeable for hundreds of years, but which communists – with their wish to care for our species' long-term future – ought to fight against. Without resolute action, ultimate doom threatens.[191]

Modern biological technology may, however, come to the rescue. According to Muller, the best way to counteract the decline in human quality is to collect sperm from those very few outstanding individuals we know *must* carry a sound and valuable genetic makeup and then let a proportion of future children be born to them by willing mothers and via artificial insemination,[192] 'How many women, in an enlightened community devoid of superstitious taboos and of sex slavery, would be

---

191. See Muller (1936), p. 50. If I have previously criticized Fisher for his belief in a build-up of genetic differences between social classes, let me say here that I do not see why the deleterious mutations Muller warns against should spread in frequency and not be counter-balanced by selective forces such as prenatal death and sexual selection also in advanced societies. We humans constitute a very numerous species, and it is not reasonable to expect that such a species will suffer from genetic meltdown.
192. The examples given by Muller of such great men are Lenin, Newton, Leonardo da Vinci, Pasteur, Beethoven, Omar Khayyam, Pushkin, Sun Yat Sen and Marx; Muller (1936), p. 141.

eager and proud to bear and rear a child of Lenin or of Darwin!', Muller exclaims.[193]

All this is clearly presented, in lively writing and with vivid examples. No more engaging arguments for a specifically communist eugenics has ever been presented.

Stalin says no to eugenics

When Muller sent his book to Stalin in May 1936, the latter had come to personify communism.[194] Joseph Vissarionovich Stalin had originally been utilized by Lenin as a dull, but efficient and trustworthy, Bolshevik organizer. By taking on different overseeing functions within the Communist Party, Stalin then surreptitiously worked himself up within its power hierarchy until, by the mid-1930s, he incarnated the ultimate source of legitimacy in Soviet politics. His political rival, Leon Trotsky, was sent into exile and was soon murdered. By 1936, the forced collectivization of agricultural land had been carried out, leading to terrible waves of famine, and the first five-year plan started a violent industrialization process. A set of highly publicized show trials were staged against Stalin's former communist comrades. The year 1936 was nobody's golden age.

Muller claimed in a letter to a friend that Stalin had at least begun reading his book.[195] This may well have been correct, since the adolescent Joseph had been fascinated by Darwinism (forbidden knowledge in the priest seminar he attended).[196] Stalin's capacity for work was formidable, as was his wish to control all aspects of Soviet society. It is therefore possible that he read at least parts of Muller's book. However, and as Muller reported to his friend, Stalin was 'displeased by it and had ordered an attack prepared against it.'[197]

Stalin's adverse reaction meant that, from the spring of 1937 onwards, eugenics was a non-subject in Soviet society and not even allowed to be debated by its lower-level proponents or critics. The decision transmitted

193. Muller (1936), pp. 152–153. While I have found no record of Lenin's possible reaction to such a suggestion, I can imagine Darwin's absolute abhorrence at the thought.
194. Babkov (2013), pp. 645–646, has a slightly different time-line than Carlson (1981), p. 233, for the interactions between Muller and Stalin; the discrepancies are not important for the present argument. See Glad (2003), for a copy of Muller's letter to Stalin.
195. Carlson (198 1), p. 233.
196. For background information on Stalin, I use the classic biography by Isaac Deutscher (1966). See p. 27 for the claim that Stalin learnt about Darwin and his theory when young. There is no evidence that Stalin ever encountered the basic principles of Mendelism.
197. Carlson (1981), p. 233.

from above was firm and unescapable – there was to be no such thing as a communist eugenics.

Why did Stalin react so negatively and in the name of communism? This we do not know for certain. His reaction may be due to the philosophical implications of genetics or to its strong international associations, but I think it is relevant also to consider two other reasons. The first was hinted at in a letter written by a German Jewish refugee in the USSR with a background in biology to his colleagues in the West, obviously under strict political supervision:

> Moreover, socialism in our country [USSR], which has come about as a result of 20 years of revolution, has presented to any member of our classless society complete personal freedom in the area of choice of occupation, choice of residence, choice of entertainment, and choice of a boy or girl friend for life.[198]

In other words, the party should not be involved in the choice of one's sexual partner. Despite the total lack of respect for people's dignity and life that the Communist Party showed in all other matters, it kept a remarkably consistent line of never directly interfering with ordinary people's sex life; as if this was a way of holding popular discontent at bay.[199] Its policy towards drinking vodka was, actually, very similar.

Another reason why Stalin did not warm to eugenics could have been his deep pessimism about human nature. The road to a classless society was for him no happy carnival; the masses could never be trusted with their spontaneous political choices. Only a hard authoritarian regime could lead the revolution in the right direction. A communist 'pessimist in power distrusts those whom he rules', is how Stalin's biographer summarized this position.[200] Given this outlook, Stalin would have no real sympathy for Muller's idealistic visions for humankind's long-term future – getting the Communist Party and the Soviet Union to survive for yet one more day was all that mattered to Stalin. He would never have expressed Trotsky's joyful conclusion that Communist Man 'will become immeasurably stronger, wiser and subtler; his body will become more harmonized, his movements more rhythmic, his voice more musical.'[201] This was the type of utopian and poetic vision that attracted Muller – but

198. The writer's name was Julius Schaxel, and his letter from 1936 is known from a copy kept in the archive of the Central Committee. I cite it from Soyfer (2003), p. 7.

199. This refers to heterosexuality. Homosexuality was made legal in the early USSR, but Stalin reintroduced laws against it in 1933.

200. Deutscher (1966), p. 264.

201. Trotsky (1924), chapter 8.

it was completely foreign to Stalin. And from this time on, eugenics lost its appeal to all serious adherents of communist ideals.[202]

Genetics under pressure

One must ask: did Stalin's dismissal of eugenics in 1936 also imply that communists should forsake the scientific study of genes and genetics? No, not then and there. Like everything else in the USSR in the 1930s and until the attack by Germany in the summer of 1941, questions about inheritance became ensnared in the violent restructuring of society at large.

Genetics had, by now, unquestionably lost some of its original and high reputation. Stalin and the Stalinists no longer wanted to rely on foreign engineers and scientists; instead, they preferred local experts from the working class – the Red Experts. Particularly those with revolutionary ideas who attacked old values and standpoints. They asked: Isn't genetics theory, with its teachings of hard gene differences, a load of undialectical reactionary crap? Or: When geneticists teach that the stability of genes and the logic of Mendelism put limits on how rapidly plant breeders can produce better varieties – doesn't that show a disrespect for the demands of the Party?[203] Such provocative questions led to a number of highly publicized debates. Muller participated in one of them, held in December 1936 in Moscow, where he hotly defended Mendelism.[204]

The importance of these intellectual skirmishes was, however, overshadowed by the political repression which by now also hit many intellectuals in Soviet society. Not only old party bigwigs were targeted but also well-known scientists; some suddenly disappeared from their positions, never to be heard from again.

This sad fate befell several Soviet geneticists, though it was difficult to know if their disappearance had to do with them being geneticists or to them having an unsuitable political past. Solomon Levit, who headed the important human genetics institute in Moscow, was sentenced for

202. This assessment agrees with Diane Paul's in her study of British and American left-wing geneticists' reactions to eugenics; see Paul (1984). She also notes, quite rightly, that the most important cause of this is probably international and historical: After the Nazi atrocities in the name of race and inheritance, no left-wing eugenic ideas were possible anymore; see p. 568.

203. 'In wheat … high yield, uniformity, crystallinity, nonlodging, nonshattering, resistance to cold, drought, pests, and disease, good baking quality, and other traits were to be obtained in three to four years', according to a resolution from the Central Control Commission of the Party in 1931. Quoted by Medvedev (1969, 1971), p. 19.

204. Carlson (1981), pp. 229–233.

trumped-up political charges and executed in 1938.[205] The same fate befell Israel Agol, who like Levit had worked with Muller in Austin, Texas, as well as in Moscow.[206] Muller understood that he was in danger. He did not want to incriminate his remaining genetics friends and made a clever move by going to Spain to help the anti-Franco forces in the civil war (with blood-transfusion research).[207] This improved his credentials, and he was able to make a quick return to Moscow in September 1937 before leaving the country for good.[208]

An obvious problem for the rulers was the power that the geneticists had gathered both within the Party and the country and with a powerful international scientific community. Some suggested that the VII International Congress of Genetics should be held in Moscow in 1937. Strong forces within the Communist Party saw prestigious advantages in such an event, others hesitated and wanted more and different Soviet participation. The matter went all the way to the highest authority – but no clear decision ensued. The plan was postponed, not just once but twice. In the end, the congress was held in Edinburgh in 1939, and with no Russian participants.[209]

The hardest blow to the USSR and the international genetics community came with the arrest of Vavilov in August 1940. After forcible and degrading interrogations, he was sentenced to death, based on several invented charges and in secret. The sentence was commuted to twenty years' imprisonment (he still had important supporters within the system), but Vavilov died in prison in January 1943.[210] His fate was for many years treated as a state secret.

---

205. Ings (2016), p. 276.

206. Adams (1989), pp. 882–883.

207. Carlson (1981), pp. 235–243.

208. Carlson (1981), p. 242. By this time 'my professor was a saddened and bitterly disillusioned man', according to his erstwhile student Bentley Glass (1990), p. 416.

209. Vavilov should have been the congress's honorary president but was explicitly forbidden to attend. The planning of the Congress is described by Soyfer (2003). See also the proceedings of the Edinburgh Congress published in *Journal of Genetics* (Punnet, ed., 1941).

210. According to Ings (2016), p. 302, Vavilov died from 'dystrophy' in the prison in Saratov where he was incarcerated, which implies starvation. At this time the battle of Stalingrad was raging further south along the Volga and starvation was acute in all parts of the USSR. For more on Vavilov's life and death, see Pringle (2008).

An agrobiologist named Lysenko

The critical voice that most often was heard lambasting Mendelism and genetics in the 1930s belonged to another ill-fated man, Trofim Lysenko. With his bullish charisma he managed to assemble a number of adherents around himself, soon to be called the Lysenkoists. His later misfortune, however, did not derive from a premature death but from being hated and despised. By posterity, he has been judged as the worst scientific fraud who ever existed.

Lysenko was an agricultural expert. He first came to notice with his experiments to 'vernalize' seeds of winter wheat by treating them with water and cold before he sowed them in spring.[211] Based on his results he went on to propose a theory of 'phasic development of plants'. It maintained that it was possible to use external treatments to alter the heritable qualities of organisms, that is, pure Lamarckism. Out of false modesty, Lysenko offered 'Michurinism' as the name for this thinking; it referred to the Russian fruit-tree breeder Ivan Michurin (dead in 1935), who like Lysenko promoted Lamarckist interpretations of various biological phenomena. Lysenko perfectly fitted the image favoured by the Stalinist system: he came from simple circumstances in the countryside, his level of education was low, and he liked to challenge academic experts.

The established plant geneticists, with Vavilov in the lead, became increasingly worried and harassed by this obviously ignorant figure. He may well have made some interesting observations, but he could not back them up with proper scientific trials. Thus, Vavilov spoke positively about Lysenko at the International Congress of Genetics held in 1932 in the US.[212] Soon, however, Lysenko's criticism of genetics became increasingly vociferous and conflictual. The previously mentioned discussion held in Moscow in 1936 between the Lysenkoists and the geneticists, headed by Muller, did not resolve anything; it just made the conflict worse.

This situation must have been to Stalin's liking. He built his rule on promoting conflicts between lower-level power establishments that he

211. Winter wheat, overwintering after having been sown in the autumn, generally yields better than spring wheat that is sown after the frost – but there is always the risk that the winter wheat dies in the field during harsh cold spells.

212. Different interpretations are possible here. It may be the case that Vavilov had to say something like this to cover his back. It may also be that Vavilov was squeezed by what meagre practical results his institute had produced compared to the advances demanded by the Party, and that he saw co-opting Lysenko as a way to ride out the crisis (this is the interpretation of Soyfer (1989 pp. 416–417). In Bengtsson & Tunlid (2010), it is erroneously claimed that Lysenko himself participated in the Ithaca congress, *mea culpa*.

could steer to his own advantage.[213] And at this moment – with the Great Purge going full blast – there was no need for him to take an explicit stand in a fight over inheritance principles. At the threshold of the Second World War, a strong and troublesome Lysenko and a still existing, but enfeebled, genetics community were locked in an unresolved strife.

Lysenkoism replaces genetics

Some years later, in spring 1945 and after the defeat of Hitler and Germany, Stalin and the Soviet Union were again positive towards science, technology and foreign expertise. Carried by the glory of having crushed Nazism, the USSR wanted to strengthen its international standing and academics from the West were again invited to the country for shorter or longer periods.

At this juncture, it was nevertheless not clear how the conflict between geneticists and Lysenkoists would develop. Lysenko and his agrobiologists had failed to produce the promised high-yielding strains (severe famine hit again in the winter of 1946–47). Their aggressive language was a constant source of international embarrassment, as was Vavilov's unexplained disappearance. Contacts with scientists from the allied nations had further weakened the Lysenkoists' position. Soviet geneticists therefore now renewed the attempt to hold the next International Congress of Genetics in USSR, a proposal that was given strong international support.[214]

The proposal was taken seriously in Moscow too, since the geneticists had found new channels of influence to the highest Party circles. But no decision came. Still, an All-Union Conference on Genetics was allowed to be held in spring 1947 under the auspices of the Biology Faculty of Moscow University. It was a six-day conference where eighty speakers gave presentations. The Conference finished by sending a letter to Stalin where the participants promised 'that activists of genetic science [will] energetically work to fulfil your instructions, Comrade Stalin.'[215]

Archival material available today show that Lysenko by now understood that his situation was seriously deteriorated. His reaction was to send complaining, but submissive, letters to Stalin. In April 1948, he threated to withdraw from his most important position, the presidency

213. Thus, Stalin had Vavilov forced out of the presidency of the Agricultural Academy in 1935. The position was soon given to Lysenko; it remained the formal power base for all his coming actions.
214. See Krementsov (1996), pp. 236–245.
215. Krementsov (1996), p. 247.

of the Agricultural Academy, if he was not given unlimited power to defeat his enemies.[216] This time, Stalin's decision came promptly – and it was positive.

Stalinism in the Cold War

Stalin now made clear, in meetings with the Central Committee of the Communist Party and its Politburo, that Lysenko was not to be touched; instead, he was to be given supreme power over biology. It was furthermore decided that this ruling should not merely be presented as an official resolution – it should be staged at a dramatized public event.[217]

A week-long meeting with the Agricultural Academy was therefore called on 31 July 1948. The tone of the meeting is well captured in this quote from Lysenko's long opening speech:

> In the present epoch of struggle between two worlds the two opposing and antagonistic trends, penetrating the foundations of nearly all branches of biology, are particularly sharply defined.
>
> Socialist agriculture … has given rise to a Soviet biological science, founded by Michurin – a science new in principle, developing in close union with agronomic practice, as agronomic biology. …
>
> It is no exaggeration to state that Morgan's feeble metaphysical 'science' concerning nature of living bodies can stand no comparison with our effective Michurinist agrobiological science.
>
> The representatives of reactionary biological science – … [the] Mendelist-Morganists – uphold the so-called chromosome theory of heredity.
>
> According to this theory, characters acquired by vegetable and animal organisms cannot be handed down, *cannot be inherited*.[218]

And so Lysenko went on and on, lambasting the 'ideological content of Morgan's genetics'; compared to the advantages of Michurinist teaching, it was in essence 'metaphysical and idealist'.[219] Lysenko returned seven days later, at the end of the meeting, to announce with pride that 'The Central Committee of the Party examined my report and approved it.' The session then passed the resolution that 'the Michurin trend headed by Academician T. D. Lysenko has performed great and fruitful work in exposing and shattering the theoretical position of Mendelism-Morganism.'

---

216. See Soyfer (1989) where Lysenko's letter to Stalin is reprinted. Borinskaya, Ermolaev & Kolchinsky (2019) refer to an earlier letter sent by Lysenko to Stalin in October 1947; pp. 4–5.
217. Gorlizki & Khlevniuk (2004), pp. 40–42.
218. Lysenko (1948), pp. 18–19. Italics in original.
219. Both quotes from Lysenko (1948), p. 20.

The effect of this intellectual show trial was strong and immediate. Genetics in all its forms was banned from the USSR. Within days, research establishments were dismantled, and several thousand individuals were 'dismissed, demoted, or removed from leadership positions'.[220] From this moment on, genetics was an absolute anathema for communists.[221]

This situation was so incredible that, to become intelligible, it must be put in a wider context, and this context is easily grasped: In 1948, the Cold War began in earnest, and the crushing of genetics in the USSR was a not insignificant part of it. Favouring Lysenkoism rather than genetics belonged to Stalin's policy of forcing the communist intelligentsia into an ideological war with the West.[222] The obvious outward sign of a new situation came when the USSR hindered land transport to those parts of Berlin that were occupied by Western forces in the otherwise Soviet-dominated eastern Germany. This international incident, called the Berlin blockade, commenced in June 1948, and from then on brinkmanship close to the abyss of nuclear war reigned between the major world powers.

Thus, the decision about genetics made public in August 1948 had a very specific political background. Stalin probably was in favour of Lysenko's rule over Soviet biology, but much more important was the closing down of all international scientific contacts. (Soon a similar situation held for the entire cultural field.) Having a severe biological conflict running within and outside the country gave Stalin a perfect possibility to keep track of who was loyal to him and who was not.

The suggestion to hold an International Congress of Genetics in the USSR, of course, led to nothing. When the Conference instead convened in Sweden in July 1948, the decision made in Moscow earlier in spring was known to everyone who cared to know. The Soviet Union did not allow anyone from that country to attend. Muller, who – as noted above had left the USSR in the late 1930s – had received the Nobel Prize in 1946 for his mutation research was now made president of the Congress.[223] He attacked Lysenko violently in his plenary address. What might have been a manifestation of the allied victors against Nazism's biological inanities,

220. Quoted from Borinskaya, Ermolaev & Kolchinsky (2019), p. 6.

221. Sometimes the Lysenkoists would talk about 'the New Genetics' or variants thereof. I do not conform to this language use and refer only to the two possibilities: Lysenkoism and (scientific) genetics.

222. Gorlizki & Khlevniuk (2004), p. 43.

223. Bengtsson & Tunlid (2010).

instead turned into a call for resistance against Lysenkoism. Hereby, the classic debate over inheritance – hard as the Mendelists claimed or malleable as taught by the Lamarckists – in 1948 unexpectedly moved into the centre of a vicious worldwide ideological conflict, with terrible military resources threatening in the background.

Belatedly, I have now reached the goal of this chapter. It is clear what the communist view on genes and genetics came to be: A complete and definitive rejection. Not just a general lack of interest as shown by social democrats, but a complete rejection. It took – as we have seen – some decades for this view to become crystalized, after an early period of fascination and admiration for the advances of the new science and a pride over formidable communist scientists such as Muller, Vavilov and Haldane. But from 1948 onwards, communists had to look at genetics in a new way. Lysenkoism was the imposed alternative.

Thus, Stalin's decisions functioned as laws for those parts of Eastern Europe that had fallen under Soviet influence after the Yalta agreement. Anti-Mendelism became the rule here too. This meant that genetics was not taught in schools or universities, and no such research was allowed. The discipline became a non-subject. There was – of course – much hidden and devious resistance behind a state-built facade of unrestricted support for Lysenkoist ideas.[224]

Not much more needs to be written here about this phenomenon.[225] To standard Lamarckism, Lysenko added a particular and direct transformative power of the environment; for example, that 'bad' treatment of wheat plants would make them produce rye kernels instead. He also included some anti-Darwinian ideas in his theories, making cooperation rather than natural selection the prime force in evolution. It is impossible today to take these ideas seriously, nor did hardly any serious scientist at the time.[226]

224. The strongest fortress for genetic research (though not so named) in Eastern Europe during this difficult period was the Gatersleben plant-breeding institute in GDR (East Germany); see Hagemann (2002) and Wobus & Schubert (2002).

225. Many studies have been published on the Lysenkoist phenomenon; here I primarily rely on the (partly) first-hand account by Medvedev (1969, 1971).

226. In the absence of experimental evidence for the Lysenkoists' claims, arguments in their favour were instead often taken from that obscure part of Marxist thought called dialectical materialism. On this aspect of the debate, see Paul (1979).

Ideology as an instrument for state power

The lack of empirical and rational substance to the Lysenkoist ideas did not matter much to the Stalinist system that promoted them. Again, we need to take a step back to get a more detached view of the situation. Communism, at least for most of the twentieth century, was a very different entity from the two ideologies we have analysed so far, conservatism and social democracy. In Michael Freeden's words, one can say that communism with its centre in the USSR had become a system for exercising power in a situation where social authority 'was only associated with the state; the leader with sole knowledge and legitimacy; liberty always meant emancipation from the falsehoods of the other ideologies; and some concepts, such as accountability, rights, and tolerance, were forcibly removed from the political lexicon.'[227]

Thus, like fascism in Italy and Nazism in Germany, communism in the USSR had become totalitarian in that it 'collapsed the space between the public and private spheres, insisting that the state was entitled to regulate all areas of social and individual life'.[228] Together these authoritarian ideologies differed from ideologies anchored in spontaneous social thought and practice. In other words, Stalinism did not so much object to the facts of genetics as to the independent truth-claims of the geneticists, especially since their claims had a strong international backing. Social democrats, as we have seen, found ways to cold-shoulder what they regarded as socially inopportune genetic ideas, at least most of the time, but the communists did not manage to do that. Instead, they stubbornly insisted on being the sole arbiters of knowledge.

In this light, it is interesting to note how strongly Stalinist communism strove to appear *scientific*. The authoritarian aspect of the ideology did not prevent a perceived need for a rational back-up of its claims. Thus, one finds many descriptions in communist propaganda from this period onwards of the strong support given by this new science of life, Lysenkoism/Michurinism, to socialist development. The old couple, science and ideology, was here, too, made to perform an intricate dance of mutual support.

227. Freeden (2003), p. 92.
228. Freeden (2003), pp. 90–91.

The later history of Lysenkoism

The strong links that Stalinism forged between the state bureaucracy and the Lysenkoist agrobiologists at all levels of society, from kolkhozes to academic research establishments, explain the next fact that is hard to believe: Lysenkoism and the ban on genetics did not disappear with the death of Stalin in 1953 or with the debunking of Stalin by his successor Nikita Khrushchev in 1956. No, genetics remained an officially despised non-subject in all communist-dominated countries well into the 1960s.

The situation – when a large part of humankind was forced to distance itself from this important science – came to resemble a black farce. All sides understood its stupidity, but there seemed to be no way out of the impasse.[229] The Swedish geneticist Åke Gustafsson (whose work on radiation-induced mutations I described in the preceding chapter and who by now was internationally famous) tried to change things with a notable intervention. In 1958, and on the eve of an official visit by Khrushchev to Sweden, he wrote an open letter to the Soviet leader pleading for a return of genetics to the Soviet Union. He stressed the absurdity of Lysenko's ideas about species turning into each other by environmental influences alone and concluded that outside the institutes run by Lysenko himself, 'no one … has so far been able to find a kernel of rye in a head of wheat. This runs into the same biological impossibility as if your wife, Mister General Secretary, were to give birth to a foal, may it be ever so beautiful, or if my wife or Mrs Lysenko were to give birth to a chimp or a baboon.'[230] The letter was spread via samizdat and was much appreciated among the geneticists in disguise in the Eastern bloc. There was no immediate positive political reaction, however. Soviet geneticists had to wait until the fall of Khrushchev in 1964. Then – immediately and everywhere – genetics was restored.[231] Lysenko died, unremembered, in

229. Two good satirical novels describe the contemporary situation in the Soviet countryside, where crazy Lysenkoist ideas had their ups and downs depending on the vicissitudes of politics: Fazil Iskander's *The Goatabex Constellation* and Vladimir Voinovich's *The Life and Extraordinary Adventures of Private Ivan Chonkin*. Both were written in the 1960s, but their publication histories inside and outside the USSR were long and varied.

230. Åke Gustafsson, 1960. Brev till partisekreterare N. S. Chrustjev om Lysenko och växtförädlingen. [Sent 10 January 1958] In Gustafsson (1960), pp. 102–114, quote from p. 111.

231. Zhores Medvedev, who was an important participant in these events, has given a well-informed description of the fight against Lysenkoism in its last phase, which he dates to 1962–1968; see Medvedev (1969, 1971), pp. 197–238.

1976, and in 1978, the XIV World Congress of Genetics was – finally! – held in Moscow.[232]

My story about official communist claims to over-rule scientific genetics could have ended there. But a Chinese episode in 1976 is an interesting reminder of a certain kind of communist thinking.[233]

In 1966, the Cultural Revolution had started in the People's Republic of China. It went through several phases. One of its latest occurred in the early and mid-1970s, when the reign of 'The Gang of Four' in a typically Stalinist form of state power commanded almost all aspects of civil society. During this time, the genetics journal of the Chinese Academy of Science, *Acta Genetica Sinica*, published the article 'Dialectical materialism being the guiding principle in genetical studies'. It was written by the Group of Mass Criticism, Class 1973, Division of Genetics, Futan

232. I attended the Congress where Åke Gustafsson introduced me to one of the most famous Soviet geneticists, Nikolay Timofeev-Ressovsky. If anyone can be said to personally embody the complex relationships between genetics and politics during the twentieth century, it would be him. The complexities were so great that he has found no natural place in this book's narrative; a brief sketch of his life is nevertheless worth giving. Timofeev was born in 1900 and started to study biology and genetics at Moscow University; due to the First World War and the Russian Revolution, these studies were never formally finished. Instead, he was sent to Berlin in 1925 (as part of a scientific exchange scheme between the USSR and Germany), where in 1930 he became head of a genetics research unit in one of the Kaiser Wilhelm Institutes. He had an insight of great scientific importance, that the ability of X-rays to induce mutations can be used to estimate the physical size of genes – an insight of importance for future molecular biology. Friends (Vavilov, Muller and others) advised him against returning to the USSR when commanded to do so, and he remained in Germany throughout the Second World War, where his eldest son died in a concentration camp after having participated in anti-Nazi activities. At the end of the war, Timofeev-Ressovsky decided to give himself up to the Soviet authorities. He was not executed on the spot – as one perhaps would have expected – but after some months was brought back to Moscow as a prisoner. Here he was sentenced 'for his supposed disloyalty and aid to his country's enemies in time of war' and was sent to a Gulag (Glass, 1990, p. 415). After years of bad treatment, he was given the task of organizing a research unit investigating the effect of radiation on biological material (the research could not be called genetics, of course). In the 1960s, Timofeev-Ressovsky was allowed to appear in civil society again but was never formally rehabilitated or allowed to make visits abroad. He figures in various writings of Alexander Solzhenitsyn and was given a fictionalized biography by Daniil Granin, *Zubr* [The Bison]. His life and legacy have always been surrounded by controversy; see e.g. Berg (1990). He was in bad health when I met him in '78, and he died in '81.

233. For an informed personal account of the trouble-filled history of genetics in China up to 1960, see Li (1961).

University. Its publication had been approved by the highest political authorities.[234]

The article expresses a critique against 'Michurinists and neo-Lamarckists' (i.e. Lysenkoists) as well as against 'Morganists and neo-Darwinists' (i.e. standard geneticists) and reaches the conclusion that 'the geneticists must reform genetics thoroughly under the guidance of dialectical materialism …' The underlying details are of no interest here – but it is noteworthy how closely the article's tone adheres to a Stalinist tradition where young Communist Party cadres, using various ideological formulas, claim to control science in a pursuit of truth and power.

Articles like this one were not seen any more after the fall of the Gang of Four in late 1976, and the Chinese Communist Party's management of science from then on took a different form.

Reactions and repercussions

One topic still remains – how did communists outside the Soviet bloc react to the imposed Lysenkoist orthodoxy?

Devastation inside and outside the communist sphere

If Stalin saw his siding with Lysenko as a way to probe his support from intellectual forces, one can say that he succeeded – albeit in an altogether negative way. Many European academics and intellectuals, particularly those who had fought in resistance groups under German occupation, were favourable to communism after the Second World War. Stalin's rejection of genetics and the pressure for absolute support of Lysenko would, however, wreak havoc among them. They sympathized with various national communist parties, but these were forced by Moscow to demand of their adherents: Support Lysenkoism or leave!

This meant that almost everyone left, when various 'Lysenko affairs' played out in several countries. It may be so that no other political issue – at least up to the repression of the Hungarian uprising in 1956 – made so many western intellectuals leave communism, Stalin and the USSR.

Certainly, there was also resistance against this idiocy within communist circles.[235] The following example comes from Denmark. The well-

234. See Bengtsson (1981), p. 3; the quoted article was published in 1976, volume 3, issue number 4.

235. J. B. S. Haldane tried, for example, to get the British Communist Party to use the Lysenko dispute as an excuse for making the party more independent of Moscow but failed in this attempt. See Tredoux (2018), p. 183.

known Danish artist and novelist Hans Scherfig had been imprisoned by the Germans during the occupation. After the war he was a staunch supporter of the Danish Communist Party. In late 1948, however, we find him writing in the Party's daily newspaper, *Land og Folk*:

> … it happens that people write to me in uncompromising language to ask about my views on inheritance problems about which I know nothing at all. They ask me, straight out, if I can remain a member of the Tikøb section of the Danish Communist Party with a clear conscience after the production of Lysenko's vegetative hybrids. I believe this is possible. I admit that I am not altogether clear over the nature of Lysenko's experiments, but I have been told that they concern, among other things, new kinds of tomatoes or potatoes; and I can assure those who have asked me that even the most impossible tomato would not change my opinion about Marxism, and that only a very strange potato indeed could get me to doubt the timeliness of a take-over of the means of production by the proletariat.[236]

Scherfig's text may seem flippant, though in agreement with his satirical writings and brightly coloured lithographs. But even decoded (and at this time all writings in the communist press must be decoded), there seems to be no attempt here to seriously counterattack Lysenko's Danish opponents. Instead, we find a hidden warning to the leaders of the Danish Communist Party: Do not force me and my intellectual friends into a situation where our scope for action becomes so restricted that we, too – firm supporters of the communist cause – will find it necessary to leave.

The perverse effects of Lysenkoism on genetics

No idea and no data coming out of Lysenkoism has, so far as I can judge, enriched our knowledge of inheritance. Some of the effects, such as vernalization, that fascinated Lysenko are today known to follow from epigenetic mechanisms of great interest and relevance. But Lysenko and his followers contributed nothing of value to elucidate them.

Lysenkoism nevertheless had a clear effect on the development of scientific genetics – albeit in a negative way. The fight against Lysenkoist ideas made many geneticists overly suspicious of new and unorthodox theories. Ideas that in a calmer situation would have been recognized as interesting and might have furthered the understanding of various complex genetic phenomena, were therefore often ignored, or ostentatiously rejected. For a decade or two, this defence of hard-core Mendelian

236. Scherfig (1965), pp. 36–37. This is, again, a newspaper article that the author republished in a later book of essays. The translation is not strictly literal. Tikøb is a small agricultural town west of Copenhagen.

assumptions undoubtedly stifled the advance of genetics. An obvious illustration of this effect is provided by the revolutionary research of French scientists Jacob and Monod.

François Jacob was a war hero.[237] In May 1940 with the German attack on France, he was training to become a surgeon. He fled to England and joined de Gaulle's Free French Forces. He fought in Northern Africa and was severely wounded in Normandy after the D-Day landing. Months of convalescence later, he understood that his injuries would prevent him from working as a surgeon; he had to create a different future for himself. After some false starts, he entered the Pasteur Institute in Paris in 1950 to do research on bacteria and their viruses. More specifically, he studied the bacteria's control of integrated viruses – how they normally are kept dormant but how this control can be released, making the viruses multiply inside the bacteria. Jacob defended a thesis on the subject and started to feel more secure in his role as a researcher, despite lacking much of the biological knowledge of his colleagues.

A dominant force within L'institut Pasteur at the time was Jacques Monod. He, too, was a war hero, in his case from the resistance movement inside France. Well trained in genetics by having spent some time in Morgan's *Drosophila* laboratory in the US, he worked on the regulation in bacteria of an enzyme that was only expressed under special conditions. Jacob joined Monod's lab. They became close collaborators, with Monod as the senior, more knowledgeable and more self-assured partner.

Then one day Jacob had a revelation (while watching a boring film with his wife). He suddenly realized that questions about virus control and enzyme regulation were similar in structure. In both cases, there was most likely some molecule that acted directly on the chromosomal sites where the virus DNA and the enzyme gene are located.

The next time he met Monod, he presented this idea with fervour – and found Monod not just sceptical but outright scornful. Monod knew the absolute rule: Genes and chromosomes are stable and untouchable; nothing external can affect them. It took Jacob much effort to get Monod to reconsider this negative position. He finally succeeded – and the rest is scientific history. After a lot of hard work, the two of them established how gene-control functions via suppressor molecules acting on operator sequences in the DNA of bacterial chromosomes. In 1961, the *Journal*

237. The following story I take from Jacob's literary ambitious autobiography *La statue intérieure* (1987). For more information on Monod, see Debré (1996). See also Morange (2002).

of Molecular Biology published their article 'Genetic regulatory mechanisms in the synthesis of proteins'. And in 1965, Jacob and Monod were awarded the Nobel Prize.[238]

According to Jacob, it was his (relative) ignorance of genetics that made him capable of thinking about molecules acting directly on the genetic material. Monod, on the other hand, not only had had a rigorous training in genetics but also for a brief period had belonged to the French Communist Party during the early conflicts over Lysenkoism. He therefore had to break the 'protective belt' around the Mendelian principles that constituted the 'hard core' of genetics.[239] This was a difficult task at a time when the genetics community rigorously defended this core against the Lysenkoists.

That a reconsideration was due – perhaps overdue – of how the hardness of the genetic material should be interpreted was also felt by another creative geneticist, Barbara McClintock, a future Nobel Prize laureate. In an interesting interview with the historian Evelyn Fox Keller, she describes the freedom she felt when learning about the results of Jacob and Monod: In Keller's words: 'When Barbara McClintock saw Monod's and Jacob's first paper …, she was overjoyed. … The similarities between her own ideas about control and regulation and the work of Monod and Jacob were so striking that the latter seemed to provide just the kind of independent confirmation needed to weaken the resistance she had thus far encountered.'[240] Some of McClintock's ideas about development and the control of genes in complex organisms turned out to be wrong. But other ideas, particularly those about movable (transposable) DNA sequences, were correct and initiated a new genetic revolution.

To my mind, there is no doubt that some of the scepticism that met McClintock's earlier work derived from some over-zealous prior assumptions about how genetic material behaves. Geneticists practised a kind of collective self-censorship when faced with the Lysenkoist onslaught; it had the tendency to stifle interesting and progressive new ideas.

---

238. They shared it with the head of the department, André Lwoff.

239. Using the terminology of Lakatos; see Chapter 2 above. For a description of the 'Lysenko affair' in France and Monod's role in it, see Kotek & Kotek (1986).

240. Keller (1983), p. 177.

The Haldanes leave for India

I have nothing more to say here about how communist ideology came to react to genetics. But there is a final story worth telling.

When the Lysenkoist crisis erupted, J. B. S. Haldane was professor of Biometry at University College in London and a communist sympathizer.[241] Haldane got himself into a lot of trouble trying to see something positive – something 'dialectical' – in Lysenko's criticism of Mendelism. For too long, he avoided attacking Lysenko and was evasive in his critical comments for even longer. Finally, no other option than silence remained for him – and a non-publicized withdrawal from the British Communist Party.

Still, Haldane was a remarkably resourceful and unpredictable man. In 1956, we therefore find him again attracting media attention, but now in a completely unexpected way. Together with his wife, Helene Spurway, he would go into exile. He could not, he argued, continue to live in a corrupt and imperialistic country such as Great Britain – Just look at its criminal performance during the Suez crisis! – so off he went to recently decolonized India.

Haldane now became professor at the Indian Statistical Institute in Kolkata and adopted a new lifestyle. Long white tunic, feet in sandals with no socks, and a predominantly vegetarian diet. His genetic thinking was still excellent, and he wrote some of his most influential papers in evolutionary biology.[242] Many personal and professional problems arose, of course, in this new situation, but these we do not need to consider here.[243] As I see it, the moral of this story is not about genetics but about ideology.

With this move, Haldane showed that changed circumstances can make individuals reconsider their ideological attachments. He did not become a conservative or a liberal, as would have suited everyone but himself. Instead, he became one of the first, should we say, ecological globalists. At heart he was probably still a kind of communist, but his public persona – which to him always was more important than his private one – showed, via his media-directed actions, a new road forward for radical thinking. Soon, 'ecologism' would become an alternative ideology

241. For Haldane's life, see the biography by Clark (1968) and the description of him in Werskey (1978). For newer interpretations, see Tredoux (2018) and Subramanian (2020).
242. See Charlesworth (2017).
243. For more on Haldane's life in India, see Dronamraju (2010).

to challenge the older ones. This illustrates, if nothing else, that neither the field of genetics nor existing political ideologies should be treated as fixed, unchangeable entities.

8. Nazism and inheritance without genes

A question of race, state and rights

On 1 September 1939, Adolf Hitler started the Second World War. That day he unleashed his armies against Poland in an effort to incorporate Danzig and other German-speaking areas into the German Reich, reduced in size after the defeat in the First World War. A few days later, Great Britain and France lived up to their promises to Poland and declared war on Germany. This European war escalated when other global conflicts amalgamated with it, notably the one between the USA and Japan. It has been estimated that 24 million military personnel died in World War II.

The very same day, the first of September 1939, Hitler started another deadly war. It was a war against his own citizens with a decree that permitted the killing of physically and mentally disabled individuals.[244] The matter had been discussed earlier in the summer of -39. The formal decision introducing euthanasia was probably taken somewhat later, but it was considered symbolically appropriate to date Hitler's decision to this very day, the first of September. It led to the killing of more than 70,000 disabled or chronically ill Germans. It also opened for systematic, and even larger-scale, extermination campaigns against other individuals considered undesirable by the Nazi regime.

Both these decisions were due to Hitler's notions of race, state and rights. Not just his personal opinions, but the opinions of all other citizens who shared his world view, the Nazi ideology. Remarkably, the links woven between these three concepts – race, state and rights – were so strong that they left almost no space for arguments based on genes or chromosomes. Nazism therefore became the only major ideology of the twentieth century with no explicit relationship to scientific genetics. This

244. Overy (2009), p. 72.

is unexpected, given that Nazism was an ideology obsessed with ideas about biology and inheritance.

In this chapter, I will therefore not discuss the horrors resulting from the Nazi ideology – they are already well documented. Instead, I will describe how an ideology so fixated on inheritance as Nazism surprisingly – and at least seemingly – came to bypass scientific genetics. The chapter is relatively long, since many aspects of genetics within the German cultural/scientific sphere need to be considered.

Nazism was a German and European historical phenomenon of enormous social importance, and it must be analysed as such. Still, it cannot be avoided: any description of Nazism has to start with the individual Adolf Hitler, since almost everything in the ideology relates back to him.

Nazism starts with Hitler

Hitler's higher schooling was limited to the teenage years he spent in 1900–05 at a *Realschule* in Linz in Austria.[245] It is possible that he heard at school about the rediscovery of Mendel's experiments, though there are no indications that he did. (The philosopher Ludwig Wittgenstein, who attended the Linz school at the same time as Hitler, similarly never showed any signs of having assimilated Mendel's ideas.[246]) Hitler's later studies and readings were disorganized and superficial. He seems to have gained no knowledge of genetics and only a vague understanding of crude Darwinism.[247] The word that always came to him when he discussed human relationships was *blood*, which shows – even if we take his statements allegorically – that Hitler's thinking about inheritance was at a pre-scientific level.

The centre of the Austro-Hungarian Empire, a conglomerate of many nationalities and languages ruled by the Habsburg dynasty, was its capital, Vienna. Hitler moved there hoping to study architecture. When this plan failed, he continued to Munich in Germany. This meant that he was enrolled into the German army at the start of the First World War in 1914. He served as a dispatch runner close to the front and reached the

245. Kershaw (2008, chapters 1 and 2).
246. On Wittgenstein's schooling in Linz, see McGuinness (1988), pp. 50–53. There is no mention of Mendel in any of Wittgenstein's major writings, while Darwin makes occasional (and only uninteresting) appearances.
247. While writing *Mein Kampf*, Hitler supposedly read the influential book by Baur, Fischer & Lentz on race biology and heredity (more about this book later), but no trace of its genetics is seen in any of Hitler's writings or pronouncements (*Mein Kampf*, 1925, 2016, p. 742, comment 17 on p. 302).

rank of corporal. Near the end of the war, he was gassed at Ypres. Thus, Hitler experienced Germany's surrender in November 1918 far from the battlefield and as an almost blind invalid.

In the confused political situation in Germany after the war, Hitler supported himself as a beer-house demagogue for the extreme right. This was a task he was noticeably good at; in this milieu, he would distinguish himself with posturing and outrageous proclamations. He was a man of the spoken word, of action rather than reflection. With his awkwardly charismatic personality, he became attractive to many, both manual workers and more highly educated persons, who looked for a meaning in life after Germany's humiliating military defeat.[248]

The ideas that Hitler preached with success, he wrote down in *Mein Kampf*, a two-volume book that he worked on when he was incarcerated in 1924–25 after a failed putsch attempt in Bavaria. In this treatise – the only substantial text Hitler ever published – the belligerence is vibrant while the quality of argument remains shockingly poor.[249] Here, he formulated the thoughts that would constitute the core of the Nazi ideology up until the end of the Second World War; for reasons to be explained later I consider that the ideology, too, would end then.

Mein Kampf

Hitler begins the book with a description of his childhood and youth. He is not always truthful, but what becomes clear from this narrative is his visceral rejection of Austria and the foundations of its empire. That a German like himself should have a Czech as a co-citizen with equal rights was to Hitler not only strange but outrageous.[250] Germans should join Germans and together they should form the German Reich. Hitler was a *nationalist*. The German nationalism that Hitler adhered to had its origin in the beginning of the nineteenth century, when Prussia fought

248. Rudolf Hess, Heinrich Himmler, Joseph Goebbels, Hermann Göring, Alfred Rosenberg and Albert Speer – to name just some prominent Nazi leaders – were all more formally educated than Hitler but sided with him and his party from early on; they also continued to support him well into the Second World War.

249. I have used the notated edition published 2016 by *Institut für Zeitgeschichte* in Munich and Berlin; for quotes I have used a reprint of the authorized translation published in the UK in 1939.

250. Hitler: 'This conglomerate spectacle of heterogeneous races which the capital of the Dual Monarchy presented, the motley of Czechs, Poles, Hungarians, Ruthenians, Serbs and Croats, etc., and always that bacillus which is the solvent of human society, the Jew, here and there and everywhere – the whole spectacle was repugnant to me.' (1939, 2011), p. 86.

against the ideas of the French Revolution and against the Napoleonic armies that brought these ideas east of the Rhine. Noteworthy in Hitler's case, was the explicitly racial basis he gave these nationalist convictions. To him, Germans constituted a race, and the best race at that.

Anti-Semitism was, likewise, a tradition with a long history. Already as a young man, Hitler admired Austrian politicians preaching anti-Semitism. By the time he himself had become a political agitator, he wholeheartedly supported this mode of thinking and made it central to his propaganda. His animosity towards Jews was directed towards the top of society as well as towards its base. Jews should be exposed and opposed as the hidden rulers of the world – an argument expressed in vaguely anti-capitalistic terms. Jews should also be prevented from destroying the German race 'from below' by marrying non-Jews and thereby causing miscegenation – a view adopted from crude eugenic thinking. Overall, Jews embodied all the dangers that threatened true Germans from all sides of life.

The bitter truth, according to Hitler and those who supported him and the Nazi party, was this: *Germans were treated unfairly*. The most acute instance of this gross unfairness was the Versailles Peace Treaty after the First World War. Then and there, the USA, Great Britain and France had pruned Germany of many of its 'natural' subjects, forced the country to disarm, and demanded a huge war-retribution. In addition, there was another gross and long-term unfairness in that Germany historically had never, like the other Western powers, been given the opportunity for profitable colonies outside Europe. Hitler took for granted that it was the Jews within and outside Germany who had promoted these misfortunes. In addition, a particularly insidious enemy to the *true* Germans was the organized labour movement, especially the Social Democratic Party (from which the German Communist Party later branched off). The Nazis did indeed see themselves as socialists in that they represented and defended the interests of the common working people – but as nationalists they rejected all internationally attuned and class-war oriented socialism. The ultimate crime committed by this political force was the 'stab-in-the-back' supposedly performed by Marxist socialists and Jews at the end of the 1914–18 war when they fomented civilian opposition to the war.[251]

251. 'Emperor William II was the first German Emperor to offer the hand of friendship to the Marxist leaders, not suspecting that they were scoundrels without any sense of honour. While they held the imperial hand in theirs, the other hand was already feeling for the dagger. There is no such thing as coming to an understanding with the Jews.' Hitler (1939, 2011), p. 134. Note that the Jews to Hitler represented the organized labour movement as well as national and international capitalism.

The only way to stop this long chain of adversities (we continue to follow Hitler's arguments) was to gather all Germans into the Nazi Party, let this party take over the state and thereby make the state and the country thoroughly German.[252] The rebirth of Germany would then be achieved through the incorporation of all Germans presently living in other countries plus the purification of German society from all foreign and deleterious elements. This achieved, a sound and fruitful development would follow, notably through the extension of control over land-areas in the East. German farmers would migrate to the fertile plains of Ukraine and Russia and in this newfound *Lebensraum* produce food and raw material for the reborn, respected and victorious German Reich.[253]

This, in short, was Hitler's world view, his *Weltanschauung* – his characteristic ideological blend regarding race, state and rights. It was a tightly knit set of ideas, which he would adhere to for the rest of his life. Many of them he shared with his old comrades in arms but also with a large part of the German bourgeoisie. It only needs one addition as a summary of the central tenets of Nazi ideology: the positive role of action and of the Führer. The Nazis may often have referred to Hitler's writing in *Mein Kampf*, but Nazism as an ideology was always primarily defined by its actions – what it did rather than what had been written. Keeping one's words was never a Nazi virtue; *acting* as a Nazi was always more important.[254] This performative, often visual, foundation of the ideology was manifested in the spectacular mass rallies that the Party (and, with time, the State) organized. Their chief actor was always Hitler himself, *der Führer*. No one else got a chance to occupy this role, and no one else was imaginable in that position.

---

252. The Nazi Party – the National Socialist German Workers' Party [Nationalsozialistische Deutsche Arbeiterpartei] – was formed in 1920 based on various preceding extreme right political formations. Hitler became the formal leader [Führer] of the party in 1921.

253. For both policies of implicit mass murder – the eugenic acts against the unwanted in society and the annexation of the East – Hitler relied on thoughts already in wide circulation in German society. As he expressed his plans in an exaggerated half-allegorical language, it remained for a long time uncertain to the outside world how seriously his ideas were to be taken. For the German background, see Wehler (1985).

254. Franz Neumann, a German lawyer living in exile, summarized his evaluation of Nazism in 1942 with these words: 'National Socialist ideology is devoid of any inner beauty. The style of its … writers is abominable, the constructions confused, the consistency nil. Every pronouncement springs from the immediate situation and is abandoned as the situation changes.' Neumann (1942 and 1944, 1963), p. 37.

Nazism as an international racist ideology

Central to the ideology was the concept of race. Germans formed a race.[255] A race was the natural basis for a state, *ein Reich*.[256] To such an established state, and particularly the German Reich, belonged various rights. Since the German race was the foremost among races, most rights should naturally belong to it. These rights had to be appropriated – they were not delivered for free by other races and states: 'Generally speaking, we must not forget that the highest aim of human existence is not the maintenance of a State of Government but rather the conservation of the race … The world is not there to be possessed by the faint-hearted races', Hitler wrote in *Mein Kampf*.[257]

These various statements about race, state and rights could, of course, be questioned and were so by many – but not by the Nazis. Hitler's naïve ideas never needed any intellectual support from, for example, scientific results. They were true and could not become truer through complicated explanations and legitimations; these would only confuse matters. Thus, in Hitler's mind, and in the Nazi ideology, there was never any doubt about what was true – in religious terms, to them, truth was in the German race, and the German race was truth.

I have up to now described Nazism as a German phenomenon, which is basically correct.[258] But the ideology's international associations were important. They came in two different, but partly overlapping, forms.

Nazism belonged to a large and diverse family of right-wing responses to the experience of World War I. It is generally called fascism, after its successful version in Italy where Benito Mussolini already in 1922 led the Italian National Fascist Party to victory. Similar movements existed in most of Europe (and elsewhere), even if there were great differences between, for example, the military regimes under Generals Franco in

255. Hitler and the Nazis often also elaborated on the notion of *Volk*, related to race; I see, however, no reason to track the details of these confused arguments here. For a richer description of the intricacies in the Nazi treatment of race, see Hutton (2005). I similarly leave all discussions about 'Aryans' out of my analysis.
256. '*Gleiches Blut gehört in ein gemeinsames Reich*.' Hitler (1925), p. 93. From the first page of *Mein Kampf*. Hitler marked this sentence in italics.
257. Hitler (1939, 2011), p. 69.
258. The convergence of thinking that existed in Germany and Austria even before the *Anschluss* joined the countries in 1938, should, however, be noted. I do not always specify this in my text but leave to the reader to make reasonable interpretations of what the words 'German' and 'Germany' should stand for.

Spain and Salazar in Portugal, and the many extreme-right movements in France with no governmental political power. Still, they were very similar in many respects: they were all nationalist and authoritarian, anti-parliamentarian, attuned to the working classes, but at war with all Marxist-inspired socialist organizations, and thoroughly racist. Nazism undoubtedly belonged to this broad political family, despite its unique traits.[259]

When the Nazis came to power in Germany in 1933, the relationship between them and the rest of the world changed. From then on, Nazism developed into a state-supported totalitarian ideology – just like communism as discussed in the previous chapter – whose task was to provide intellectual and emotional support for an authoritarian military regime. Out of this situation, and particularly after Germany's occupation of surrounding countries, the Nazi ideology came to determine what should be considered truth in large parts of Europe. It now evolved into the *primus inter pares* in the family of fascism, and thereby into a genuinely international ideology. As such, it participated in the Spanish Civil War, interacted with French right-wing *ideologues* during the occupation, and made anti-Semitism more important within Italian fascism – not to mention how it inspired various European sister parties to terrible racist atrocities. This transnational enlargement in Nazism's base and scope is an important reason why I have chosen to treat it as one of the major political ideologies of the twentieth century.[260]

Nazism died with Hitler at the end of the Second World War in 1945, and the word lost its specific meaning. This does not mean – certainly not! – that all parts of the ideology disappeared. Authoritarian right-wing regimes of various kinds continued to exist, as did the racist and nationalist ideas that Nazism had built upon. But the specific *ideological formation* that constituted Nazism ended with Hitler and with the military defeat of the German military forces; from then on, related ideological thoughts must be analysed under other headings.

---

259. Thus, the American political scientist Robert Paxton treats Nazism as a prototypical fascist ideology in a classic treatise on the topic. See Paxton (2004), pp. 26–28 and throughout his book.

260. France was the largest country to be defeated and occupied by Germany. It had a rich intellectual scene that included individuals who from early on sided with Nazism. Some of the notes in this chapter are therefore devoted to the development in that country; for more information on the French situation, see for example Schneider (1990) and Lackerstein (2012).

Scientific background

Even compared to other fascist movements, Nazism accorded an exceptional importance to race – ranging from the superior virtues it ascribed to the Germans to its virulent hatred of the Jews. It was under this extreme racism that people in substantial parts of Europe had to live during the late 1930s and the first half of the 1940s. The Nazis never doubted the truth of their racist ideas. Questions arise, however: What legitimacy did they seek for their ideas from biology and medicine, and from the new science of genetics? What did they and others at the time really mean when they talked about race? My analysis starts with the development of genetics in Germany, before my attention turns to the notion of race – how it was understood and used.

Genes in Germany

Genetics did not develop evenly over the industrialized world. Eminent research groups existed from early on in Great Britain, the USA and Scandinavia, where there was also strong popular interest in the applied achievements of early Mendelism.

The situation was different in the two scientific superpowers France and Germany. The newfound inheritance rules were eagerly studied in their plant breeding institutes, but Mendelism did not gain the same importance in their academic communities as in the previously mentioned societies. In France, what I call the hardness of the genes, i.e. that truly heritable differences are *hard* and impossible to change by external, environmental means, went counter to ingrained Lamarckian sentiments, while genetics ran into another obstacle in Germany. Here, biological teaching normally incorporated wider holistic views on the nature of life; the Mendelian results did not particularly suit this approach. The gene, as described by Morgan and colleagues, was too crude an object for all-encompassing theories of life to be built around it. In Germany, there was also a tradition of ascribing importance to the cytoplasm (the gelatinous liquid that fills the inside of a cell), stressing that some source of inheritance must reside there rather than in the nucleus and the chromosomes. Thus, it was impossible for Mendelian genetics to declare itself central to all aspects of life. In effect, German academic zoology, botany and microbiology continued to be mainly interested in development and evolution and did not leave much room for research on transmission genetics. There were, of course, some excellent geneticists in Germany, but they primarily held less-prestigious positions or worked in institutes devoted to applied research.[261]

I am here summarizing the results of the historian of science Jonathan Harwood, who has studied the German genetic community between 1900 and 1933.[262] The philosopher Ian Hacking has made a similar cultural interpretation when analysing the history of theoretical statistics in Germany. His question was why no important statistical theory evolved in Germany, despite the country's mastery in mathematics as well as in collecting social data. Hacking answered: 'Mainline western thought was atomistic, individualistic and liberal. The eastern, in contrast, was holistic, collectivist and conservative.'[263] Thus, if you were a well-trained German intellectual, you did not believe that scientific conclusions could be drawn from individual data alone: '[l]aws of society, if such there be, are … not distillations of individual behaviour.'[264]

Hacking's argument, when applied to genetics, translates into a German scepticism towards the possibility of learning deep laws about life from sorting lots of individual peas and flies. Grand scientific goals could only be obtained via a deeper understanding of the world, not by assembling atomistic data. No such qualms existed, however, with respect to more applied scientific problems. Here, the insights provided by genetics were used without hesitation.

On the medical side of the life sciences, an interest in genetics existed primarily among physicians concerned with what in German was called *Rassenhygiene* [racial hygiene], which for most intents and purposes can be equated with eugenics.[265] Due to the almost complete lack of empirical data on human genes, abstract considerations became important instead.

261. 'Until 1945 … there was only one chair (and very few tenured posts) devoted to genetics in the twenty-six German universities. Those interested in genetics, therefore, had to find jobs in institutes of botany or zoology or in the Kaiser Wilhelm Institute for Biology which was created in 1914 to compensate for the universities' failure to develop the new experimental biology.' (Harwood, 1985, p. 299.) Typically, Erwin Baur, Germany's most prominent geneticist, ultimately became head of a plant breeding institute belonging to the Kaiser Wilhelm research system. On the corresponding lack of prestigious positions for geneticists in France, see Chapter 5.

262. Harwood (1993). For the role of cytoplasmic inheritance in Germany, see Sapp (1987).

263. Hacking (1990), p. 36. By 'eastern', Hacking here means the German cultural sphere.

264. Hacking (1990), p. 37.

265. The term was introduced in 1895 by the Munich-based physician Alfred Ploetz, who in 1905 founded the eugenic society in Germany, *Deutsche Gesellschaft für Rassenhygiene* [The German Society for Racial Hygiene].

In 1908, the first major result of German genetics had been produced by the mathematically proficient physician, Wilhelm Weinberg, who in theoretical terms described the effects of Mendelian segregation at the population level.[266] Weinberg also helped Herman Lundborg with the analysis of a rare neurological disease in Sweden, leading to the conclusion that the syndrome was caused by a recessive gene variant.[267] This was done at a time when psychiatry sought to classify mental diseases into objective and clinically useful entities. Lundborg's results fitted perfectly into this tradition within the German psychiatric community, to which many physicians in Austria, Switzerland and Scandinavia also belonged. It had its beginnings in the 1890s when Emil Kraepelin split severe psychosis into manic depression and dementia praecox. At the beginning of the twentieth century, Eugen Bleuler changed the latter term to schizophrenia; this was at about the same time that he introduced the term autism and Alois Alzheimer described 'his' specific disease.[268]

Since a heritable component seemed to exist in these various mental disorders, much attention was originally paid by psychiatrists to their pattern of inheritance. Recognizing specific 'disease genes' would add legitimacy and precision to proposed classification schemes, which implies that Mendelian segregation patterns were eagerly looked for. Psychiatry thereby developed into the dominant field for genetic investigation within German medicine (together with blood-group serology, as discussed below). A milestone in this genetic endeavour was the extensive study of schizophrenia published in 1916 by Ernst Rüdin, a Swiss-born psychiatrist active in Munich. He showed that no single-gene explanation would work for this disease and hence discussed various multi-gene alternatives.[269]

---

266. The English mathematician G. H. Hardy reached the same result simultaneously, and today the 'Hardy-Weinberg principle' is taught in every elementary course on population genetics. Weinberg was a gynaecologist and paediatrician who studied the biology of twinning. He was interested in eugenics and was an early member of the *Gesellschaft für Rassenhygiene*.

267. The Swede Herman Lundborg was introduced as a conservative thinker with a strong *Völkisch* attitude in Chapter 4 above. He was well integrated in the German eugenic/psychiatric/genetic community and moved ideologically rightwards until he become a supporter of Nazism.

268. Comparisons can here, of course, be made with the work of Sigmund Freud and the early psychoanalysts in Vienna. Their interest was, however, mainly in neurosis and not psychosis. And even if they cared about development and biology, *inheritance* was not of much interest to them; see note 82 in Chapter 4 above.

269. Rüdin (1916). In this study, Rüdin still used the old term *dementia* praecox for the disease. The search for genes and causes underlying schizophrenia has from then on been a permanent fixture in medical genetics; its current status is discussed in Chapter 11 below.

Ernst Rüdin's personal trajectory helps us understand how this influential psychiatric research tradition came to forge a crucial link between genetically informed medicine and Nazism.[270] When Rüdin became a leading force within the *Deutsche Forschungsanstalt für Psychiatrie* [the German Research Institute for Psychiatry] in Munich at the end of the 1920s, he gradually shifted the institute's research interest away from mathematically oriented gene-analyses towards statistical studies of patients and their relatives, particularly twins, that is, towards what was then called 'the empirical hereditary prognosis'.[271] This implied a shift from searching for factors directly causing mental diseases towards tracking 'hereditarily tainted' (*erbliche Belastet*) families.[272] With no long-term hope of curing patients – or even of confidently diagnosing them –, psychiatrists moved towards eugenic measures, i.e. towards preventing patients and their relatives from procreating.[273] At this time in biological circles in Germany there may have lingered some interest in Lamarckian ideas on inheritance; still, no such traces of genetic malleability are to be seen in the psychiatry of Rüdin and his colleagues. According to them, the heritable determinants for disease were immutable and they were present not only in those affected but also in their surrounding family members.

This may sound like standard genetics, but Mendelism is much more precise. It states, for example, that among the healthy sibs of children with a recessive disease, a third are completely free from any deleterious gene variant. Or, as the sceptical Wilhelm Johannsen never stopped admonishing: It is impossible to know from outer appearance (the phenotype) what genetic constitution (genotype) someone has. When this warning was ignored and the focus on causative gene variants was lost while the idea of unchangeable heritable determinants was retained, German psychiatry came to legitimize all kinds of violent interventions against mentally ill individuals and their relatives.

I will illustrate this with what happened when Rüdin in 1933 joined the 'Expert Advisory Council for Population and Racial Policy'. The

270. My description of Rüdin is mainly taken from Mazumdar (1996), pp. 652–654, and Weiss (2010), pp. 121–183. Rüdin's importance can be judged from how often he is referred to in Paul Weindling's comprehensive study *Health, Race and German Politics between National Unification and Nazism, 1870–1945* (1989), where only the names of Alfred Ploetz, Fritz Lenz and Alfred Grotjahn occur on more pages than Rüdin's.

271. Weiss (2010), p. 122.

272. Mazumdar (1996), p. 646.

273. 'Rüdin's science and his eugenic-inspired politics were two sides of the same coin.' Weiss (2010), p. 129.

Council was created to bring together academic, state and party experts after the Nazis' *Machtübernahme*. One of its first tasks was to oversee the passing of a new sterilization law. Rüdin's stress on inheritance, even in the absence of any direct genetic information, was materialized here in the official claim that it is possible 'to predict the future condition of the offspring apart from the establishment of the actual genetic law. … [E]mpirical prognosis is regarded as the most productive method of research on the statistics of inheritance.'[274] Or in other words: it is possible to predict the status of future offspring from statistical information alone, even without knowing the exact genetic constitution of any of the individuals involved.

Thus, Rüdin and colleagues performed an intellectual sleight of hand with respect to the meaning of terms like 'familial', 'heritable' and 'genetically determined'. By doing so, they prepared the ground for compulsory sterilizations of patients with mental defects, schizophrenia, manic-depressive psychosis and epilepsy – *plus* their relatives.[275]

Not only did Rüdin join the Nazi-run council, but he also agreed to chair its Task Force II. This body 'examined laws from the standpoint of genetics and eugenics'. It also 'offered suggestions for acceptable university professors and gave advice on the execution of racial policy.'[276] Given Rüdin's willingness to take part in these activities, it comes as no surprise to learn that he joined the Nazi Party in 1937.[277]

Via Rüdin, we can see how what started as a fruitful research interest in the German medical community within a few decades developed into a supporting force for the Nazi ideology and administration; this was partly due to scientists ignoring the initial attention to actual genes. The hardness of the genes was instead transformed into a hardness of psychiatry, which claimed that it knew what was best for the individual, the family, the race and the Reich. Nazism wanted to show its readiness for action, and Rüdin and his like-minded colleagues forged the intellectual tools that Hitler needed to wage his second war: the war against the weakest of Germany's citizens.

---

274. The quote is taken from an official commentary on the law; Mazumdar (1996), p. 653.

275. Mazumdar (1996), p. 653.

276. Weiss (2010), p. 138.

277. Müller-Hill (1998), p. 133.

Race in German biology

This much about the trends in genetics and inheritance studies in German biology and medicine up to the war; let me now tackle the topic of race. We have met the word in the German language already twice in this book. The first time when Kant discussed the origin and nature of the human races, and the second when Marx and Engels in the *Communist Manifesto* wrote that 'the cost of production of a workman' was almost entirely restricted to what 'he requires for his maintenance, and for the propagation of his race.'[278] In both cases the spelling *Race* was used, which makes the word look more European than with its later German orthography *Rasse* or *Raße*.

In German, as in most other European languages, the word started as a non-specific collective noun for associated individuals, as for example 'the human race' (Marx's and Engels' usage); it could also represent something of a definite quality, as in expressions like 'she is a woman of race'. During the eighteenth and nineteenth centuries a more specific biological and anthropological meaning emerged. Race started to designate anatomically and geographically differentiable human groups, the 'races' (which is how the word was used by Kant). In all languages that I know of, this sub-meaning came gradually to colonize the vaguer and more general concept from within.

Misunderstandings sometimes arise in historical studies due to this linguistic evolution of the concept. If someone today talks about 'race biology' in any European language, most listeners automatically assume that the topic deals with biological differences between human races. Still, and up until at least the Second World War, this was not necessarily the case. *Statens Rasbiologiska Institut* [The Swedish Race Biology Institute] was founded in 1920 primarily for the study of variation among Swedes, just as the *Deutsche Gesellschaft für Rassenhygiene* mainly discussed heritable differences among Germans.[279]

Thinking based on the notion of race was, however, never fully rational. Differences within and between human groups were considered partly heritable, especially by those eugenically interested. It was rarely made explicit whether this variation was due to Mendelian genes or some Lamarckian phenomenon in which inheritance and environ-

278. Marx & Engels (1848, 1973), p. 12. See previous Chapters 3 and 6 respectively for these examples.
279. For more on the Swedish institute, see Chapter 5 above.

ment interplayed. In any case, most biologists in Germany in the interwar years seem to have regarded races as *essentially* distinct entities, i.e. as differing not only through some visible traits but through their inner nature.[280]

What this meant ideologically is well illustrated in *Mein Kampf*, where Hitler, in the chapter devoted to 'Race and People', after having discussed differences between different *Wesen* [beings], for example the goose, the fox and the tiger, goes on to apply his conclusions to the human races, primarily the Aryans and the Jews. He thereby equates differences between human races with the differences between widely distinct animal species.[281]

This essentialist view can be found at least up to the Second World War and in all kinds of writings in Germany on the human races and the variation between them. Differences between the races were seen as *given*, not as randomly or selectively evolved between geographically and reproductively partly separated populations. Thus, humans living today had developed from a state of originally distinct races, which only late in time had started to intermingle and interbreed.[282] Genetic variation within populations was therefore not perceived as *natural*, but as something that could only be explained by some prior history of racial intermingling. This – to us strange – view helps explain the ease by which different kinds of studies on human genetic variation could be treated under the unified heading of race biology. For example, the well-known anthropologist Eugen Fischer stated in 1926 that 'racial biology' was a concept not limited to the study of traits related to humanity's major 'racial' groups;

280. Darwin contributed to this kind of thinking by naming his 1859 book *On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life*. It appears as if Theodosius Dobzhansky's 1937 book, *Genetics and the Origin of Species*, with its detailed examination of genetic variation in nature, did not find time to exert any influence on German biology before the Second World War. (For more on Dobzhansky and his book, see Chapter 7.) For him, as for all biologists today, the important hiatus in the hierarchy of life runs between species and not between races, since species are normally reproductively isolated from each other and therefore represent distinct evolutionary entities. Essentialist notions about race differences were also common outside Germany; see e.g. Provine's description of some prominent US geneticists' views on Blacks, up to at least the late 1930s; Provine (1986).
281. Hitler (1939, 2011), pp. 179–209.
282. This idea we have already encountered in an unusually exaggerated form in note 67 to Chapter 3, where the French anatomist Paul Broca's suggestion is mentioned that all human variability follows from crosses between different primate species.

it also investigated normal and pathological characteristics of any 'hereditary line' or interbreeding population.[283]

With respect to the notion of race, we may therefore conclude that the road towards a more insightful understanding of biological variability, which in the 1920s and '30s was being staked out by genetically interested scientists in other parts of the scientific world, was not the road taken by the German biological community. Here, an essentialist notion of race continued to dominate, particularly with respect to humans.[284]

Genetics fails to deliver

But what about the genetically informed medical scientists and practitioners – didn't they have something relevant to say about the genetics of the human races? This query leads us to one of the great 'failings' of genetics in the ideological arena.

A completely unexpected phenomenon became known to the medical community around the turn of the twentieth century – the human ABO blood groups.[285] The pattern by which the red blood cells of an individual become coagulated by blood serum from other individuals was shown to be distinct and stable over time, as originally outlined by the Austrian physician Karl Landsteiner. Then, in 1924, Felix Bernstein, a German mathematician interested in genetics, showed that the four known blood groups, A, B, AB and O, are caused by pairwise combinations of the variants *A*, *B* and *O* of a Mendelian gene.[286] The historian of medicine Pauline Mazumdar has summarized how hopeful the situation then appeared:

> … blood groups were going to be able to provide everything that human genetics had lacked so far… The blood groups were easily definable as Mendelian unit-characters, with a simple, direct relationship between genotype and pheno-

283. Quoted from Weiss (2010), p. 75.
284. Richard Goldschmidt was Germany's most prominent animal geneticists at the time, and his work on geographic variation in butterflies was carefully referred to by Dobzhansky in his book. Goldschmidt's primary interest was in development, however, and not in the genetics of evolution, though this changed when he later went into exile in the USA. See Harwood (1993), pp. 51–52.
285. For this story, I primarily rely on Mazumdar (1996); Boaz (2012); Berner (2015). To simplify the description, the modern blood group nomenclature is used.
286. From each of its parents, an individual inherits one gene copy. *O* is recessive to *A* as well as *B*, which implies that individuals with genetic constitutions *AO* and *BO* have blood groups A and B, respectively. The rest of the relationships between genotypes and phenotypes are self-evident.

> type. They were normal human traits that every human family inherited and, most importantly, they provided an ideal material basis for *Vererbungsmathematik* [inheritance mathematics] … The blood-grouping laboratory was the fly-room of the human species.[287]

The methodology could be used for many different purposes. It could, for example, determine paternity questions or establish associations between blood groups and diseases. But most importantly from our point of view – blood groups could be used to investigate the genetic composition of human populations and the differences between them.

This anthropological approach started already at the end of the First World War when the Polish medical scientists Ludwik and Hanna Hirszfeld studied soldiers stranded in Greece. They investigated individuals from many parts of the world and reported in 1919 that blood group A predominates in northwestern Europe while blood group B is more common further to the east and south, a result that attracted much attention.[288]

After the methodology had been improved and simplified, blood group research was ready to be used for large-scale population studies; 'seroanthropology' had become a possibility. Studies were made all over the world, and it has been estimated that more than 1.3 million individuals were ABO-tested in the 1920s and '30s to answer scientific, and not only clinical, questions.[289] Typically, Herman Lundborg in Sweden sent a specialist to investigate the blood groups of the Sami in the north of Scandinavia.[290]

Within the German medical community, blood group research developed strongly (after a somewhat belated start). In 1926, enthusiasts created the *Deutsche Gesellschaft für Blutgruppenforschung*, and plans were made for huge investigations of the fine-distribution of the blood groups over Germany and surrounding countries. In 1928, the society also started the speciality's most important journal, *Zeitschrift für Rassenphysiologie*.[291]

287. Mazumdar (1996), p. 620.
288. Schneider (1996), pp. 283, 285.
289. Schneider (1996), p. 277.
290. Soon after the founding of his institute, Lundborg started a large-scale study of the 'Lapps', as the Sami were generally called at the time. For many years, he and his assistants travelled to the north of Sweden to measure and photograph Sami individuals – based on the premise that it was important to document this race before it was overrun in its Darwinian competition with the more developed 'Scandinavians'. See Hagerman (2015) and Berner (2015).
291. Translations: 'The Society for Blood Group Research' and 'Journal for Race Physiology'. For more on this journal, see Schneider (1996), pp. 290, 295–296.

Many must have felt that the vagueness surrounding the explicatory power of the concept of race would finally become scientifically enlightened by this powerful method of genetic analysis.[292]

The enthusiasm for blood group studies faded rapidly, however. This was due to a simple reason: genetics refused to deliver. The results of the blood group investigations did not live up to expectations. *Yes*, there are differences between populations with respect to the frequencies of their blood groups; but, *No*, these differences are not particularly pronounced, and they do not follow any clear pattern. It was thus impossible to deduce from someone's blood group to which 'race' he or she belonged. Furthermore, the variation in blood group frequencies did not follow any obvious pattern that would indicate the level of 'advancement' of the population under study. This suggestion, born from the initial report by the Hirszfelds that blood group A belonged to a more western human type, became irrelevant when it was found that also Australian aborigines have a high frequency of this blood group.[293] Similarly, their antipodes, the Sami, turned out to have blood group frequencies that differed from the surrounding Scandinavian-speaking populations, *but* with differences so small that they could not be used to discriminate race membership. These blood group results were therefore rapidly ignored.[294]

In short, nothing of value came out of the genetic blood group optimism for those who were obsessed with race biology. The data produced by the seroanthropological investigations were just as complex and confusing as all earlier anthropological measurements had been, for example of the shape of skulls. In addition, it was not possible to associate any of the blood groups with particular heritable diseases or physical or mental traits. Thus, the expectation that the relationship between human genes and expressed racial variation would be enlightened by blood groups failed – though this debacle was rarely openly admitted.

It did, however, have some direct consequences. In the difficult economic situation of the late 1920s, the German seroanthropologists

292. In France, a paradoxical effect of the interest in blood groups was that it gave a boost to the genetic study of humans, a field that so far had been only weakly developed in the country. Here, one also finds an example of how the early results were put to direct use, as when a well-established expert in social medicine recommended whom one would allow to immigrate: 'Keep the O's and the A's, eliminate the B's, only keep the AB's if the psychological and health examination is favorable.' See Schneider (1990), p. 248.

293. Schneider (1990), p. 227.

294. Berner (2015), p. 25.

could not impress their scientific peers in the competition over research resources; thus, no nationwide blood-group survey came ever about, only many local ones.[295] And the founder of the Society for blood-group research was forced to use the standard rhetorical claim of all failing research programmes when he came to the defence of its activities in 1928: Interesting results would certainly be produced – if only more resources were invested in this kind of research.[296]

At lower levels, the medical and anthropological scientists fixated on racial questions did not immediately give up their hope but continued with their blood group investigations, exaggerated claims and internal conflicts. Still, their activities as previously hoped did not have any direct effects on the further development of the Nazi ideology. Some of these scientists would nevertheless later turn up as 'experts' to assess the degree of individual Jewishness.[297]

Weak resonances and increasing irrelevance

We can now conclude: The gene did not play any important role in the Nazi ideology. Its possible relevance disappeared from Nazi-attuned discourses when the psychiatrists preferred vaguer statistical correlations between relatives in 'tainted' families, and when informative differences failed to materialize in blood-group studies of the races. We have here an interesting example of how an ideological movement looked for, expected to find, but did not obtain the support that it was convinced it would get from an attractive science. No resonance developed between the genetic results and the preconceptions held by the ideology. Nazism – ranging over time from Hitler's early writings on blood in *Mein Kampf* to the systematic mass murders organized during the war – remained an ideology seemingly devoid of genes.

The prime reason for this was probably the *precision* that characterizes all good genetic investigations, which did not thrive near Nazism's certainty over its self-proclaimed truths. Just one example: the year after the leader of the seroanthropological movement in Germany had argued for allocating more resources to this kind of research to find at least *some*

295. Mazumdar (1996), pp. 635–637.
296. Otto Reche, quoted by Boaz (2012), pp. 112–113.
297. Müller-Hill (1998) recounts one such example where a conflict developed over the use of serological data, see p. 40. In France, no prominent geneticist took part in any activities of this kind, as far as I gather. George Montandon, for example, who was the doctor overseeing certificates on race in France, seems to have had no special knowledge of genetics. See Chevassus-au-Louis (2004), pp. 185–198.

associations between blood groups and racial characteristics, the Nazi magazine *Der Stürmer* self-assuredly proclaimed:

> Jewish blood is a combination of Negro, Mongolian, and a portion of animal (probably ape) blood. A transfusion of such blood into the body of a non-Jew would have poisonous effect.[298]

When such convictions were socially acceptable, what role was there for a science functioning with precision? None. When an ideology has become so deaf that it produces its own facts, legitimation functions under new and different rules. The aura of exciting modernity that surrounded genetics in most parts of the world had no place in Nazi-dominated Germany.

Obviously, this was the conclusion also reached by the propaganda apparatus of the Nazi machinery. After genetics' failure to find informative racial blood markers, more or less all references to genes and chromosomes disappear from the ideological scene presented to the German public. (For a lexicographical example of this, see below.)

Races without genes

Ideologies present structured visions of the world to be used for political explanations, proposals and actions. No ideology in the twentieth century could function without a relationship to the rapidly expanding field of genetics. Conservatism accepted genetics almost whole-heartedly, while social democracy relegated it to the off-stage part of the political scene. Communism came to abhor it but felt forced to replace it with something else – Lysenkoism. Nazism was in a very similar situation. With its stress on blood and race, it needed some explanatory system that in a trustworthy manner linked biological facts to politics – not perhaps for its devoted adherents but for the broader intellectual strata that the ideology tried to win over. When genetics did not deliver this support, Nazism had to look elsewhere for a helpful knowledge system. It did not invent its own inheritance theory (as the communists did); instead, it found what it needed – a high-status explainer of the relationship between history, values and human differences – in another discipline: biologically attuned anthropology. It would provide the scientific support for Hitler's views on race, state and rights.

298. Quote taken from Boaz (2012), p. 138.

A different kind of science and scientists

Anthropology has always had an interest in human variation. Much was written in the late eighteenth and early nineteenth century about anatomical differences and different 'types' of humans – we have seen how the philosopher Kant explained the evolution of races in his anthropological lectures.[299] Out of this tradition emerged a widely encompassing field of race study, where anatomical measurement became integrated with folklore collecting, linguistic analyses and comparative studies of religion. The influence from various romantic ideas was strong. The Swedish historian of ideas Hertha Hanson sees this development as culminating in 'an idealistic world view that motivates empirical investigations'.[300] The combination of *idealism* and *empiricism* may appear strange today, since we normally associate only the second tradition with science and not the first. But Hanson makes a comparison with alchemy, which in a similar way combined esoteric principles with experiments and data collecting. She describes the work of the race anthropologist like this:

> The race researchers' energetic gathering of information and measurements from all corners of the world gives in the beginning an overwhelming impression of enthusiasm for the visual and measurable reality. But after a while it becomes clear that the visual is often only a means to penetrate into another world, where the spiritual stands in the centre as a value and formative force. Shape of skull, angle of nose, and colour of skin do not only tell about the individual's moral and intellectual qualities but also reveal more deep-going patterns and structures that transcend the particular and furtive. The alert investigation and the careful measurement seem to reveal patterns and structures to the scientist's inner eye that are not assessable to the non-informed. Against the background of a self-evident, almost intuitive idealism, the race researcher navigates in reality.[301]

This description explains the hallucinatory feeling one gets when one reads German texts from the inter-war period about degenerates and race-mixtures, schizophrenics and Jews. Not the gross examples, like the quote above taken from *Der Stürmer*. No, the problematic texts are the allegedly scientific ones, printed in schoolbooks or pronounced as speeches at academic festivities. They abound in empirical examples described in careful details, but the results are forced into rigid, and often denigrating, conceptual frameworks. Underlying this is also often an

299. See Chapter 3 above.
300. Hanson (1994), p. 11.
301. Hanson (1994), pp. 11–12.

idea that the truthfulness of the assertions derives not from the empirical results as such but from the analysing scientist's visionary capacity. On the special position of the race scientist, Hanson writes:

> In this tradition, the scientist therefore plays a particular role. He knows his exclusiveness and knows that the external is just a sign of inner secrets. The insight and feeling for the material which solid experience has given him, make him into the best interpreter of nature's signs.[302]

302. Hanson (1994), p. 15. A very attractive character comes – perhaps surprisingly – out of this tradition: Commissaire Maigret. Since one of the aims of the present chapter is to demystify elements that went into the formation of the Nazi ideology, I add here a note devoted to this observation. – The Belgian-French journalist and pulp-fiction writer Georges Simenon produced in the early 1930s a series of crime novels based on Jules Maigret, a fictive police detective in Paris. The publisher Fayard issued nineteen such novels before 1934. They are still available in many languages, and I limit my characterization of Maigret to this set. (For details about Simenon and his books, see Assouline, 1996.) – From the start it is clear that Maigret is an unusual character for whom standard police routines are neither of interest nor of much value. He needs to go to the scene of the crime, get to know the people involved and to have long, seemingly rambling discussions with them. He maintains that there is no method to his investigations, but they are obviously characterized by his wish 'to enter the minds' of the people involved. As expected from the period and Simenon's professional background, racial stereotypes abound in the novels. 'Typical Jewish' traits are discussed in *La guinguette à deux sous*, while Maigret can almost magically discern the Jewish origin of the doctor in *Le fou de Bergerac*. Racial and anti-Semitic slurs are, however, not what make these novels special relative to other popular writing from the time. It is instead Maigret's uncanny ability to understand what exists behind any human facade. In many of the novels, the story builds upon some false or disguised identity, and it is Maigret's ability to 'see the truth' and get a lead character to confess to it that takes the reader to the resolution of the crime. Problematic identities are not unique to Simenon's detective stories, but, unlike most other crime writers, there is no use in the Maigret novels for blood group testing or fingerprint comparisons to ascertain identities – Maigret's superior qualities as an investigator of human nature are sufficient. Two examples: It is trivial for Maigret to discern that the lead female character in *La Nuit du Carrefour* is a prostitute from Hamburg though she has paraded for a long time as a society lady from Copenhagen. It is more difficult to understand that the main character in *Monsieur Gallet, décédé* once sold and changed his personal identity, but not beyond Maigret's powers. However, to grasp the functioning, and the attractiveness, of Maigret, one must take note of his ability to assess also the moral qualities of the individuals he encounters. This means that Maigret often knows who the villain is before any direct evidence exists whatsoever; this occurs for example in the story named *Maigret*, where the Commissaire's task is limited to tricking the villain into a self-incriminating confession. But Maigret's qualities stretch, in fact, even beyond the ability to recognize criminal minds. He discerns all kinds of deep human weaknesses hidden behind proper facades: Thus, some side characters in *Le fou de Bergerac* and *Le chien jaune* are understood by Maigret to be degenerated and perverted (and thereby not to be trusted). Similarly, Maigret can recognize good human qualities even where they are not expected:

I will not attempt any psychological analyses here, but I believe that it is possible from this characterization to understand why some German scientists – thinking that they had privileged access to the *truth* about other humans – came to develop personas that made them perform morally despicable acts.

The Kaiser Wilhelm Institute in Berlin

What happened to German race studies during the central years from 1925 to 1945 can be followed via the development of the National Institute for Anthropology in Berlin.[303] It was founded in 1927 during the Weimar Republic by a government run by Social Democrats and the Centre Party (close to the Catholic Church) and was given the full name of *Kaiser Wilhelm Institute für Anthropologie, Menschliche Erblehre und Eugenik* [the Kaiser Wilhelm Institute of Anthropology, Human Inheritance Theory and Eugenics]. It was *not* a Nazi project – the reverse would probably be more correct to claim. The political forces behind its creation had no interest in supporting anti-Semitic or Nazi racial theories, and they trusted that the person chosen to head the institute, Professor Eugen Fischer, would guarantee that such ideas were kept at bay. Fischer was at the time *the* foremost race anthropologist in Germany, highly academically acclaimed and with a personal background as a national conservative. The institute was given ample economic resources and Fischer was able to employ a substantial staff. Among them was a young medical doctor and aristocrat, Otmar von Verschuer, whom Fischer appointed as head of the Institute's section for human heredity.

---

among the 'simple' people who have run into misfortunes (*Le chien jaune*), for example, or in an old aristocratic family with a good-for-nothing son who at the critical moment turns out to act superbly (*L'affaire Saint-Fiacre*). The ability of Maigret to discern 'true' human qualities stretches to the extent that he sometimes – with tacit agreements from the author and the reader – takes his own juridical decisions and allows some criminals to go free. This is for example the case in *Monsieur Gallet, décédé*, where an insurance fraud is left unreported, due to its unimportance compared to the despicable way an unfortunate individual has been treated by life. Underlying these almost supernatural capacities of Maigret is the assumption that every individual carries an inner 'essence' of importance for his or her actions. It is normally hidden but becomes accessible to someone like Maigret via his seemingly unfocussed investigations. To summarize: criminal acts follow from inner nature; explaining them can only be done by someone who has access to both the empirical and the ideal spheres. It is in this that Maigret conforms to the image of a perfect race researcher.

303. My primary source for this description is chapter 2 in Weiss (2010).

The task of the Institute was to forge links between inheritance studies and race anthropology, and to spread the insights obtained to society at large. Well-motivated eugenic proposals were particularly desirable.[304] Eugen Fischer acted as the Institute's figurehead, but he was also an able administrator and a skilful political operator. The section devoted to human inheritance, run by von Verschuer, concentrated its research on similarities and differences between twins. This is significant from our point of view, since a characteristic of twin research is that it studies heredity *without any specified genes.* (It may be the best method available for its task, but it constantly runs a risk of misjudging the interactions between environment and inheritance.) In Germany at this time, the two major research groups devoted to twin research were the centres led by von Verschuer in Berlin and Ernst Rüdin in Munich.

The *Machtübernahme* in 1933 made life complicated for the Anthropological Institute. Fischer was not a member of the Nazi Party and did not fully support its racial policies; strong voices were therefore raised to have him sacked and replaced.[305] With his academic prominence and great international renown he was, however, an important asset to the Nazis when they wished to legitimize the importance of racial thinking.[306] A Faustian bargain was therefore reached between Fischer and the Nazis: Fischer toed the line and stopped voicing critical views, while the Nazis continued to give the Institute substantial economic support.[307] The effect was that the Institute of Anthropology became more and more Nazi-compatible.

Fischer retired in 1942, and the position as head of the Institute went to von Verschuer, who had continued his twin research during some years

304. I have found the discussion of German eugenic thoughts and politics in Dickinson (2004) very enlightening.

305. Fischer was anti-Jewish in many respects. He refused, however, to follow the Nazi policy to forbid all marriages between Jews and non-Jews and maintained that something good may come out of them. My guess is that he in this was influenced by plant-breeders like Erwin Bauer and Herman Nilsson-Ehle, who taught that crosses may be important for strain improvement. Weiss (2010), p. 87, discusses Fischer's standpoints relative to Jews. Fischer did enter the Nazi party, but not until 1940; Weiss (2010), p. 111.

306. The institute 'was too vital a research center to be easily overlooked as a site where Nazi racial policy could be scientifically legitimized. - - - With the exception of the Rüdin Institute in Munich …, there was no center for human heredity and eugenics in Germany that did as much to provide the intellectual underpinnings for the Nazi regime's racial policy…' Weiss (2010), p. 71. For the general importance of German genetics in international relations, see Weiss (2005).

307. I have taken the expression 'Faustian bargain' from Weiss (2010), p. 70.

away as professor in Frankfurt. The Institute had by now evolved into the Nazi medical bureaucracy's main intellectual powerhouse, important not just for research but also for racial teaching and various outreach functions.[308] When von Verschuer took up his position in Berlin, he brought with him his twin-research archives but also many well-established scientific contacts. One of them was with his earlier doctoral student, Josef Mengele. He was retained as a visiting scientist at the Berlin Institute when he became a physician at Auschwitz in May 1943. Von Verschuer and Mengele planned several joint research projects, one of which was aimed at sampling blood from 'the very diverse racial groups in this camp' for studies of specific proteins.[309]

The end was near, however. Less than two years later, in February 1945, von Verschuer reported to the central administration of the Kaiser Wilhelm Institutes that the material of the Anthropological Institute had been sent from Berlin to western Germany to avoid falling into the hands of the advancing Soviet army. All potentially incriminating documents had been destroyed. And the historical continuity of German race anthropology – linking Enlightenment ideas, idealist type-notions, revanchist sentiments, scientific self-aggrandizement and, ultimately, an all-too-close association between anthropology and biology based on ridiculous hopes for a better human future – had come to its close.

Nazism in action

Earlier in this chapter I stressed that Nazism was an ideology for action, not just some outrageous views expressed in violent terms. It is therefore also necessary to study the acts based on biological principles as performed by the Nazis during the years 1933–1945 when they were in full political power in Germany.[310] This in an unpleasant task, for which we may, however, obtain assistance from a valuable source.

308. Thus, Müller-Hill (1998) estimates that the Institute in 1942 wrote about fifty expert reports, 'determining whether the Jew concerned was to live or die.' For this, the Institute earned more than 2,000 Reichsmark. See p. 21.
309. Müller-Hill (1998), p. 20. Josef Mengele's history and criminal behaviour have been well described and need not be detailed here.
310. The histories of the atrocities caused or inspired by Nazism in various occupied countries are too extensive to be treated here. They are also often more informative about the different countries' internal histories than about Nazism as such.

A German chronicle

In 1998, the German molecular geneticist Benno Müller-Hill published the book *Murderous Science.* It cannot be too highly praised.[311] The book is based on well-researched archival information plus interviews with surviving race scientists and their relatives – all with the aim of detailing the book's subtitle: *Elimination by Scientific Selection of Jews, Gypsies, and Others in Germany, 1933–1945*. I cannot here do better than summarize the book's introductory 'German Chronicle'; it must be remembered how incomplete any such list will be; after the war, however, it would provide part of the basis for the Nuremberg and other war trials against Nazi-led crimes against humanity.

> April 1933. A law is introduced to dismiss all Jewish and half-Jewish civil servants and state employees.
>
> July 1933. The sterilization of various classes of the mentally ill is proclaimed (as discussed above). The extension to their relatives comes later.
>
> September 1935. Marriages and sexual relations between 'Jews and citizens of German or related blood' are forbidden at a Party rally in Nuremberg.[312]
>
> Spring 1937. The sterilization of German coloured children is commenced, illegally, with the approval of, among others, the anthropologist Eugen Fischer.
>
> September 1939. Hitler decides (as discussed above) 'that patients who are judged incurable … can be granted mercy killing'.[313]
>
> January 1940. The chief of the SS and Police in Danzig and West Prussia reports that he has used storm troopers to eliminate 6,400 incurable patients from mental hospitals in Poland.

311. The book is the English version of an earlier book published in German.

312. For the unresolved administrative problems over the interpretation of 'Jews' in these laws, see Essner (2013).

313. A quote to make the last statements more concrete: 'It is estimated that between 220 000 and 269 500 individuals with schizophrenia were sterilized or killed. This total represents between 73% and 100% of all individuals with schizophrenia living in Germany between 1939 and 1945.' Torrey & Yolken (2010), p. 26.

March 1941. It is reported that the problem with sterilizing large numbers of individuals by means of X-rays has, at least in principle, been solved.

June 1941. With the attack on the Soviet Union, German *Einsatzgruppen* begin their mass murder of Jews, Gypsies and mental patients in Eastern Europe.

September 1941. The killing of Soviet prisoners of war with Zyklon B gas is tried out in Auschwitz.

December 1941. Himmler orders prisoners in concentration camps that are ill, 'psychopaths' or unfit for work to be 'combed out'. They are later killed by gas.

January 1942. The details of the final solution to the Jewish question are discussed at the Wannsee Conference (see also Chapter 12 below).

December 1942. Himmler issues an order that persons of mixed Gypsy blood should be sent to Auschwitz.

May 1943. Mengele becomes physician at Auschwitz and starts by sending Gypsies suffering from typhoid to the gas chambers.

Summer and autumn 1944. Mengele and his assistant transport large quantities of material from Auschwitz to von Verschuer in the Institute of Anthropology in Berlin. Included are eyes from Gypsies, organs from killed children, the skeletons of two Jews and blood sera from twins infected with typhoid bacteria.

May 1945. At the end of the war in Europe, five to six million European Jews have been killed. The numbers of dead European Gypsies, 'psychopaths', 'asocial individuals' and homosexuals are unknown.[314]

Characteristic of these criminal acts was a constitutive 'pathologization of difference'.[315] This mode of thinking, evident already in Hitler's early, purity-obsessed writings, was later taken to its extreme. All human differences were seen as pathological abnormalities; they were dangerous since they were contagious and/or heritably transmittable and could only be controlled by extermination. Exactly who should be regarded as

314. Müller-Hill (1998), pp. 10–22.
315. I have taken this expression from Dickinson (2004), p. 4.

different was to be determined by professors, physicians and race experts, always present and always willing to give their legitimizing support. Still, it must be noted that while all the actions listed above were based on race-biological arguments, none of them seems to have been justified, or guided, by any precise genetic thinking.[316]

SS – a parallel power structure

Almost everything that needs to be said about Nazism's relationship to inheritance and human variation is provided by the above list; I will only complement it with some acts performed by the SS [*Schutzstaffeln*], the Nazi Party's paramilitary elite organization. Under its leader Heinrich Himmler, it functioned in many ways as a parallel state within the state.

Himmler had a background in agronomy and was thereby perhaps the only Nazi leader with a certain knowledge of biology. He was an efficient administrator and became one of Hitler's most trusted collaborators; to him was given the task of organizing the Nazi concentration camps and the systematic annihilation of Jews and other undesirables. He also took on the role of advancing the Aryan race by organizing a system for maternal and child care called *Lebensborn* [The Fount of Life].[317] It had its origin in the racial principles on which membership in the SS was based.[318] All new recruits, at least in the beginning, were screened to check that they were true Aryans; when these men engendered children (with similarly suitable women), it was – according to Himmler – a duty for the Reich to care for the welfare of the mothers and the children (in particular since the men often disappeared in the war). For this purpose, various *Lebensborn* homes were created in Germany and abroad.[319] Care was also given to those 'Aryan-looking' children that were kidnapped from occupied countries like Poland and the Baltic states.

In Himmler's ideas for this organization, one can find traces of his schooling as an agronomist – he saw the advancement of the Aryan race as a kind of animal breeding matter. In this, he acted as an old-fashioned

316. A possible exception to this generalization is given by some of Mengele's experiments, which under a broad definition could be said to deal with genetic questions – for example his experiments with twins – though without ever being explicitly related to *genes*.

317. On *Lebensborn*, see for example Hillel & Henry (1976).

318. As late as December 1943, a conflict arose inside the SS concerning the admission of two men who had a seventeenth century Jewish ancestor. This situation was due to the uncertainty in the Nuremberg laws concerning the definition of Jews. Essner (2013), p. 241.

319. For the situation in France with respect to *Lebensborn*, see Thiolay (2012).

cattle breeder to whom all knowledge about inheritance was concentrated in questions of race and racial purity, and for whom genes and genetic principles did not exist.

Plant breeding was the area where Nazism and applied genetics came closest to each other. Here too, the SS was involved, this time via a second organization called *Ahnenerbe* [the Ancestral Heritage]. After the German attack on Soviet Union, vast landmasses to the East became open for exploitation, and an *Ahnenerbe* expedition to Ukraine and Russia was organized to collect valuable genetic material for future Nazi-led plant breeding. This meant a virtual plunder of Soviet agricultural field-stations of material planted by Vavilov and his colleagues, material collected during their many expeditions to different parts of the world. Due to the Soviet counter-attack, the *Ahnenerbe* expedition was soon forced to withdraw and would have no special effect on biology in Nazi Germany/Austria.[320] This futile effort should, however, be placed in its appropriate context. It was not just a mercenary foray to reap some valuable genetic bounty but an integral part of a policy to starve local populations to the east of Germany to death and thereby open up their land for Aryan settlement.

All in all, these actions indicate that the mature Nazi ideology, despite its being based on biological and hereditary thinking, did not take any explicit interest in genetic concepts and ideas. It was, nevertheless, perfectly prepared to use genetics as an applied science whenever the opportunity arose.

An indirect dependence on genes

The conclusion therefore stands, also after this overview of what the Nazis not just said but actually did: genetics may have existed in the background during the early expansion of Nazism in German society, but the ideology in its mature phase had almost no obvious association with standard scientific genetics. This did not imply that the Nazis cut support to research in genetics when they came to power, because it did not.[321] But Nazism *as an ideology* had no use for genes or for the kind of insights

320. For more on this expedition, see Deichmann (1996), pp. 258–264, and Hossfeld & Thornström (2002).

321. On the funding of biological research under the Nazi regime, see Deichmann (1996), pp. 319, 324.

that only the theory of genetics could provide (particularly concerning the effect of recombination). Its need for a scientific backing to its obsession with biology was instead met by an alternative – race anthropology, a perspective devoid of almost any explicit references to genes.

To this conclusion I wish to add two comments. They do not invalidate it but will add to what has been said by showing how very special the relationship between power, race and genes turned out in Nazi Germany.

My first comment concerns the legitimacy that Nazism obtained from genetics – indirectly, but unquestionably. It came from the strength that all reductionist biological thinking derives from the sheer existence of genes and genetics. Just *knowing* that there is a well-founded modern science of heredity can add strength to arguments, even to those about which genetics has nothing relevant to say.[322]

A paradigmatic example of this effect is the large, two-volume book *Grundriss der menschlichen Erblichkeitslehre und Rassenhygiene* [An Introduction to Human Heredity and Eugenics] published in Germany in 1921.[323] The eugenicist Fritz Lenz and the anthropologist Eugen Fischer wrote most of the book, but it began with a section on inheritance by the prominent geneticist and plant breeder Erwin Baur. The work was a great commercial success and became a classic; Hitler is supposed to have read it while in prison working on *Mein Kampf*.[324] It was considered 'the standard textbook on racial hygiene in the Weimar Republic', and appeared in many editions of which the last was printed in 1940 (by which time Baur was dead – he died of a heart attack in late 1933 at the age of 58).[325]

I myself have carefully read only the part of interest for our present purpose – the section on genetics written by Baur. To my surprise, I found it really good. Its 74 pages are clear, instructive and interesting. They are infused with a scientific optimism, but the author is careful with his conclusions and constantly recommends criticism against loose theorizing about inheritance. He mentions the names of Mendel, Johannsen,

322. Teicher (2020) describes the common use of Mendelian-inspired examples up to the end of the Nazi reign.

323. Baur, Fischer & Lenz (1921); the book came in many subsequent editions.

324. Müller-Hill (1998), p. 8.

325. For more details on the book and its reception in German medical circles, see Fangerau & Müller (2002). The quote comes from their article's summary in English. Baur's contribution to the last edition seems, from a rough comparison, to be very similar to his contribution to the first.

Nilsson-Ehle and Morgan, writes very little about humans, and only one racist slur can be found in the text (directed against 'negroes' in the USA).[326] Instead, the snapdragon, *Antirrhinum*, Baur's favourite research organism, is used to illustrate important genetic principles such as segregation, recombination and mutation. Thus: An excellent introduction for its time to classic non-molecular genetics.

It is known that Baur was a strong nationalist. The historian Jonathan Harwood classifies him as a 'right-wing radical' in his study of German genetics.[327] Another historian, Benno Müller-Hill, mentions that Baur in May 1933 (together with Eugen Fischer and Fritz Haber) expressed confidence in the President of the Kaiser Wilhelm research organization who had then just placed the institution at the disposal of the new Nazi Government.[328] It seems correct to regard Baur as 'Nazi-friendly' but he was not a member of the Nazi Party.

Given this knowledge about Baur's political views, and a context where Lenz's eugenic contributions were summarized by a contemporary as 'No environment, only inheritance, no individuals, only race', the objective and critical tone used by Baur in his introduction to genetics is almost shocking.[329]

And this is exactly the point I wish to make. From early on, the Baur-Fischer-Lenz volume laid the intellectual basis for what would happen later in Germany. Probably *every one* of the future perpetrators of the crimes against humanity enumerated in the terrible list above had read the book that started with Baur's excellent description of genetics. Maybe they had just glanced at his contribution since it seemed too technical to them and the parts of the book dealing with human races and eugenics appeared more interesting. But they knew that *the text was there*. It did not say anything specific about the inheritance of the traits that the psychiatric eugenicists or the race anthropologists were interested in. But by its sheer existence Baur's contribution certified that the rest of the book was based on a sound, scientific foundation. Genetics may not have

326. Noticeable, however, is Baur's conviction that humankind is suffering a continuous biological deterioration.

327. He writes about Baur: 'Thus eugenic policy and agrarian policy were closely linked in Baur's technocratic vision of the integration of science in a planned economy'; Harwood (1993), p. 238.

328. Müller-Hill (1998), p. 26.

329. The quote comes from a review by a doctor J. Marcuse and reads in the original: '*Nicht Umwelt, sondern Erbmasse, nicht Individuum, sondern Rasse*'; taken from Fangerau & Müller (2002), p. 1044.

appeared in any prominent role on the Nazi ideological scene, still, it was there, as a behind-the-scenes machinery that made the show look convincing – at least during the initial phase of the ideology before it snowballed into complete madness.[330]

Thus, Nazism gained legitimacy from the very existence of genetics. Baur's text in the joint work with Lenz and Fischer was of decisive importance, even though genetics, as such, added next to nothing to the ideology's key ideas. This legitimacy was there, relayed via psychiatric eugenics or race anthropology, and hardly ever by direct transmission.[331]

My second comment derives from a simple observation that I wish to share. Remember that the word 'gene' originally was coined in German as 'das Gen' – thus, it was not a word or a concept foreign to the language. I wanted to know about its status during the Nazi era and went to the Lund University Library to look at a copy of *Meyers Lexikon*, a famous large encyclopaedia published in Leipzig. Its eighth edition was launched in 1936, though only nine out of twelve planned text-volumes were printed before the Allied bombings prevented further publishing. I found that the word '*Gen*' was given eight lines in a column, while '*Genetik*' [genetics] was given two lines. In both cases, most of the information concerned what other entries to consult. I then looked up the entry race, '*Rasse*', and found that it went on for more than fifty columns of seventy lines each! About twenty of these columns were devoted to 'Race science' and thirty to 'Race politics'.[332] The details are irrelevant here, since what the encyclopaedia shows with all necessary clarity is that the race concept, by 1942, had subsumed absolutely everything to be said in Germany about inheritance, human differences and all related topics.

The encyclopaedia was heavily censored by the Nazis – one could say that, in reality, it was written by them. It gives a clear illustration of Nazism's lack of interest in genetics as a rapidly developing natural science. Once more, we see that even though scientific genetics continued to function under Nazism, and in some indirect ways perhaps was

330. The various illustrations and schemata often used to illustrate the Nuremberg Laws were clearly inspired by genetic pedigrees, but they missed out the chance effects caused by the segregation and recombination of real genes.

331. I wish here to remind the reader of how close the links between psychiatry, eugenics and genetics were at the time also outside Germany and the direct influence of Nazism; for a fascinating description of how the German tradition came to influence the intellectual tradition in the US after World War II, see Cottebrune (2009).

332. *Meyers Lexikon* (1936–1942).

important to the ideology, the subject given intellectual predominance was instead always race anthropology.

Responses to Nazism

Ideologies always want the final word on how they are characterized – but this is never possible. All ideologies are affected by the reactions of their political supporters, competitors and critics. We therefore need to consider how the geneticists responded to the Nazi usage of ideas on inheritance and race.

Loyalty, exit, voice

In a classic analysis of how consumers react to a product or service that they find lacking in quality, the German-American political economist Albert Hirschman distinguishes three kinds of responses.[333] The two directly negative ones are (*i*) to complain to the producer over the loss in quality, and (*ii*) to stop buying the product (or stop using the service). The third, more ambivalent response is (*iii*) to continue supporting the product/service *despite* its shortcomings, since this is the most reasonable thing to do in the given circumstance. Hirschman labelled these three modes of reaction *voice*, *exit* and *loyalty*, and found that this classification could also be used to describe how people behave when confronted with, for example, political dilemmas. Here, I use the terms to organize the reactions to the Nazi ideology from individuals associated with scientific genetics.

Loyalty: Yes, there were geneticists who were, or at least appeared to be, loyal to Nazism.[334] Erwin Baur, known from his contribution to the Baur-Fischer-Lentz volume, is the most obvious case. He was an excellent geneticist and a fervent eugenicist who helped give scientific support to Nazi racial thinking, also a convinced nationalist, who in his attempts to build a strong base for German agricultural science showed himself willing to accommodate to Nazi politics. He died, however, in December 1933, before he was forced to show his true response to the Nazis' way of wielding absolute power. Had he lived he might have become a prominent

333. Hirschman (1970).
334. '[M]ore than fifty percent of biologists belonged to the Nazi Party (NSDAP), over twenty percent to the Sturm-Abteilung (SA, Storm troops), and five percent to the SS'; Paul & Falk (1999), p. 258.

figurehead for the Nazi system – or an obstinate critic of the system. We will never know. Other examples of highly respected genetic researchers who were loyal to the Nazis were the already presented Ernst Rüdin, the head of the psychiatric research institute in Munich, and Otmar von Verschuer, the last director of the anthropological institute in Berlin.

Still, the main support from the educated elite came from individuals who were neither particularly famous nor scientifically important. Here is a characterization from 1938 of the educated strata that sided with Hitler, valid for most of Europe and not just Germany:

> They shudder when they encounter modern art, sexual education, Bauhaus architecture, psychoanalysis, Jews, big banks, big enterprises, cooperative movements and labour unions. They belong to or have their roots in the badly drained marches where the water has been stagnant since 1914. They are the most vulnerable victims of Goebbel's propaganda, they see in Hitler a saviour against all that is new and unwanted. They are numerous within the state bureaucracy and the higher education system, among doctors, shopkeepers, engineers, artisans and the military.[335]

These people were the spontaneous conservatives who, in the 1920s and '30s, had left their 'natural' more passive ideological views and chosen to join Hitler's activist forces. After the war, many would downplay their loyalty to Nazism and present their allegiance as only having been in support of the German cultural tradition and not of Nazism; as having been a reaction against Soviet Communism; as having been a harmless opinion since they were ignorant of the Nazis extermination campaigns and had personally helped some individual Jews… And even when the loyalty appeared sincere, it may not have been oriented so much towards Nazism as being a necessity for supporting oneself, one's family, one's reputation, one's research institute… in difficult times. Showing passive support could have been a way to avoid problems – the time was not one for resistance but for trying to survive.[336] Or as someone who at the time had been a young researcher at the Kaiser Wilhelm Institute of Biology

335. The quote comes from a short-lived Swedish radical journal called *Nordeuropa*. The well-known geneticist and plant-breeder Herman Nilsson-Ehle was specifically named as an example of the outlined personality type. See Bokholm (2001), pp. 90–91, from where I have taken this information and quote.

336. Similar situations existed in all cultural spheres in Germany/Austria at the time – also, for example, among composers of classical music. Here, enthusiasm, opportunism, disgust, economic need, depression, manly pride and many other feelings influenced the behaviour of, say, Carl Orff, Paul Hindemith, Richard Strauss and Karl Amadeus Hartmann; see Kater (2000).

said in a later interview with Müller-Hill: 'We were not heroes of resistance, but we muddled through.'[337]

For my present purpose, I will, however, disregard questions about individual responsibility and instead look at the other side of the coin: what did the Nazis gain or fear from the highly educated?[338] It is clear that loyalty from these strata helped Nazism, first to gain social acceptance and then to function as a state ideology. At no stage did academics constitute a major problem for Hitler. From the day he reached power, he knew – quite rightly – that he could never trust the German army, particularly not in times of defeat. But he also knew that no such threat would ever come from the universities or the Kaiser Wilhelm Institutes. The German academic intellectuals were fully controlled, and they allowed the state of affairs to persist.

Exit: In the present context Hirschman's term exit means going into exile. This was the option that many geneticists chose. Some left Germany (or Austria) early in the development of Nazism. They saw what was coming and knew of no way to prevent the catastrophe. Others left belatedly, due more to being forced abroad than from taking an active decision themselves.

For some, exile led to scientific success. Charlotte Auerbach came to Edinburgh in 1933, where she did ground-breaking research on how some chemicals and not just radiation can induce mutations, which made her a prominent star in post-war genetics.[339] Curt Stern left Berlin and continued his *Drosophila* work in the USA. When he could not find a good textbook when asked to teach human genetics, he wrote *Principles of Human Genetics*, which became a classic that defined the field for decades.[340] And the physicist Max Delbrück went further and further into biology, and became one of the pioneers of molecular genetics.[341]

Still, many of those who went into exile had a less happy future. Felix Bernstein, the mathematician who proposed the standard genetic ABO-interpretation, never reached firm ground in the US (as seen from letters to his friend Albert Einstein) and returned to Europe when the war

337. Müller-Hill (1998), p. 172.
338. What responsibility to ascribe to some of the leading geneticists is thoughtfully discussed by Paul & Falk (1999).
339. Kilbey (1995).
340. Stern (1949, 1960); see Neel (1983).
341. Fischer (2007).

was over.[342] Even more unfortunate was the geneticist Heinrich Poll who had a strange – but also strangely typical – life and fate.[343] Born into a Jewish family converted to Christianity, Poll went to medical school and served as an army doctor during the First World War. After his return to civil life, he studied topics typical for an anthropologically interested medical researcher at the time: twins, fingerprints, sex determination and development. He became professor of anatomy at Hamburg University in 1924 and was involved in the Rockefeller Foundation's efforts to support genetics in war-damaged Germany. He had good contacts with colleagues in Sweden and asked them insistently for better descriptions of the genetics behind race formation in nature.[344] When 1933 came, he was expelled from the University by the anti-Semitic laws and moved to Berlin where his non-Jewish wife Clara practised as a gynaecologist. In spring 1939 he understood that he had to leave Germany and departed for Sweden with the help of invitations from colleagues there. He arrived in Lund on 3 June but died of a heart attack nine days later during a discussion of how he should continue his research in the local genetics department. His wife then travelled to Lund twice. The first time to arrange for her husband's funeral in the local cemetery; the second time to visit his grave on his birthday, 5 August. This she did in the afternoon, and later in the evening she committed suicide in the hotel room where she was staying. On their grave – which I regularly pass on my way to the Biology Department – they left a poem describing the freedom and unity loving souls can reach after death. This was the only hope that remained for them.

Voice: Care must be taken when Hirschman's option 'voice' – implying a verbal protest against what one feels should to be better – is used in this historical context. For in a situation where there 'was very little resistance in Germany, since most of the time it led straight to a concentration camp' – how could one raise one's voice?[345] Well, the plant geneticist

342. Schappacher (2005). See also the MacTutor History of Mathematics archive: https://mathshistory.st-andrews.ac.uk/.

343. Braund & Sutton (2007); Bengtsson (2006), pp. 85–91.

344. Letter from Heinrich Poll to Göte Turesson dated 14 March 1936. I thank Anna Tunlid for giving me copies of their correspondence.

345. The quote comes from the same student as cited above in note 337; see Müller-Hill (1998), p. 172. Victor Klemperer (1947, 2018) describes in his book *The Language of the Third Reich* the effect of Nazism on the German language as a communicative system – written, spoken and sometimes reduced to just non-verbal acts. With its sensitivity to the complex ways in which language and politics interact, Klemperer's book has been an important inspiration for the present work.

Elisabeth Schiemann, who started her career as one of Erwin Baur's closest co-workers in Berlin, did. A frail voice, but brave:

> As a little illustration of her attitude I like to mention her performance in a small symposium that had been organized by the student group of the Botanical Museum – the section of the NS Students' League which existed in each department or school – and was to deal with the topic of hereditary and racial aspects of culture and science. The main speaker had been imported from the central Nazi party organization of Berlin … He started his speech with the declaration that there were three human races; good races, poor races, and the Jews. The following speakers either sought to provide support for this classification by citing various examples, or avoided the 'Jewish question' altogether. Only Elisabeth Schiemann got up and stated, with a clear although slightly breaking voice – as was her wont in times of great stress or passion – that we should acknowledge the great contributions of different people to German culture and science – French, Italian, 'and yes, let us say it clearly, the Jews.' She went on to name names, too, including scientists and writers who at the time – it was 1937 or 1938 – were harassed by the Nazi authorities or had already been forced to leave the country.[346]

Schiemann, who got her strength from a deeply conservative family background, was sacked in 1940 by the university in Berlin from her position as extraordinary professor of genetics.[347]

After the war had started in 1939, the opportunities for any kind of verbal protest against Nazi ideas disappeared almost completely. Significantly, the only noticeable instances of opposing 'voices' heard during the final years came from the very few partially independent social organizations that still existed, namely the organized Christian churches. Thus, the Catholic bishop von Galen protested publicly against the secret euthanasia programme: 'Woe unto the German people when not only can innocents be killed, but their slayers remain unpunished!' His sermon was spread all over Germany and led to a halt of the programme (even though the regime executed three priests who distributed the text of Galen's sermon to soldiers).[348]

Similarly, the Prussian branch of the independent Protestant Church in Germany, called the Confession Church, 'was the only Christian body in the twelve-year history of the Third Reich to protest publicly against the unspeakable outrages inflicted upon the Jews.'[349] It comes as no surprise

346. From Anton Lang's personal recollections of Elisabeth Schiemann; see Lang (1987).
347. She managed, however, to survive the war, partly due to help from colleagues at the Kaiser Wilhelm Institute for Biology. For more on Schiemann, see Lang (1987); Scheich (2002); Stamhuis & Vogt (2017).
348. Grunberger (1971), p. 568.
349. Grunberger (1971), p. 570.

to learn that Elisabeth Schiemann belonged to this congregation until the end of her life in Berlin in 1972.[350]

International protests – confused, too little, too late

With critical speech being impossible in Germany and the occupied countries, what was said outside the boundaries of the Nazi empire?

We should first get the perspective right. The international struggle against Nazism was primarily a *military* one. The consensus was that an unconditional surrender must be obtained. Ideological differences and moral outrage against inhuman policies could be used for propaganda purposes, but what really mattered was military victory – nothing else. This is easily forgotten today, when what dominates our thinking about the period is not always the military struggles but the incomprehensible atrocities performed by the Nazi regime.

The large majority of the world's geneticists unhesitatingly supported this military response to the Nazi threat.[351] As a group they were young men and women who thought of themselves as modern and international. Many had benefitted in one way or another from American grants or opportunities. English was rapidly superseding German as the primary scientific language, and the scientific culture admiring German traditions and *Bildung* had worn thin. The very few international geneticists who were 'German-friendly' were old and on their way out, like the two Swedes, Herman Nilsson-Ehle and Herman Lundborg, met earlier in this book. By 1939, both had left their academic positions, and their successors demonstrated clear anti-Nazi sentiments.

This next to unanimous opposition by geneticists to Nazism, however, never manifested itself in a strong, organized response against Nazi ideas on inheritance and race. Looking back at the period commencing in 1933, one cannot but be surprised at the dearth of such reactions from the international genetics' community.[352]

---

350. Lang (1987).
351. For two such examples, see the preceding chapter where short descriptions of François Jacob's and Jacques Monod's war experiences are given.
352. The German-American anthropologist Franz Boas was in late 1938 instrumental in organizing a manifesto denouncing 'racialism' and Nazi criticism of Jewish scientists. The manifest was signed by more than one thousand scientists. The text rejected the 'racial theories which … have been demolished time and again' but it did not particularly focus on genetic arguments. Neither were geneticists prominent among the signatories; see Barkan (1988).

The primary reason for this lack of reaction – which would have constituted an international 'voice' to use Hirschman's expression – is due, as far as I understand it, to the way Nazism treated genetics. Nazism downplayed genetics, as I have shown, at least in its central ideological kernel. In this respect, it differed from communism. While Lysenko's anti-genetics preaching met strong international reactions, Nazism's cold-shouldering of genes and genetics was too vague a target for the international genetics community to mobilize against.

It also seems as if the community was infused by internationalist feelings that made it prepared to tolerate wide political and ideological differences – as long as the genetics involved was sufficiently interesting and good.[353] This policy of 'genetics before politics' can be seen in a report written by the young Danish medical geneticist Tage Kemp to the Rockefeller Foundation after he had made a sponsored research trip round Europe in 1934. He here describes Otmar von Verschuer as a 'keen National Socialist', but also as someone who was 'completely honest … [;] one can rely upon his scientific results as being objective and real'.[354] This internationalist feeling was also present in the strong attempts by the rapidly convened 1939 World Congress of Genetics in Edinburgh to assemble geneticists from *all* counties.[355] At the start of the meeting on August 23, many countries, including Germany, were indeed represented by delegates.[356] But most of them had to leave the very next day because of the rapidly deteriorating international situation.[357]

A final example of how leading geneticists tried to keep the community together even in turbulent times, was the 'Geneticists' Manifesto' published in the journal *Nature* on 16 September 1939.[358] The organizers of the Edinburgh congress had used the question 'How can the world's population be improved most effectively genetically?' to summarize propositions agreeable to all progressive geneticists with eugenic interests. Muller's views formed a starting point for the text, yet efforts were made

353. After the First World War, German and Austrian scientists were excluded from the international scientific community for a number of years; a policy that the early geneticists with their internationalist leanings generally objected to.
354. Quoted in Koch (2014), p. 169.
355. See the conference report by Punnett (1941).
356. Vavilov and colleagues from USSR were, however, not given permission to attend – see the preceding chapter.
357. Only a reduced group of scientists remained during the planned duration of the Congress, and it ended concomitantly with peace in Europe; see Punnett (1941).
358. Crew and co-authors (1939).

to express only ideas that could be supported by colleagues from a broad political spectrum.[359] What is most striking in the text, however, is not what it says but what it does not say. It contained no explicit criticism of anti-Semitism or other types of racism (though a future 'removal of race prejudices' is mentioned as something positive). If this represented the international genetics' voice against Nazism, it was very subdued indeed.

Rubbish!

The most articulated genetic voice against how Nazism linked inheritance ideas to race postulates came from a least expected place – a fact that made it extra clearly audible.

In 1935, the Social Democratic government appointed the mathematically interested physician Gunnar Dahlberg to succeed Herman Lundborg as head of the Swedish Race Biology Institute.[360] A few years later and after having attended the genetics congress in Edinburgh in 1939 and experienced the start of the war, Dahlberg sat down to write a book for the general public. It would present the basic facts of genetics and refute common fallacies about race. The book was published in Swedish, but unexpected war conditions were to affect its fate.[361] Lancelot Hogben, a well-known British social biologist, happened to be in Oslo when Germany attacked Norway in April 1940. He managed to flee to Sweden where he received help from Dahlberg.[362] While waiting for an opportunity to return to England, he translated Dahlberg's book. It was given a title under which it would become internationally known: *Race, Reason and Rubbish*, with the subtitle *An Examination of the Biological Credentials of the Nazi Creed*. The book was published in 1942 by Allen & Unwin in Britain and Columbia University Press in the USA.[363]

The book's first part, introducing the basics of genetics, is – actually – very similar to the previously discussed contribution by Baur to the German volume on *Rassenhygiene*: the whole ballet of genes, segregation,

359. To the historian Diane Paul (1984), the Manifest was a statement from those geneticists that saw 'themselves as confronted by enemies on all sides; on the one, "Extreme environmentalists" such as Watsonian behavioralists and many "Lamarckians", and on the other, proponents of conventional, that is, race- and class-biased eugenics.'; pp. 583–584.
360. This appointment is reported on in my chapter on social democracy. The Race Biology Institute – 'Lundborg's institute' – was so famous in Germany that this appointment even led to critical comments in the Nazi-dominated press there. For more on Dahlberg, see Dunn (1956) and Böök (1956–1957).
361. Dahlberg (1940).
362. For more on Hogben, see e.g. Werskey (1978).
363. Dahlberg (1942).

chromosomes, linkage and mutations is introduced, explained and put into context with examples ranging from Morgan's *Drosophila* to Baur's snapdragons.

What Dahlberg then does is best described by a contemporary reaction. It is informative for our purpose, since we are not primarily interested in what particular geneticists *said* at the time, but what the general public *heard* them say. And this is what Dahlberg's voice was heard saying, according to the reviewer in the American *Journal of Nervous and Mental Disease:*

> At times one finds an unscientific book with a high-sounding scientific title. In this instance the reverse is true and a thoroughly scientific book has a very plain and everyday title. The author presents with fair elaboration the known data on heredity which are a little too difficult for any but the scientifically trained to grasp. He then blasts away most effectively at the towers of superstition, prejudice and 'rubbish' that have been erroneously erected upon the known data.[364]

And the reviewer summarizes Dahlberg's main points:

> It seems that there is not any evidence that any race is superior … There is no evidence in the field of heredity that there is such a thing as a Nordic race, or that Jews are inordinately intelligent, or that the Negro is stupid or that the Japanese are mean.[365]

So, here it finally is: an international, reliable and trustworthy, genetic voice raised against Nazi ideas on inheritance, race and eugenics. True – Haldane, Muller and many other geneticists had attacked Nazism before, but then always in ways that could be seen as partly motivated by their ideological standpoints. In their criticism there was also, as seen in the 'Geneticists' Manifesto', a certain hesitancy over what importance to give to eugenics. None of these problems exists in *Race, Reason and Rubbish*. Dahlberg – with his authority as head of an internationally well-known Institute for Race Biology – not only points out that commonly quoted racial characteristics are far from being scientifically certified and are rarely more than loose prejudices. He is also scathing about what advantages to expect from eugenic interventions; he summarizes his critique with an ironic chip: 'Since we cannot stamp out rare defects, we cannot stamp out advantageous characters which are rare … For instance, we cannot get rid of intelligence.'[366]

---

364. A. N. F. (1945).
365. A. N. F. (1945).
366. Dahlberg (1942), p. 162.

The book's last chapter then directly addresses the most sensitive point – the anti-Semitism preached by Nazism. After his earlier description of what human races are and are not, it is easy for Dahlberg to show that what is generally claimed about Jews is just un-justified prejudice – as summarized by the chapter's final sentence: 'Arguments brought forward from anti-Semitic sources are without scientific justification.'[367]

I find it interesting to note that Dahlberg's criticism of Nazism, race biology and loose eugenic thinking does not rely on humanistic compassion or liberal values. He may have been a social democrat, but the ideological persuasion that permeates this book is the conviction that 'we must strive for truth alone in scientific investigations. Any attempt to control science and suppress its results will be luckless in the long run.'[368] In this plea for an ideology-free science, based on facts alone, Dahlberg expressed what many scientists in the 1940s must have felt after more than a decade of hard ideological confrontations. Every real science, like genetics, must at times be defended from ideologies that try to scavenge its ideas. And with *Race, Reason and Rubbish* Dahlberg produced a pedagogical example of the response called for by the racist inanities preached by the Nazi ideology.[369]

Still, this reaction – this 'voice' – from international genetics came late, very late. There is something symbolic in that the enthusiastic book review referred to above was published in April 1945.[370] Before the end of that month, Hitler was dead and Nazism, as such, extinct.

A new world was then being born. A world that must be characterized – in particular with respect to the role of genetics in it – before an analysis can be made of the last of our five major ideologies: liberalism.

367. Dahlberg (1942), p. 232.
368. Dahlberg (1942), p. 240.
369. Dahlberg suffered a cerebral stroke in 1945 and disappeared from professional prominence; otherwise, his influence on the development of human and medical genetics in the post-war period would undoubtedly have been greater. His intellectual legacy is partly seen in the anti-racist writings of his friend L. C. Dunn in the US (see e.g. Dunn & Dobzhansky, 1946).
370. For another positive review of the book, this time in *Nature*, see Anonymous (1942).

9. A new world

The French philosopher and intellectual Simone de Beauvoir has described the elation she felt when, in August 1944, the German Army in Paris surrendered and the city was liberated after years of occupation. She covered the banks of the Seine on foot; dodged from sniper fire; tried to find some potatoes to boil; talked to friends making newspapers that suddenly were not clandestine anymore. She *chose* to be happy, because she longed for this experience even whilst knowing that there was little reason to feel relieved.[371] The war was not over, and the coming months were going to be bad. But she wanted to live up to the new situation: 'My happiness would reflect the magnificent adventure of a world creating itself afresh.'[372]

This new world, however, suffered terrible birth pangs. In January 1945, the first reports came from the Nazi extermination camps after Soviet troops had entered Auschwitz. In August that same year, US nuclear bombs – produced by an enormous scientific effort – erased two Japanese cities: Hiroshima and Nagasaki. 'A world creating itself afresh' was perhaps a new world but also an intellectually and morally more challenging one than anyone could have foreseen.

In this new world, people would look upon themselves and others through changed mental glasses; standard meaning-systems had ceased to work. Human social conditions were re-evaluated, and earlier convictions came up for review. The outcome was often a hardening of ideological convictions. In addition, the arguments for the ideologies, and the way they presented themselves, were transformed.

This change in attitude applied particularly strongly to the relationship between politics and biology. After the defeat of Nazism, it was realized that all thinking about human differences had to be reformulated. Any simple argument expressed in the language of race biology – something

371. One can say that by describing her feelings like this, she wanted to project herself as a true existentialist. On this dimension of her writings, see Bakewell (2016).

372. Beauvoir (1960), p. 600.

that had been normal in pre-war parlance – from now on risked being vehemently rejected as tainted by Nazism.

Still, there was no general mistrust of science, at least not of biology. As a matter of fact, several natural sciences – and genetics among them – experienced strong developments in the post-war period due to economic support from military and nuclear interests. Abundant funding for radiation biology, for example, came to benefit many research activities related to genetics.[373]

This present chapter aims at describing the growth in knowledge about inheritance, genes and genetics that occurred after the Second World War. It led to a situation where genetics came to mean something quite different from what it did before the war. My aim is not to write another history of modern genetics; instead, I wish to sketch how the advances in understanding became incorporated into modern thoughts about human social relationships, thereby also affecting ideological thinking. Several different topics must be covered, since some of the crucial developments occurred in unexpected places, as is often the case with such ideological 'meaning-creation'.

Rethinking biological determinism

In late 1947, while working on an essay devoted to the 'woman question', Simone de Beauvoir stumbled upon a treatise that made her plan more ambitious. As she wrote to a friend in Chicago, '… I am reading the big book about Negroes, *American Dilemma*, and I am enthusiastic about it. [Its author, the economist Gunnar Myrdal] is really clever; he knows and understands much. He speaks not only about the Negro problem but about many other American problems, and I read it with passion.' And she concludes, 'I should like to write a book as important as this big one' – a feat she actually managed to carry off.[374]

373. For an instance of this concerning the analysis of protein synthesis, see Rheinberger (1997), pp. 43–44.

374. Letter to Nelson Algren, 1–2 December 1947; Beauvoir (1998), p. 113. It should be noted that Beauvoir had compared the lives of women and African Americans even before she read *The American Dilemma*. Likewise, Myrdal did not rely on Beauvoir when he included in his book an appendix on 'A parallel to the Negro problem', where he writes 'In every society there are at least two groups of people, besides the Negroes, who are characterized by high social visibility expressed in physical appearance, dress, and patterns of behaviour, and who have been "suppressed". We refer to women and children.' See Myrdal (1944), appendix 5, p. 1073.

It ain't necessarily so

Le deuxième sexe [The Second Sex], the book that Beauvoir was working on, was published in two volumes in 1949. Here, she is indeed highly ambitious. She covers the situation for women in society in six extensive sections and via the topics Destiny, History, Myths, Formative Years, Situation and Justifications, before ending with Towards Liberation.[375] Her aim, stated in the Introduction, is to understand the paradox that:

> [M]any men affirm, with quasi-good faith, that women *are* equal to man and have no demands to make, and *at the same time* that women will never be equal to men and that their demands are in vain.[376]

Such an obvious – but ingrained and 'everyday-lived' – contradiction, she argues, can only exist if associated with some incorrect, but generally accepted, notion of what is *natural*: 'It is difficult for men to measure the enormous extent of social discrimination … whose moral and intellectual repercussions are so deep in woman that they appear to spring from an original nature.'[377] Beauvoir sees as her task to describe, analyse and occasionally throw ridicule on this irrational situation and on all thinking that supports it. Yes, it is irrational, but also morally unacceptable since it denies women the freedom to choose their own life-direction. Her book, therefore, concludes with demands Towards Liberation.

Beauvoir's chapter on biology makes up the largest part of the section on Destiny. Here, she summarizes what was known about sex-differences at the time. She also gives a not very positive description of what it means to be a female – bothersome menstruation, dangerous childbirth, painful breastfeeding … – and continues:

> These biological data are of extreme importance: they play an all-important role and are an essential element of woman's situation: … Because the body is the instrument of our hold on the world, the world appears to us depending on how it is grasped, which explains why we have studied these data so deeply; they are one of the keys to enable us to understand woman.

Then comes the punchline:

375. The French expression 'la femme' is variously rendered by the translators as 'the woman', 'woman' or 'women', depending on its precise contextual meaning. The same holds for 'l'homme'.
376. Beauvoir (1949, 2011), p. 15; italics in original (quoted from the English edition, 2011).
377. The direct continuation of the preceding quote.

> But we refuse the idea that they form a fixed destiny for her. They do not suffice to constitute the basis for a sexual hierarchy; they do not explain why woman is the Other; they do not condemn her for ever after to this subjugated role.[378]

This is, in principle, the same argument that she used in her third section (Myths) to criticize biological determinism: 'Is the ascertained smaller average muscle mass of women really of such a magnitude that it warrants the exclusion of all girls from higher education?' It is now, however, presented within a well-structured philosophical framework and backed up by extensive discussions of scientific results.

At this point, it is illuminating to compare Beauvoir's study to the work she found so inspiring. Its very title, *The American Dilemma*, makes clear that here is another book investigating a social conflict, in this case a contradiction within 'the American Creed'.[379] Its background was the following: At the end of the 1930s, the Carnegie Foundation wanted to make a study of the situation for African Americans – then generally called Negroes – in the United States. To head the investigation, they appointed the Swedish economist Gunnar Myrdal. We have met him earlier, in connection with the book that he and his wife Alva wrote to outline a social democratic population policy.[380] In the US, Myrdal was given ample resources. In 1944 he and his team of colleagues and assistants delivered their results and conclusions.[381] The 'dilemma' identified by Myrdal is based on a fundamental conflict; here, Myrdal unhesitatingly sides with the Blacks. He summarizes his results in the Preface to the book:

> When … the data on the American Negro problem are marshalled under the high ideals of the American Creed, the fact must be faced that the result is rather dark. Indeed … the Negro problem in America represents a moral lag in the development of the nation and a study of it must record nearly everything which is bad and wrong in America.[382]

The investigations by Beauvoir and Myrdal are similar in their critique of the current state of affairs, so ingrained in society that it was con-

378. Beauvoir (1949, 2011), pp. 44–45.
379. Myrdal (1944), p. lxi.
380. For an introduction to Gunnar Myrdal as an important twentieth-century social scientist, see Lyon (2007).
381. The book consisted of almost 1,500 pages in 46 chapters plus appendices.
382. Myrdal (1944), p. lxi. According to Jackson & Weidman (2004), p. 177, the book 'established the post-war liberal orthodoxy [with regard to race relations], building on … earlier arguments that race prejudice was dangerously undemocratic and basically un-American.' Later (p. 181) they write that 'Myrdal's book … had a tremendous influence on social scientists, on policymakers, and on presidents for twenty years after its publication.'

sidered natural despite the harm it caused. Both authors discuss how inherited markers identify the disadvantaged individuals – blacks and women respectively – and how biological arguments are used to justify the oppression against them. And neither of them finds necessity, destiny or fate to be involved – the biological differences used to legitimize the state of affairs can, they say, in no way explain the *magnitude* of disrespect and oppression that these groups are subjected to.[383]

In other words: It ain't necessarily so. None of the reprehensive social structures analysed follows from biology, genetics or genes.

Simone de Beauvoir and Gunnar Myrdal are not normally included among those who formed the history of genetics. Still, I would claim that their studies were crucial for how the public in the aftermath of the Second World War came to relate to questions of inheritance and biological differences. Not because everybody read their books (even though both sold surprisingly well). They helped, however, to disseminate an understanding that biological determinism could be questioned by rigorous scientific thinking and carefully assembled empirical data. In no way did the authors rule out the importance of biology in political life. But they discredited a host of conventional arguments about what was 'natural' and 'self-evident'. No matter how much nature-nurture questions were to be discussed in the decades that followed, it would therefore be from a different baseline compared to earlier decades. Thus, Beauvoir and Myrdal helped redefine how genetics was looked upon in society – not by changing the subject from within, but from repositioning the subject's outer boundaries.

New takes on genetic variation

If we then turn our attention to what happened *within* biology, it is relevant to start by noticing the great increase in genetically based investigations. Ever since genetics, around 1920, had obtained its theoretical foundation, the discipline had expanded as a central biological domain. New teaching positions were created, new laboratories started, new departments inaugurated, and interesting research results accumulated bearing upon genetic principles. Most of these results appear to us today as unrelated to the political conflicts that ravaged the surrounding world. New ways of viewing living matter emerged, however, from these efforts, and

383. It should be recalled that women had no voting rights in national elections in France until 1944, and that strong political forces have always tried and often managed to prevent USA's black citizens from voting.

some of them influenced how we look upon ourselves and our place in society.

First, there was the realization that if humans have many variable genes – and blood-group research, for instance, indicated that this was the case – then no standard human genetic type will exist.[384] Nobody is 'genotypically normal'; everybody is genetically unique in his or her own specific way.[385] This insight was one of the reasons why behaviourism – according to which inborn differences between humans can and should be treated as irrelevant – gradually lost its dominant position within psychology.[386] It also promoted the view that there can be something positive in variation as such; the crude notion that all gene variants are either good or bad came to be seen as too simplistic.

A second insight was that every living being – animal, plant or micro-organism – belongs to a local 'gene pool', which is more or less delimited but always under evolutionary change. During the 1930s and '40s, central Mendelian and Darwinian ideas were amalgamated into a 'New Synthesis' of evolutionary theory, leading to a dynamic view of how genetic differences become distributed over space and evolve over time.[387] From now on, biologically critical differences were seen to reside between species, that is, not between races, populations or other subunits within species. Thus, the chimpanzee, the gorilla and the orang-utan are definitely different from humans, while humans that differ in skin colour and originate from different continents – the 'races' – cannot be seen as being *essentially* different.[388]

These briefly reviewed developments concern changing views on inheritance that were derived from changes within areas of *general* biological knowledge. I will now turn to two post-war developments that were

384. The close interplay between genetics and blood group research is described in Bangham (2020).

385. From sequencing it is today known that not even the genotypes of monozygotic twins are identical; they are, however, *very* similar.

386. The behavioural scientist Jerry Hirsch described in 1963 how two of the USA's foremost statisticians tried to disprove him when he claimed that the number of potential human genotypes largely exceeds the number of living humans, and that one therefore cannot posit the existence of a standard human type. For the interesting history of how 'Behavior Genetics' was developed in post-WWII America to avoid politically loaded controversies, see chapter 2 in Panofsky (2014).

387. The crucial role of Theodosius Dobzhansky for this development has been touched upon in the two preceding chapters.

388. Harry Federley's positioning of Aboriginal Australians close to the apes – as seen in Chapter 5 – was therefore from now on totally absurd.

more directly related to genes and the genetics community – quantitative genetics and molecular genetics.

Inheritance with unidentified genes

In the summer of 1948, the Eighth International Congress of Genetics was held in Sweden. This event can be taken to mark the commencement of a new period in the history of the science. It was obviously a joyful occasion, full of invigorating energy. Genetics continued to extend its interest in all kinds of organisms; talks in the congress covered humans, petunia, coffee, silkworms, wheat, onion, cattle, mink, mice, *Drosophila*, sugar beet, mosses, grasshoppers, bacteria (*Escherichia* and *Salmonella*), yeast and fungi (*Saccharomyces*, *Aspergillus*, *Neurospora*), flatworms, nematodes, tobacco mosaic virus, and much more.

Six hundred scientists participated, mostly from Scandinavia, the UK and the USA. No delegate from USSR was allowed an exit visa to attend and only twelve, carefully vetted, scientists arrived from Germany.[389] One might have expected that the victory over Nazism, with its disqualified assumptions about inheritance and its reprehensible eugenic practices, would have dominated the event. But it was not so – the tone of the congress was set by its president, H. J. Muller, who in his official address instead lashed out in a violent attack against Lysenko and the Lysenkoists.[390]

389. Bonnier & Larsson (1949) published the proceedings of the congress. A description of its background is given by Bengtsson & Tunlid (2010). A remarkable historical document is available from the event – a thirty-minute-long silent film made by a young Swedish student, Nils Nybom. As a participant to the congress, he could walk around and catch all the famous names in informal situations. Thus, in the film one sees von Tjermack (one of the three rediscoverers of Mendel's results) talking to plant breeder friends; Charlotte Auerbach being the queen of the proceedings; Haldane and Gustafsson in discussion; Kihara and C. C. Tan representing Japan and China, respectively. Plus, Elisabeth Schiemann, who by now had regained an academic position in Berlin. The film can be reached via the website of the Mendelian Society in Lund: https://mendeliansocietylund.org/the-1948-congress/.

390. Muller had – after some politically motivated difficulties – obtained a permanent position in USA at Indiana University in Bloomington. His presidential address, *Genetics in the scheme of things*, is reprinted in the proceedings of the congress; see Bonnier & Larsson (1949), pp. 96–127. For more on this talk and the negative response it got from some delegates from Eastern Europe, see Bengtsson & Tunlid (2010). Muller was chosen to be the president of the congress since the obvious local choice, Herman Nilsson-Ehle, was considered to have been too 'German-friendly' during the war. Instead, his old friend Harry Federley from Finland, whom we have met earlier, in the chapter on conservatism and in the preceding note 388, was made vice-president.

From a broad perspective, it may be said that the Mendelian genes had come out relatively unharmed from the preceding turbulent decades. Still, two difficult problem-areas remained where geneticists needed to get a better grip on the situation. One concerned the fundamental question: What are genes? What is the underlying principle for their functioning? Great breakthroughs were made during the post-war period in this problem area. Before we turn to them, we must first, however, consider a question that is awkward for Mendelian geneticists: How is inheritance to be understood in the absence of specific genes? Such kinds of inheritance cannot be excluded from the realm of scientific genetics, and certainly not if one claims that the gene is the key factor in *all* instances of biological inheritance.

Quantitative genetics

Animal breeders took the first steps towards getting a better handle on quantitative genetics – as this field became known – and they did so already before the war. Thus, in 1939, Jay Lush, professor of Agriculture at Iowa State University, spoke at the World Congress in Edinburgh about 'Methods of measuring the heritability of individual differences among farm animals', thereby inaugurating a new meaning for the word 'heritability'.[391] Nine years later, at the congress in Stockholm, his presentation had almost the same title: 'Heritability of quantitative characters in farm animals'.[392]

Lush's analysis went back to a difficult paper published in 1918 by R. A. Fisher about the correlations to expect between related individuals under Mendelism.[393] According to him, it is indeed possible to use the statistical correlations between relatives in a population to estimate what effect selection will have on future generations – at least in some specific circumstances. Many underlying gene differences must be assumed, each with a small effect. Dominance-relationships can be tolerated, but there should be only limited interactions between environmental and genetic influences. Under these assumptions it is not only possible to calculate the proportion of a population's variance due to genetic causes, but also to predict what gain to expect from selection. The relative proportion of 'additive genetic variation' to the total variation is what Lush calls the trait's *heritability*. If there is a non-negligible heritability then selection

391. Lush (1941).
392. Lush (1949).
393. Fisher (1918).

will work well, and the population will change in the desired direction. If the heritability is too small, selection will be ineffective and cause no noticeable trans-generational change.

These results were not revolutionary, and they did not lead to any particularly surprising insights.[394] At best, they could advise a breeder what particular selection procedure to use. Still, the results had an attractive inner beauty. Few fields are indeed as satisfying to teach as quantitative genetics: one cannot but be amazed by the fact that it is possible to ignore all details about the many unknown genes involved and still reach simple results of substantial power.[395] Later, it was even found that by assuming an underlying distribution in *liability* for falling ill, it is possible to turn correlations in disease rates between relatives into heritability estimates.[396]

Most geneticists, nevertheless, did not care much about these elaborations. For them, quantitative genetics lacked the excitement of the real thing: actual, almost palpable, genes with clear phenotypic effects open to experimental investigation. While questions about the nature-nurture balance continued to simmer among animal breeders and human psychologists, the attempts of quantitative genetics to find ways to dissect trait variation into variously named 'components' met with little interest from the general genetic community. It is telling that R. A. Fisher did not discuss 'heritability' in his prominent lectures in the 1950s about the future of genetics and statistics.[397] Neither was the term used by Anne Anastasi in her presidential address about heredity and environment to the American Psychological Association in September 1957. Her point was instead that it is uninteresting to study the proportions of causality for important human traits compared with how exciting it is to investigate how these factors *interact* in development.[398]

Partial essence

As discussed in Chapter 4 above, genes were from the very beginning often regarded as carriers of what constitutes the *essence* of an organism – as the 'thing' that makes the organism to what it is. The elaboration of

394. Fisher used his early results primarily to understand the evolutionary process; see Fisher (1930).

395. Quantitative genetics was also given a textbook of unusual quality by Douglas Falconer in 1960.

396. Falconer (1965).

397. See Fisher (1951 and 1957).

398. See Anastasi (1958). Note that heritability cannot be meaningfully defined when such interactions are strong.

the heritability concept added a new twist to this fundamental theme. It is not easy to understand how this happened, but an attempt is worth the try. Here is, after all, the background to some of the most politicized debates that genetics has been involved in (as will be illustrated in the next chapter).

Under ideal assumptions, the heritability of a trait describes how much of its variation, as measured in a specific population at a specific time, is due to gene differences. By just a small change in thinking, this can be taken to mean the degree to which the trait is genetically determined. The crucial difference between the two interpretations is that in the first case the measurements used for making the calculations exist, but nothing else does. In the second case, the trait *as such* is treated as existing; it is assumed to have some kind of generalized reality. This reality is not a trivial matter, since when applied to humans it may specify a necessary attribute of some specific human faculty.

These two ways of interpreting measurements came to function antagonistically in discussions about mental traits such as intelligence. For some, it is self-evident that even if IQ values can be estimated, no special ontological status should be given to the notion of 'intelligence' as such, since – at least methodologically – intelligence only appears as a statistical construct for the particular study cohort. For others, there is no need for such ontological subtleties. Intelligence is an obvious aspect of all humans' lives and its existence is supported by its heritability: Genes are real and existing, and if there are genes for IQ, then intelligence itself must be a real entity.[399] This standpoint has often been associated with the conviction that since variation in intelligence, at least in part, is caused by 'hard' gene differences, then policies for schooling, welfare support, race policies and other such social interventions must take this into account.[400] Biological determinism here found a new, scientifically more sophisticated, form in which it could be expressed.

399. Stephen Jay Gould regards this argument as an example of 'reification' – that is, of treating an abstraction as if it were a real thing. See Gould (1981), chapter 6.

400. It is fascinating to trace the history of the trope that the human mind can be divided into distinct parts due to different *causes*. This idea was, for example, behind the question posed by the Academy of Dijon in 1754: What is the origin of the inequality among men, and is it authorized by natural law? In his famous answer, Jean-Jacques Rousseau claimed to demonstrate that 'inequality is hardly observable in the state of nature, and … its influence there is almost non-existent', but that 'it is easy to see that, among the differences that distinguish men, several of them pass for natural ones that are exclusively the work of habit of the various sorts of life that men adopt in society.' (Rousseau, 1755, 2011,

This political dimension explains why the dispute over the interpretation of psychological constructs developed into such bitter intellectual fights. After the defeat of Nazism, and during about two decades, biological differences had, in general, been kept out of political discussions. Now, at the end of the 1960s, they re-entered the public arena with force, though in a form different from how they were presented before the war. Simplistic arguments based on biological determinism clearly could not function in serious discussions anymore – not after the critiques by Beauvoir, Myrdal and others. In this situation, the technical notion of heritability appeared as a perfect tool for those who wanted to stress the importance of genetic differences between humans. Significant heritability for a trait implied only 'partial causation' and was therefore, as such, not ridiculously deterministic. At the same time, statements about 'hard' and certified genetic differences between individuals (and groups of individuals) could again be made in the name of science. Thus, being *different* once more became an essential attribute to ascribe to some individuals in society, even if it now was done in a more complex and 'scientific' way.[401]

Many geneticists reacted with distaste to the determining role given to a diffuse mass of uncharacterized genes. Geneticists had previously never particularly objected to popular (mis)interpretations of their science. Now, however, strong reactions were elicited when heritability – this complex and assumption-laden genetic notion – was used to confer biased interpretations in politically infused conflicts. As a result, a paradoxical situation developed from 1970 onwards, where in the melee over the social relevance of genetics, many geneticists chose to *downplay* the importance of their science.

---

pp. 68 and 67). Using modern parlance, one would say that Rousseau concludes that the natural (genetic) variation in human traits is small, but that life in civilized societies tends to enlarge the differences that do exist into substantial social inequalities. In other words, a clear case of a genotype-environment interaction. This century-old worry over internal (genetic) and external (environmental) causes affecting human minds became crucial to conflicts among liberals, as is further discussed in the next chapter.

401. A crucial step in the history of this nature-nurture conflict was taken when the American psychologist Arthur Jensen published his book-length article 'How much can we boost IQ and scholastic achievement?' in *Harvard Educational Review* in 1969. A variant of this intellectual tradition was continued in *The Bell Curve* written by Richard Herrnstein and Charles Murray (1994).

The material nature of genes

While the first problem area for genetics after the war concerned how inheritance is to be understood in the absence of specific genes, the second involved questions about the molecular nature of the genes.[402]

Around 1920, and after much meticulous research, geneticists had concluded that genes, at least in organisms like humans, mice and maize, are something physical that reside in chromosomes. Excellent! But what then? Where in the chromosomes – visible as thin threads in strong light microscopes– are the genes, and how do they function?

By the end of the Second World War, a kind of balance had been reached between ignorance and knowledge in this area, illustrated in a quote from the prominent British chromosome researcher Cyril Darlington. Here he is speaking at the Congress of Genetics in Stockholm in 1948: 'The gene, it seems, is biologically adjustable in both length and breadth.'[403] From today's perspective, we understand what he meant by genes having 'length' – but what did he mean when talking about their 'breadth'?

From Bateson's desperation to Crick's dogma

In retrospect, one must conclude that the classically trained geneticists by this time had reached the limit of their abilities. Their standard experimental tools – progeny analysis, microscopic investigations, and the treatment of living material with chemicals and radiation – were not sufficient for a deeper understanding of the finer details of the chromosomes. A new scientific approach, molecular biology, was needed for this purpose. This was an area where practitioners often were biochemists or retrained physicists, and where the biological material normally was bacteria or fungi, and not animals or plants. Molecular biologists handled test tubes and Petri dishes but also heavy and expensive equipment such as ultracentrifuges and scintillator counters. Furthermore, some of them understood the theoretical concept of 'information', something they had picked up from thermodynamics or from problems arising with noisy telephone lines.[404] The time was ripe for this approach – and they had the right

402. See, among many studies, Judson (1979), Morange (1994) and Kay (2000).

403. See Darlington (1949), p. 199.

404. Erwin Schrödinger's prescient *What is Life?* where he postulates the existence of a genetic code, was published in 1944, while Claude Shannon and Warren Weaver's book on information came in 1949. Neither book played an immediate role in the working out of the molecular basis of genetics, but they were important for the results' wider acceptance.

tools for the task. In a remarkably short time – ranging roughly between 1945 and 1965 – they reached important answers to what genes are and to how they function.

The intellectual highpoint of this development was Francis Crick's explication of 'the central dogma' in 1957, followed by Jacob and Monod's work on gene regulation published in 1961.[405] Thus, if Mendel is considered to have started a scientific revolution in 1865 when he presented his result to the Natural Science Society in Brünn, it is fair to say that the revolution ended slightly less than one hundred years later. Just as Kepler and Newton finished the revolution started by Copernicus, so did Crick, Monod and Jacob finish the Mendelian revolution.[406] A lot more remained to be figured out – of course! But the foundation was there; all further work concerned details and practical applications.

After having worked out the molecular structure of DNA together with James Watson, Francis Crick tried to understand how genes function. This had obviously something to do with what proteins the cellular machinery produces. In a talk to the Society for Experimental Biology held at University College London in September 1957, Crick summarized current knowledge and drew some conclusions about the likely relationship between DNA and RNA (both nucleic acids) and proteins (polypeptides). His tentative conclusions turned out to be bang on.[407]

Crick's ideas were simple: Genetic information is coded in DNA via the sequence of four nucleotides designated A, C, G and T. Helped by RNA, this information is used to synthesize proteins. Or more exactly: The information in DNA is transcribed and then translated, by some intricate transformations involving different kinds of RNA molecules, into chains of precisely ordered amino acids that then fold into complex proteins.[408] Particularly important among these proteins are the enzymes

405. Crick (1958), and Jacob & Monod (1961). Watson and Crick's famous article on the molecular structure of DNA contained little of direct genetic interest (see Watson & Crick, 1953a). Of much greater importance was Watson & Crick (1953b), where they explicitly stated that DNA 'is the carrier of a part of (if not all) the genetic specificity of the chromosome and thus of the gene itself' and that it 'seems likely that the precise sequence of the bases is the code which carries the genetic information'; see pp. 964–965.
406. Kuhn (1957).
407. The talk was published the following year; see Crick (1958). For more details on this lecture, see Cobb (2017).
408. Whether additional information is needed for the correct folding of polypeptides was for long an open question; today we know that the 3D structure of such a molecule is normally an immanent function of its linear array of amino acids alone.

that steer the cell's biochemical reactions. They are the molecules that make things happen in the cell; they are the prime movers of life.

The posited 'genetic information' can be copied (replicated) from one DNA molecule to new ones; it can also be transferred from RNA back to DNA (Crick was uncertain about this; today, we know that it happens in some specific situations). However, the genetic information *never* moves from the realm of proteins (polypeptides) back into DNA or RNA. We find here the basis for the impossibility of transmitting to offspring via DNA any environmentally caused modification of an organism during its lifetime. This tenet Crick called molecular biology's central dogma.[409] The inheritance of acquired characteristics is just not possible.

Nowadays, this is textbook stuff – which only shows what a momentous achievement Crick's interpretation was. It relied on data from genetic, microbiological and biochemical studies of organisms ranging from plant viruses over yeasts and bacteria to humans. The only thing missing from his structural understanding of life's key processes was an explanation of why genes sometimes are 'active' and sometimes are as if 'turned off'. Soon, however, Jacob and Monod would provide the missing knowledge, when they showed that certain molecules can bind to specific positions along DNA molecules and thereby influence the expression of nearby genes.[410]

The flowchart for genetic information outlined by Crick was rapidly accepted, and from then on, the 'only' research questions that remained concerned details. In particular, scientists had to find the different kinds of posited RNA molecules and work out the exact translation scheme from nucleotide triplets to specific amino acids. Much hard work followed, performed under fierce competition but also with the help of extensive male camaraderie, leading to several key players receiving Nobel Prizes.

---

409. In retrospect, Crick phrased it like this: 'once (sequential) information has passed into protein it cannot get out again'; Crick (1970), p. 562.

410. The central article by Jacob and Monod (1961), described in more detail in Chapter 7, gives rise to just three short comments in the present context. The first is how closely it follows – already in its title – Crick's approach of seeing the functioning of genes as a question of protein synthesis. The second is that they acknowledge economic support from the *Commissariat à l'Energie Atomique*, illustrating the importance of nuclear interests for biological research at the time. Finally, in their conclusion it is interesting to note that 'the genome is considered as a mosaic of independent molecular blue-prints for the building of individual cellular constituents'. This engineering metaphor is further commented upon below.

Plus achieving the deep satisfaction of having figured out life's greatest scientific mystery.

When I started to study genetics in the late 1960s, all these molecular results had fallen into place. So too had the more organism-oriented insights concerning phenomena such as blood groups, genetic diversity, evolutionary processes and heritability, discussed earlier in this chapter. This gave the impression that the science of genetics had reached its mature phase. No longer were there any black holes of ignorance in the field. Instead, it seemed to me that this exciting knowledge about the DNA molecule was on its way to be accepted by society at large. Let me just give a few examples.

The genes' new associations

With the molecular breakthroughs, the genes became concrete. Irrevocably so. Not just material 'in principle', as when the early geneticists understood that genes must be part of chromosomes. No, the genes now turned into actual physical molecules with known atomic compositions. Furthermore, they took on a specific shape: as a double helix.

This helix had graceful proportions and a beautiful form, which meant that it attracted attention far outside genetics proper. DNA's physical outline became a carrier of symbolic meaning – a molecular stairway associated with almost mystical power. No surprise that the world soon was enriched with objects referring to this molecular structure. Innumerable double helix murals and sculptures adorn universities, hospitals and research establishments today, symbolizing the power of the molecule that incarnates life's secrets.

Genes also gained new meanings when they started to be regarded as carriers of genetic information. From now on, they were seen as *blueprints* for organismal development, referring to how a technical drawing (often copied in blue ink) specifies how some complex manufactured object, such as a welding machine or an oil tanker, is to be constructed. Alternatively – and using a more modern comparison – genes were seen as *programs* specifying how cells, as digital machines, should run.[411]

This social interpretation of genes is made explicit in the successful 1993 film *Jurassic Park*, based on a novel by Michael Crichton. The plot is made realistic with the help of an educational film shown within the film.

411. When applied to humans, this thinking could be used – more or less intentionally – as a modern version of La Mettrie's provocative metaphor *L'Homme machine*; see La Mettrie (1748, 1999).

Here, DNA is presented as the blueprint for life in all its diversity; the take-home message being that with access to the relevant DNA sequence, you can recreate whatever life-form you wish (including, in this case, dinosaurs).

By this time DNA also entered another dimension of social life. We may remember that Johannsen, when coining the term 'gene', wrote that the most likely fate for any newly introduced scientific term was that it would never be used. An obvious follow-up is: The most likely fate for a new term that has been accepted into common parlance – is to be made fun of.

Its clearest illustration from genetics is the expression: 'It is not in my DNA'. It has various precursors, such as 'It's not in my chromosomes' and 'It's not in my genes', with different relative frequencies in different languages, but has now, it seems, found its most generally accepted form. A symbol for its success is the TV series *Sex and the City* from 2003 and the moment when the lead character Miranda (with an enormously big mobile phone in her hand) hesitates about telling someone that she loves him: 'I can't do it. It's not in my DNA.'

The example has it all: the life-determining decision that is legitimized by the use of a genetic reference – but with a joking undertone giving the speaker (and the viewer) a distance to the significance of the matter involved. Miranda's argument is also perfectly clear – everybody will understand what she means. Only a hard-core geneticist will be intrigued: What DNA is she talking about? Does it have anything to do with actual molecules? Or is it a just a label for her sense of her innermost self?

In the subtitle to their book *The DNA Mystique* (published in 1995), the American anthropologists Dorothy Nelkin and Susan Lindee claim that the gene nowadays functions as a 'cultural icon'. It has become increasingly difficult to know what meanings concepts such as genes, chromosomes and DNA carry in the world outside the scientific sphere. Geneticists cannot be certain anymore – even when they choose their words with care – about what society *hears* them saying when they talk about their results.

Homing in on humans

In the new world that came into existence after the Second World War, genetics thrived, as we have seen. It grew in volume and strength and became amazingly diversified. Still, behind the diversity there was a steady trend for genetics to become more and more human-oriented – a development that affected both the questions approached and the endeavour's ethical basis.

Towards a central position for medical genetics

It is not self-evident what role biology should play in a scientific approach to humankind. Earlier in this chapter we have seen how discussions about the genetic background to human differences had to be reformulated after the Second World War and how the elaboration of the heritability concept came to play an important role in this process.

At the same time, some other topics bearing on humankind were not discussed anymore using genetic terms – it was as if they were put in a historical quarantine. There was minimal interest in trying to find genetic markers for human races, even if some blood-group researchers continued to produce complex data; similarly, articles on the heritable characteristics of, for example, Jews were – hardly surprising – rare. Greater distance to the Nazi atrocities and more informative empirical sources were needed before genetic diversity studies could become interesting again.[412]

Genetics was also absent from the many politically prominent anti-racism and decolonization conflicts in the decades following 1945. I do not know of a serious debate about *genes* in any of these fights. To take but one example, genes are absent from Franz Fanon's fundamental anti-colonial writings; instead, psychoanalytical terms and ideas take prime position.[413] This does not mean that biological arguments were unimportant in the struggles for and against oppression and denigration – but the rhetoric used to legitimize the existing state of affairs only rarely became so specific that genes were used. It is interesting to note that eugenics and genetics were unimportant in the establishment and maintenance of the Apartheid system in South Africa.[414]

412. Marking the renewed scientific interest in this type of questions was the article by Luca Cavalli-Sforza and colleagues named 'Reconstruction of human evolution: Bringing together genetic, archaeological, and linguistic data', published in 1988.
413. See for example Fanon (1952).
414. Klausen (2018).

Of all possible aspects of human life for which genes could be relevant, it was instead the phenomenon of *disease* that came to dominate genetics after the Second World War. Gradually, its clinical importance increased, and medical questions moved towards the centre of the discipline. Still, this change did not mean a narrowing in scope; medical genetics may include advanced mathematical analyses of pedigrees and populations as well as sophisticated chromosomal and biochemical investigations of cells. It has also always been seen as natural that human medical genetics should include studies also of animals like mice, rats, rabbits and monkeys. For many geneticists it was, furthermore, not difficult – perhaps even attractive in the struggle for resources – to shift one's interest to the human medical field. As a preparation for the analysis of liberalism, let me therefore finish this chapter with some key stories about the development of medical genetics.

Many diseases have by tradition been considered heritable. At the end of the nineteenth century, this usually meant that a consulting doctor would recommend extra vigilance towards early symptoms. Thus, a coughing cold would be attended to with particular care when tuberculosis was known in the family. Similarly, younger relatives would be recommended to live uneventful lives if some elderly relative was mentally ill. The bedside was the place where the suffering individual, the *patient*, met the physician with a specialized knowledge.[415]

Under early Mendelism – which did not provide any hope for patients with heritable diseases – scientific interest shifted beyond the individual patient towards wider groups. In their quest to reduce degeneration and improve humankind, physicians would focus their analytical interest on well-documented ancestries, on inhabitants in specific geographic regions, and on geographically separated races. The *population* became the natural unit for study by human geneticists; this held, as a broad generalization, well into the 1940s.[416]

---

415. I take these examples from an excellent little booklet published in 1879 by the Swedish physician Gustaf Trägårdh called *Några ord om sjukdomars ärftlighet* [Some Words on the Inheritance of Diseases].

416. The following note is relevant for this entire book but finds its most natural place here: This transfer of interest from 'the body' to 'the population' corresponds to what Michel Foucault called the development of biopolitics. His ideas on this topic were outlined in a lecture to the Collège de France in March 1976 (see Foucault 1997) and in his first book on sexuality, *The Will to Knowledge* (1976). In these works, he also sketched a theory of how the modern state in its strivings to normalize society promotes 'racializa-

A series of results then gave genetics a renewed relationship with medicine and with human biology and biochemistry. Now, the attending physician met with and gave advice to the *family*, most often meaning a married couple that perhaps already had given birth to a diseased child. 'Genetic counselling' became an important activity within most countries' health systems. It did not mean a return to the limited therapeutic consultations of earlier times; instead, it represented a reconfiguration of 'the relationships between the state, the scientists, the doctors, and the health industry', with worried (potential) parents at its centre.[417] Medical genetics did not become less social with this return to the patients and their families. Instead, it grew to be the channel through which the post-war welfare state provided resources for measures of relief and control, ranging from biochemical tests and pharmaceutical interventions to social security aid and disease registration.

PKU, the hope-inducing paradigm

Central to the revolution in how medicine came to approach inherited diseases was the understanding of phenylketonuria, PKU, and the discovery of how to prevent it.

PKU is a recessive disease that disturbs the mental development of children. In Europe, it has a frequency of about one in fifteen thousand newborns. Its cause is similar to other such recessive diseases: the child inherits damaged gene versions from both parents that make it unable to perform some important part of the normal biochemical programme. In the case of phenylketonuria, scientists deduced that a diseased child suffers from an incapacity to regulate the amount of phenylalanine (an amino acid) in the body, causing subsequent damage to nerve cells. This understanding, which was reached in the 1930s, led to a suggested cure: affected children should be given diets low in phenylalanine. After some early setbacks – the first attempted diet had to be withdrawn – functioning alimentary recommendations were developed in the 1950s. Fantastic!

---

tion' by providing stereotyped classification schemes for its citizens. Foucault's plan for a wide-ranging research project devoted to these phenomena came to nothing, however. His next books were on the history of sexuality, and his lecture series at the Collège de France 1978–79 that should have been devoted to the origin of biopolitics, turned instead into a study of governance and early neoliberalism. To me, his terms biopolitics, biopower and racialization are interesting and thought-provoking, but so vaguely outlined that I prefer not to use them in my analyses.

417. The quote is taken from the French historian Jean-Paul Gaudillière's description of 'biomedicine'; Gaudillière (2002), p. 9.

Children with PKU, diagnosed early enough, could from then on develop normally when raised on the prescribed diet.

Almost all children born in rich countries are today therefore tested for the biochemistry involved (this is the basis for the common procedure of taking a drop of blood from newborns). Manageable dietary advice is then available that makes affected children able to live normal lives (as normal as adhering to a strict diet allows). Here, genetics, in combination with biochemistry and pharmacology, showed itself able to help those we most of all want to help – the suffering children.

This is a brief outline of a long and fascinating medico-scientific process involving many quirks and complications.[418] For my present purpose, the importance of the PKU case is that medical genetics hereby gained its prime paradigmatic case – it showed itself able to prevent a terrible disease. It is no exaggeration to say that, without this successful example, no large-scale project for sequencing the human genome would have been financed and launched. The PKU paradigm replaced the vague eugenic dream of improving future humankind with a clinical reality where suffering newborn children were helped – *actually helped*.

Trisomy 21, Penrose and the power of diagnosis

Unfortunately, most diseases caused by 'inborn errors of metabolism' are not amenable to such relatively simple interventions.[419] Damage caused by faulty biochemistry during foetal development may not be easily reversed later in life, and no direct remedy may exist for the suffering patient even when the faulty genes and enzymes become known.

Genetic knowledge may, however, bring relief of a different kind. A trustworthy diagnosis may reduce suffering, even when there is no cure. Ignorance – not knowing how to find words for an abnormal situation – can be extremely hurtful.

Genetics' most important contribution to medicine in the twentieth century was therefore – undoubtedly – its understanding of the cause behind Down's syndrome.[420] Recalling this achievement gives me a reason to write about the British human geneticist Lionel Penrose. He came

418. The social history of PKU biology is described by Paul & Brosco (2013).
419. Archibald Garrod (1909) coined this expression in his early study of inherited childhood diseases; see Chapter 5 above.
420. In 1862, the British physician John Langdon Down gave a description of the syndrome. He mistakenly considered it a 'throwback' to an earlier evolutionary state, represented by people in Asia. This is the reason behind the name 'mongolism'. A third common way of designating it is 'Down syndrome'.

to play an important role for the post-war relationship between genetics and society.

Lionel Penrose, born into a Quaker family, served as stretcher-bearer in the First World War, before going to the University of Cambridge to read mathematics, logic and psychology.[421] The last topic took him to Vienna where he did some research in psychology, but also met Freud and started psychoanalysis. He then decided that he wanted to know more about mental disorders and abnormal psychology and returned to Britain to study medicine. He obtained his medical degree in 1928 after further academic training in Cambridge and London. Soon thereafter, he became involved in a study that would determine the direction of his life.

The aim of the Colchester Survey was to investigate the causes of mental deficiency. It was led by the Medical Research Council and was based on 1,280 inmates in an institution on the east coast of England.[422] The organizers – which included the Darwin Trust – employed Penrose to perform the analysis, and he was obviously the right person for the task. With great energy, he and his assistants studied the inmates with a range of physiological and psychological methods (some of which Penrose developed himself). They also included information on more than 50,000 of the patients' relatives in the analysis.

In the report published in 1938, Penrose – like all who have conducted serious empirical investigations of people with mental deficiencies – stressed their wide range of phenotypes. The patients could not easily be sorted into distinct categories; neither could the causes of their problems be classified into distinct groups being due to heritable, infectious or environmental factors. This did not mean, however, that it was impossible to recognize *certain* characteristic groups of patients. Thus, Penrose found among his subjects those with already well-described genetic diseases, such as PKU and Huntington's chorea.[423] Another well-represented group with characteristic physical and mental traits included those with

421. I base my description of Penrose's life and activities on Harris (1974); Laxova (1998); and Watt (1998). For Penrose's importance in freeing post-war medical genetics from the crudest kinds of scientific racism, see Barkan (1992), pp. 260–266. Any description of his life, however brief, is incomplete without mentioning that he and his wife Margaret had four highly creative children, of which Oliver has been rewarded with the Fields Medal and Roger with the Nobel Prize.

422. Penrose (1938). Chapter X in Kevles (1985) gives a detailed description of Penrose's study.

423. Penrose was himself involved in some of the early studies on PKU. For more on Huntington, see the next chapter.

Down's syndrome; it constituted about 5% of the studied population. For the rest of his life, Penrose came to give special attention to such individuals. With data from the Colchester study, he used statistical analyses to prove that birth-order has no effect on the risk that a child is born with Down's, but that they, on average, have older mothers. He also noticed that most cases occur sporadically, though a small proportion of them appears to run in families.[424]

Penrose suspected that the syndrome was caused by a chromosome mutation, though the exact nature of the mutation was unknown to him.[425] It was, at the time, technically difficult to make detailed studies of human chromosomes – even their number was wrongly recorded to be 48 (instead of 46). In the 1950s, however, better cytological methods became available, and soon reports from France claimed that children with Down's syndrome are born with an extra chromosome 21 – they are, what is called, trisomic.[426] The reports turned out to be correct, and chromosome analysis rapidly became the standard method for diagnosing Down's.

The importance of this finding is difficult to overestimate. The simple – almost physical – reason for the affliction came to de-dramatize the problems with the Down's patients and made them less anxiety-inducing. The stigma often felt by their parents – 'What did we do wrong?' – was reduced, which shows how genetic knowledge *as such* may affect people's feelings, even when the knowledge does not lead to any particular medical benefit. Our knowledge of the world determines what we feel, and genetics that helps structure our perceptions may influence our emotional reactions to the world.

Lionel Penrose had by then taken over a professorship in London after J. B. S. Haldane and become an important figure in the burgeoning international community of medical geneticists. He did not play any direct role in elucidating the cause of Down's syndrome, but he promoted chromosome investigations in his laboratory as well as studies of such patients' finger- and handprints to understand processes underlying their

424. We know today that such cases are due to a chromosome mutation – called a translocation – which links together a chromosome 21 to some other chromosome, thereby disturbing its regular pattern of transmission.

425. See Watt (1998), p. 459, for this claim.

426. For more on the background to these events, see Gautier & Harper (2009) and Chadarevian (2020). The improved methodology for investigating mammalian chromosomes came to play a crucial role also for the understanding of cancer – another important topic in medical genetics.

disturbed neurological development. When he retired from his professorship after twenty years, he chose to start a new research laboratory for 'Mental Deficiency Research and Diagnosis' at the Harperbury Hospital in North London with himself as director. He continued to receive students and visitors, and he always – almost as a ritual – let them meet some patients with Down's.

A sounder moral ground

This brings me to why I have chosen to write about Penrose. He, more than anyone else, symbolizes the change in moral foundation experienced by medical genetics in the latter part of the twentieth century. He helped bring a special quality to the study of human differences: a strengthened sense of decency and compassion. His approach, made clear already in 1933 when he was a few years into the Colchester survey, was the following: '[W]hat to do with the simpletons will always remain a social problem. This is a question which civilization has to face. A society which is ideally conducted will have to make arrangements so that the simpletons can find a useful purpose in their existence.'[427] In his clinical assessment of patients he could be as strict a genetic reductionist as any of his colleagues, but he always combined this approach with an interest in and a respect for the individuals he met, however 'subnormal' they were. His successor to the position in London writes about Penrose's approach to children and adults with Down's:

> It might be thought because of his insistence on the collection of exact factual data about mongols and on its detailed statistical analysis, that Penrose regarded these severely retarded individuals simply as convenient biological objects to study. But nothing could be further from the truth. From the very beginning at Colchester, he was attracted and charmed by their usually good tempered dispositions, their liveliness, and their frequent liking for music. … [H]e always seemed to derive a great deal of pleasure out of working with mongols and playing with them. As far as he was concerned there was no question that they were each to be regarded as human beings in their own right.[428]

To Penrose they were human beings, and this very fact he tried to convey to all colleagues and students within the medical genetics community.[429]

427. From Penrose's first book, *Mental Defect*, as quoted by Harris (1974), p. 3.
428. Harris (1974), p. 9.
429. Personally, I was much affected by reading *The World of Nigel Hunt: The Diary of a Mongoloid Youth*, which Penrose helped publish in 1967 and to which he wrote a foreword.

I can exemplify with a personal observation how the tone inside this community changed. When I started studying genetics in the late 1960s, the photographic illustrations of inherited diseases in my (rather old) textbooks were horrible – inhumane and degrading, often showing frightened children in bleak laboratory milieus. The corresponding photographs in the textbooks of today instead depict happy and smiling children, often involved in some sporting activity.

I have made Penrose a symbol for how genetics changed its moral approach to humans after the Second World War. One must, however, realize that there were many underlying processes contributing to this change.

Most importantly, genetics' relationship to its constant shadow – eugenics – was weakened and transformed. From its very start, the ethical problem with eugenics had been its unlimited horizon. Who can argue against an argument claiming to improve and perhaps even save the future of humankind? This ultimate goal had such a high value that almost any intervention could be defended by it – as we have seen in earlier chapters from the examples of Galton and of the Nazis. Such a vague and imprecise goal of immense importance is, however, not a sound basis for concrete moral decisions.

With its contributions to the understanding and treatment of individuals affected by PKU or Down's (or other inborn diseases), the moral underpinnings for genetic research became more real and manageable.[430] When some suffering children and their parents could in fact be helped, then the urge to help others in similar situations increased, and genetic research evolved towards a much sounder ethical basis for its activities than just vaguely trying to save humankind. Penrose, with his stringent arguments and exemplary personal conduct, symbolizes this shift in the public debate about children with genetic diseases. Eugenics – meaning attention to the genes in future societies – did not thereby disappear, but it lost most of its bearing in a medical world that wanted to help *living* children.

Still, this did not imply that all moral dilemmas now disappeared – no, rather the opposite. For example, understanding the cause behind Down's did not only lead to a change in how such individuals were perceived by society. It also opened up for the possibility of prenatal diag-

430. The emotional intensity in the endeavour can still be strong, as shown by the book title used by the French genetic paediatrician Arnold Munnisch, *La rage d'espérer*; see Munnisch (1999).

nosis followed by abortion. In other words, genetics has given society a paradoxical legacy with respect to Down's syndrome. On the one hand, it has promoted arguments for greater respect for those who are different, on the other hand, it has produced possibilities for selection against them. Such ethical dilemmas – and their number is constantly increasing – must, however, be seen as *sounder* than those formulated in earlier times. Then, the choice raised by some scientists was between performing some vile actions today in order to reach some absolute, highly-valued goal in an unspecified distant tomorrow.

This brings me to the fifth political ideology to be analysed here: to liberalism, and its contradictions.

10. Liberalism's contradictory reactions

An ideology favouring freedom

Liberalism is an ideology stressing freedom, in particular freedom for individuals. The ideology has a long history, and most of its development has been in opposition to conservatism. Originally, and with its critique of old authoritarian society, liberalism was part of 'the Left' in opposition to 'the Right'.[431] Its position changed, however, with the spread of socialist ideas; today, it finds itself in the middle of the political spectrum. With its belief in the positive power of private initiative, liberalism has always been – and seen itself as – a proponent of capitalism. It has also normally supported parliamentary democracy, though hesitating over how much the state should share its power with the economic market.[432]

It is difficult to write about liberalism, since there are almost as many views of what it is as there are liberals. Liberalism has always been hotly debated, and it has often been seen to be in a crisis. Innumerable attempts to understand the essence of liberalism have been made, and to classify it into distinct types.[433] 'Neoliberalism', for example, is a term applied to many different families of thought that over time have become associated with meanings even wider than liberalism itself.[434]

To analyse the reactions of liberals to genetics, I have therefore had to structure my analysis severely. In the present chapter I discuss how

431. These terms originated in the French revolution. In Denmark, the classic liberal-conservative party is still called *Venstre* [the Left].

432. '[T]he liberal does not have to be a democrat but it is uncommonly difficult for him [sic] not to be', according to the British economist Arthur Shenfield; a quote taken from Slobodian (2018), p. 146.

433. Semantically, things have become even more complicated with the divergence in meaning of the word 'liberal' between British and American English.

434. Present-day neoliberalism is more of a policy prescription than a popular political ideology and it is therefore not given a separate analysis in the present book. Neoliberal ideas are often adopted by conservatives, but they are normally better understood when seen as originating from fundamental liberal principles.

old, fundamental liberal ideas led to divergent responses to new genetic results, while the next chapter is devoted to how genetics has been presented in modern liberal society. This approach, I believe, makes it possible to reach at least some enlightening insights.

I have also decided to bypass standard schemes for classifying liberalism. Instead, I base my analysis on some of the ideology's primary texts. Their intellectual and emotional richness explains why spontaneous liberal reactions may appear contradictory. Actually, I do not find it surprising that an ideology as broad and strong-willed as liberalism has produced paradoxical responses to new scientific results. They can be seen as natural – perhaps even as healthy – reactions to a dynamic and evolving field of knowledge.[435]

Natural Man

> To understand political Power, … we must consider what State all Men are naturally in, and that is a *State of Perfect Freedom* to order their Actions, and dispose of their Possessions and Persons, as they think fit within the bounds of the Law of Nature, without asking leave or depending upon the Will of any other Man.[436]

When John Locke published these lines in 1689, he had lived through a lot of political turmoil and power struggles. Civil war broke out when he was twelve; King Charles I was decapitated when he was seventeen. During the subsequent restoration of the monarchy, Locke had to go into exile. When the Jacobean restoration was interrupted by a second revolution – this time a 'glorious' one – he returned to England. Here he could print his thoughts on freedom and government.

Locke started from what to him (and a whole generation of European political thinkers) appeared as the basic unit for a rational discourse on power: Natural Man. This was a rather strange object. Not only because it could stand for both men and women, but for what characterized its existence. Thus, he/she was devoid of spouse, sibs, parents and children; at the same time, he/she had valuable possessions to dispose of. These assumptions are called 'possessive individualism' by the Canadian historian C. B. Macpherson – it seems an apt characterization.[437] It is this

435. Libertarianism differs from standard liberalism in (among other dimensions) its views on social welfare, solidarity, fraternity …; it is therefore not treated further here. As in earlier chapters, it is the main ideologies' everyday reactions that I try to understand and capture in my analysis; the more precise details I leave for others to investigate.

436. Locke (1689, 2016), p. 4. I have changed the commas in the quote to make it more easily readable. The italics are original.

437. Macpherson (1962).

property-owning individual Man that the liberal ideology wishes to support.

The 'State of Perfect Freedom' which 'all Men are naturally in' can, however, be interpreted in very different ways. To understand liberalism's response to biological results, it is necessary to refer also to another stylized description of Man, this time given by Jean-Jacques Rousseau about a century later:

> This is the only portrait of a man, painted exactly according to nature and all its truth, that exists and will probably ever exist. … I am resolved on an undertaking that has no model and will have no imitator. I want to show my fellow-men a man in all truth of nature, and this man is to be myself.[438]

If Locke writes about an abstract free individual, Rousseau in his *Confessions* presents an actual, autonomous and free-living individual. By describing his personal wishes, sentiments and sexual urges in unashamed detail, he tries to give a picture of Everyman: unique in his personal make-up, but a representative Natural Man, nevertheless, in this very uniqueness. It is fascinating to see that the liberal quest for individual freedom is so broad that it relies both on Locke's abstract proprietor and on Rousseau's intimate confessor – plus many other visions of human life striving for freedom.

There is, however, a significant restriction in *whose* freedom liberals cherish. Their support does not automatically extend to individuals acting in solidarity with each other. Liberals have, for example, been generally sceptical of (or – depending on time and circumstance – critical towards/totally against/enraged by …) the freedom of workers to organize themselves in unions. Sometimes, this principled stance against organized labour makes it difficult to see any difference between the two dominant 'bourgeois' ideologies: conservatism and liberalism. Their respective emotional flavours are, nevertheless, different. Conservatives are at heart pessimists; to be crude one may say that they at best look forward towards their future Christian release from this degenerate world. Liberals, on the other hand, see immediate social benefits to be within reach for all, if only the fetters limiting vital aspects of individual freedom are removed.[439] To

438. These are the first sentences of the Introduction and of Book One of Rousseau's *Confessions* (1782, 2008); the text was originally written in the 1760s.
439. This liberal optimism is expressed by Freeden (2003) in the following way: 'liberalism entertains the idea of the open-ended development of human beings towards increasingly civilized states of existence'; p. 81.

them, there is hope as long as there is life and debate, even if stupidity all too often puts obstacles on the road to a better existence. Optimism, belief in rationality, and opposition to unjustified limits on individual freedom, are thus what characterizes liberalism.

Two spontaneous modes of reaction

From this brief description, one can understand what constitutes liberalism's fundamental moral and political conundrum, namely: How should a Natural Man – let us call him or her '*I*' – relate to others?

It is obvious, already from Locke, that *I* do not have the right to let my freedom harm others. It is also easy to understand how *I* ought to relate to those that are similar to me: they should be given the same freedom as me, and thereby we may engage in healthy competition.[440]

But how should *I* behave towards all those humans that are *not* like me? They may be uneducated, sick, 'ignorant natives', drunkards, paedophiles, or poor, lazy, or suffering from PKU, or …; the list can be made arbitrarily long, since Natural Man is problematically multiform when it comes to concrete details. What responsibility do *I* have towards all those individuals that are not like me?

Obviously, the answer depends on what constitutes the ultimate cause of the difference. Is the difference self-inflicted, an effect of insufficient education, or due to a whim of God? My responsibility to help others undoubtedly seems much more limited if their problems are due to personal moral weaknesses rather than to factors beyond their individual control.

Thus, questions of what causes human misfortunes always underlie liberalism's moral and political positions. *Why* humans differ turns out to determine the kind of policies towards others that liberals want to prescribe.[441]

This means that information about the causes of human variation is of great interest to liberals, but their reactions to such knowledge is often spontaneous. A range of diverging responses may therefore follow from any particular genetic result. Still, they can normally be sorted

440. The word 'healthy' is so commonly used in this context that the underlying biological/medical metaphor is rarely noticed.

441. The question asked in 1754 by the Academy in Dijon, 'What is the origin of the inequality among men, and is it authorized by the natural law?', can be seen as an early attempt to formulate this conundrum; see the discussion of how Rousseau answered it in note 400 in Chapter 9.

into either of two broad groups; these are dissimilar but not necessarily antithetical.

The first mode of response is quite obvious: it wishes to free humans from unnecessary constrains that limit our development. I will call this mode of reaction 'liberating liberalism'. The second mode of response follows from the rationality with which liberalism wishes humans to conduct our affairs. We should not be bound by unnecessary restrictions originating from tradition, religion, the state, or any other kind of external authority; we should make our decisions as autonomously as possible – that is, as *rationally* as we are capable of. I will call this mode of reaction 'rational liberalism'. It closely parallels liberalism's basic view of how the economy should function, since the market logic that liberalism promotes has rational deliberations at its core.

Important conflicts have developed between these two modes of response to genetics, as I will analyse later in this chapter. However, before these tensions are discussed, I wish to characterize the modes somewhat further. I do so with a handful of examples, where my focus is on the original responses as such and not on the debates they have engendered. My examples come from a range of social phenomena, illustrating the wide variety of settings in which interactions may arise between new genetic facts about inheritance and an all-encompassing political ideology.

Liberating liberalism and genetics

Locke and Rousseau may have been important for the origin of liberal thought, but John Stuart Mill's role was even greater. Let us look at a key passage in his *Autobiography*, written towards the end of his life and published in 1873, one year after his death.

Fighting class prejudices in education

> I have long felt that the prevailing tendency to regard all the marked distinctions of human character as innate, and in the main indelible … is one of the chief hindrances to the rational treatment of great social questions and one of the greatest stumbling blocks to human improvement.[442]

According to Mill, the obsession with what is 'innate' comes easily to conservatives and to the lazy, and must be strongly rebutted:

442. This and the following two quotes come from Mill (1873, 1989), p. 203.

> … it is a tendency so agreeable to human indolence, as well as to conservative interests generally, that unless attacked at the very root, it is sure to be carried to even a greater length than is really justified by the more moderate forms of the intuitional philosophy.

Fortunately, the struggle against a spontaneous assumption about innateness can be based on facts, since it ignores:

> …the irresistible proofs that by far the greater part of those differences, whether between individuals, races, or sexes, are such as not only might – but naturally would – be produced by differences in circumstances.[443]

This is a beautiful example of liberating liberalism. Mill objects to the conservative standpoint that ascribes human differences, not to external circumstances but to heredity, which would make them difficult to eradicate. Only by breaking with this unfounded preconception will social improvement become possible.

Mill notes that such misinterpreted differences often exist in association with race and sex, but his concern here is how the nation's schooling system disfavours children from the lower classes. The most urgent task for a socially conscious liberal – if only to avoid a violent revolution – is therefore to fight for an educational system where every child is given a fair chance to develop herself/himself.[444] The family's status – neither their wealth nor the divide between town and country – should play a role for a child's upbringing. A liberating liberalism must react against every kind of unfairness.

It is fascinating to see the similarity to the liberal response some eighty years later. What has changed is that it now can garnish itself with support from scientific genetics.

In 1957 a newspaper polemic erupted in Sweden over a planned reform of the country's schooling system; it involved the liberal *Dagens Nyheter* and the conservative *Svenska Dagbladet*. The conservatives considered that insufficient attention was paid in the reform to the natural differences that existed between children. For the pugnacious editor of *Dagens Nyheter* this was race-biological rubbish that should not influence politics:

> Essential is that the ideas – or better expressed: the prejudices – about inborn differences in aptitude between the social classes … are completely wiped out.

443. To improve readability, I have added two dashes to the quote.

444. Mill had outlined his arguments for 'universal education' a few pages earlier, see Mill (1873, 1989), p. 175.

And he quoted support from the professor of genetics in Stockholm, Gert Bonnier, who did not believe that 'different social classes or different races have different [inherent] levels of intelligence'.[445]

This diatribe became the starting point for a surge of articles on the relevance of nature-nurture studies for the reform of the Swedish school system, which I will not explore here. The important observation for us is instead the visceral reaction shown by liberating liberalism to (quasi-) biological arguments to restrict access to education for children (presumed less talented) from lower social strata. Also, how easily modern genetics could be mobilized – by liberals – *against* biologistic arguments.

Against racial oppression

Following its strong reaction against Nazism (and with a proud past of having contributed to the abolition of slavery), liberating liberalism turned after the Second World War against other remnants of oppression due to 'race, colour and creed'. This response took many forms. Most prominent was *The Universal Declaration of Human Rights*, adopted by the United Nations in December 1948. Liberating liberalism dominated the push for the declaration, even though support also came from a broad range of ideological principles (often functioning as screens for different national interests). For the first time in history, it was globally proclaimed that 'All humans are born free and equal in dignity and rights.'

Not all anthropologists and geneticists were happy with this expression. The academic world that for a long time had harboured scientists devoted to race biology did not change overnight just because the war against the Nazis had been won. The United Nations Educational, Scientific and Cultural Organization, UNESCO, got itself embroiled with expert committees that tried to clarify the exact meaning of the concept of race – with no great success.[446] New ways of thinking confronted old, and fragile agreements over 'facts' had to be verbally constructed. Personal animosities between the discussants turned bitter. What united the academics involved was, however, their feeling that politicians (and social

445. The editor, Herbert Tingsten, had been a friend of the, by then deceased, professor of human genetics in Uppsala, Gunnar Dahlberg, whose book *Race, Reason and Rubbish* was discussed in the chapter on Nazism. Tingsten's leading articles were printed in *Dagens Nyheter* on 17 and 19 December 1957.

446. The different statements on race are available at UNESCO's website; for printed versions, see Montagu (1972). For a background to the committees' discussions, see e.g. Müller-Wille (2007) and Brattain (2007).

scientists) should not be allowed to run away with half-baked statements about human nature. According to these experts in physical anthropology and genetics, such matters belonged to *their* part of the playing field – even if this was almost the only thing they could agree upon.

A few years later – after a substantial reorganization of race research in anthropology and biology – a closer relationship developed between liberating liberalism and modern genetics.[447] Their agendas often overlapped, even though their backgrounds were different. While liberating liberals reacted against ideas restricting the freedom of individuals, professional geneticists reacted against over-simplified interpretations of genetic results.

The liberals' reaction was obvious, while the geneticists' agenda was more subtle. They wished to teach the outside world how very little is understood when something is deemed 'genetic'. They noticed – all too often – a tendency among the public to regard as important whether something was genetic or not, something which for the geneticists represented a misreading of genetic knowledge. To them, finding a genetic component in the causality of a trait implied the *beginning* of a problem, not its culminating conclusion; moreover, it did not constitute any reliable base for social recommendations.[448]

An illustration of the close relationship that had evolved between liberating liberalism and modern genetics is provided by the Stanford population geneticists Walter Bodmer and Luca Cavalli-Sforza and their response to Arthur Jensen's writings on IQ and race.[449] In a much-read article published in 1970 in *Scientific American*, they combined the two elements, genetics and liberating liberalism. Here they reach, on the one hand, an agnostic conclusion about the existence of genetic differences in intelligence between Whites and Blacks in the USA; according to them,

447. The re-figuring of race in the English-speaking academic world in the decades around the Second World War is described by, among others, Barkan (1992), Tucker (1994) and Bangham (2020).

448. Not every geneticist followed this development. Opposition to liberating liberalism came, for example, from the British cytogeneticist Cyril Darlington; see Darlington (1943 and 1969). With respect to studies on IQ and inheritance, one can note that Francis Crick, Cyril Darlington and Jacques Monod among others signed a petition in *The American Psychologist* supporting such research (see Page et al., 1972), but that the large majority of the classical geneticists abstained from doing so.

449. Bodmer & Cavalli-Sforza (1970). Bodmer soon afterwards returned to the UK and a professorship in genetics at Oxford University, where I was his graduate student 1970–74.

this is a question that cannot be empirically determined (for methodological reasons that they carefully outline). On the other hand, they explode in a defence of liberating liberalism:

> Our society professes to believe there should be no discrimination against an individual on the basis of race, religion or other a priori categorizations, including sex. Our accepted ethic holds that each individual should be given equal and maximum opportunity, according to his or her needs, to develop to his or her fullest potential.

And they continue:

> Surely innate differences in ability and other individual variations should be taken into account by our educational system. These differences must, however, be judged on the basis of the individual and not on the basis of race.[450]

The combination of aims between modern population genetics and individual-centred liberating liberalism could not be more clearly expressed than so.

Gender trouble

Thus, liberating liberalism has sided with genetics to debunk ideas of innate differences justifying class or racial oppression. My third example concerns sex determination. Here, the response by liberating liberalism emerged directly from a genetic insight.

In 1986 – mid-way between the Olympic Games in Los Angeles and those in Seoul – the Finnish-American human geneticist Albert de la Chapelle published an article about 'gender verification' in sport in the *Journal of the American Medical Association* (JAMA). He was critical of the lack of precise aims for such verification and the poor procedures used for this purpose. The standard methodology (based on sex chromatin screening) was imperfect since it occasionally excluded women who because of a particular kind of mutation did not exhibit the expected sex chromatin profile – but without therefore being men. De la Chapelle's conclusion was straightforward: 'Thus, the present screening method is both inaccurate and discriminatory.'[451] I see his conclusion as an example of how liberating liberalism – with its wish to avoid being discriminatory – by the end of the twentieth century could reside within human genetics itself.

450. Bodmer & Cavalli-Sforza (1970), both quotes from p. 29.

451. De la Chapelle (1986), p. 1920; his critique was supported by many human geneticists the world over.

An illuminating sequel to this response was provided by two subsequent events. They illustrate what often happens with the verbal interventions of liberating liberalism. In November 2018, an editorial in the scientific journal *Nature* – known since the days of Darwin for its liberal principles – continued de la Chapelle's theme with the following statement about transgender individuals:

> Political attempts to pigeonhole people have nothing to do with science and everything to do with stripping away rights and recognition from those whose identity does not correspond with outdated ideas of sex and gender.[452]

One might think that the question had been settled by now, with science coming out in favour of a non-binary view of sex/gender. But such issues *never* die. In February 2021, Representative Marjorie Taylor Greene hung up a poster in the US Congress (where she was in personal conflict with another member) saying[453]

> There are TWO genders:
> MALE & FEMALE
> 'Trust the Science!'

This event illustrates not only the depth of prejudice that liberal liberalism has to fight against, but also the tendency for such views to reappear again and again, while constantly claiming support from a presumably trustworthy source such as science.

I have used these examples to illustrate the most prominent way for the liberal ideology to react to genetic results. Liberating liberalism uses verbal public interventions in a wish to eradicate unfairness due to false biological presuppositions. Now for the other liberal mode of responding to human differences; it is more noticeable in actions than in words.

Rational liberalism and genetics

While proclamatory statements come naturally to liberating liberalism, rational liberalism is normally expressed in other ways. Liberalism is not just a machine for turning out anti-conservative views; it is a political ideology wishing to change society – and often succeeding in doing so.

---

452. *Nature* (2018).
453. See, e.g., *Washington Post*, 25 February 2021.

Human differences and the division of labour

To understand this mode of response, it is useful once more to go back in history, this time to Adam Smith, the Scottish Enlightenment philosopher and economist. His book on *The Wealth of Nations* is an impressive piece of work that, despite its stress on the division of labour, does not say what one might have expected it to say, namely that individuals are born unequal. Instead, Smith claims the reverse:

> The difference of natural talents in different men is, in reality, much less than we are aware of; … The difference between the most dissimilar characters, between a philosopher and a common street porter, for example, seems to arise not so much from nature as from habit, custom, and education.

At birth, individuals are 'much alike', but with time they will be 'employed in very different occupations.' Their difference thereby 'widens by degrees' until 'scarce any resemblance' would be acknowledged by 'the vanity of the philosopher'.[454] By then, these differences also have become potentially *useful*. Compare with dogs, Smith writes: Among them, there are breeds capable of doing different tasks; they are, however, incapable of acting in consort. The situation in humans is much better since here,

> … the most dissimilar geniuses are of use to one another; the different produces of their respective talents, by the general disposition to truck, barter, and exchange, being brought, as it were, into a common stock, where every man may purchase whatever part of the produce of the other men's talents he has occasion for.[455]

Again, a wonderfully clear statement. Adam Smith shows himself to be a true liberal, who – unlike the conservative 'philosopher' he refers to – does not believe in important inborn differences between humans. He rejoices, however, over the variation in talents that differences in education and family conditions bring about, since every individual would otherwise need to procure 'to himself every necessity and conveniency of life which he wanted'.[456] Such unproductive situations are avoided when a social division of labour can be organized, to great benefit for all.

---

454. All quotes come from Smith (1776, 1999), p. 120. The first edition of the work was published in 1776; I have used a reprint (1999) of the fifth edition which was published in 1789, the year of the French Revolution. Smith's view on the role of the environment in enhancing originally small differences between individuals closely follows Rousseau's response to the question from the Academy in Dijon; see note 441 above and note 400 in Chapter 9.

455. Smith (1776, 1999), p. 121.

456. Smith (1776, 1999), p. 120.

Thus, we live in a world where adult humans differ in many interesting ways, among which talent is one. It would be unreasonable not to take such variation into account when thinking about the economy, but differences in talents should also be reckoned with when one sets out to organize society in a liberal-compatible way. It is this ambition of rational liberalism to *use* knowledge that has been its major mode of reaction to new genetic results about human differences. Human beings need to use each other, and every individual should be free to act on the encountered diversity of humankind, as long as no harm is caused by that.

When describing liberating liberalism, I discussed its verbal responses about differences related to education, race and sex. To illustrate rational liberalism, it is more natural to turn instead to *actions*. I will give three examples of rational-liberal responses to genetics: the development of scientific measures of human merit, the evolution of new ways to relate to genetic diseases and attempts to commercialize genetic information.

Judging merit with IQ tests

A *sine qua non* for all liberal use of human differences is that these can be objectively ascertained. One should always be sceptical towards one's own spontaneous judgements since they may be influenced by common prejudices; fair and unbiased measurements are therefore called for. Only when such methods are available can the diversity of humankind be safely and rationally approached. The development of IQ tests to measure personal merit may thus be seen as an answer to one of rational liberalism's deepest needs.[457]

The American historian John Carson has described how post-revolutionary French and American societies responded to the rush of objectifying the notion of merit and thereby securing it for use.[458] In both countries it was an important endeavour, but their responses differed because of dissimilar cultural and political starting positions. In France, the nationally organized school system relied on exams to identify pupils worthy of further education. Psychometric investigations were tried but were mainly used for other purposes. Hence, the aim for the neurologist Alfred Binet

457. Measuring 'ability' can also be seen to follow from Galton's interest in positioning as many human traits as possible on quantitative scales; see Chapter 3 above.
458. Carson (2007).

when developing tests for intelligence was to find ways to sort children with various mental handicaps into relevant regimes of care.[459]

In the USA, on the other hand, aptitude tests were commonly used for classifying children within the much less centralized schooling system, and later – during the First World War – for channelling conscripts into suitable army tasks. Binet's test was reworked into a test of general intelligence for mass use. It came to totally dominate the scene, first in the US, later in Britain and the world at large.

The IQ test is a remarkable invention.[460] It claims to position individuals on a one-dimensional scale of 'ability', a claim based on advanced statistical methods and a rather special psychological theory about the organization of the human mind. Basically, this theory says that there is something 'general' involved in how individuals respond to tasks of various kinds (related to verbal, numerical, visual and other skills), and that this propensity is a good measure of the individuals' overall functional ability and social merit. Extracting this general propensity from empirical data is not easy but can be done with lots of tests and some non-trivial statistics.

Such scores give every tested individual a single IQ value and thus seem made to be aggregated. Scientifically precise comparisons could now be performed, not only between individuals but between groups, for example between black and white children; this supposedly said something about their intrinsic difference in merit. IQ values could, in addition, be processed with methods of quantitative genetics to assess the trait's heritability (using the tools that I discussed in the preceding chapter). Since almost all analyses resulted in a positive correlation between the IQ-values of relatives, the standard conclusion was that IQ was an inborn predisposition. Earlier – in the nineteenth century – such a result would have left at least some space open for the improving effects of education and better morals, i.e. to Lamarckism. However, with the hard genes posited by Mendelism, heritable differences became absolute and not amenable to environmental change. Measured differences in ability therefore came to imply *essential* differences – between individuals, as

459. Gould (1981) gives a sympathetic description of Binet and writes that his aim 'was to identify in order to help and improve, not to label in order to limit. Some children might be innately incapable of normal achievement, but all could improve with special help.' (p. 152).

460. The 'IQ test' is in fact a family of tests and test procedures. The details involved are, however, not important in the present context.

well as between groups of individuals, for example those belonging to different 'races'.

These developments in the theory and application of IQ tests took place under a strong conviction that the research involved was scientifically motivated and ideologically unbiased.[461] The endeavour was felt to be of great social importance due to how *usable* the results were. A 1999 textbook claims, for example, that 'ability tests are extremely useful in applied psychology, where they are estimated to have saved firms literally billions of dollars through allowing them to select applicants with the greatest potential for success'.[462]

Thus, from about the mid-twentieth century, the wish to have a scientific and unbiased measure of differences in talents was seen by many liberals as having been achieved – albeit at the price of having completely reversed Adam Smith's view on human diversity. The liberal insistence on a rational approach towards others had – by a historical irony – led to situation characterized by a belief in important and essential differences between humans that could be acted upon. In a few pages, I will return to the conflicts this belief generated *vis-à-vis* those liberals who promoted the liberating dimension of liberalism. Let me first give two further examples of social phenomena affected by rational liberalism.

Living – rationally – with risks

In its ambition to favour interventions unconstrained by old prejudices, rational liberalism has manifested itself in many other ways than through supposedly objective methods of measuring talent. The ideology's wish to promote autonomous, rational behaviour has also influenced its responses to sensitive phenomena such as family-linked diseases.

For most conservatives, the way to react to heritable diseases is clear: One must try to save the future of humankind by preventing, by whatever method necessary, the spread of unfavourable genes to subsequent generations.[463]

---

461. For a summary of what the proponents of the IQ research community considered their most important results, see the manifesto 'Mainstream Science on Intelligence' (reprinted in Gottfredson, 1997).
462. Cooper (1999), p. 3. Cooper bases this claim on another source, but he uses it in his book to advertise the importance of a psychology of ability.
463. Unless such interventions run counter to the will of God. See the discussion on this in Chapter 5 above.

For liberals, matters become more complicated. Before genetics, the natural and socially expected response to heritable diseases was to accept them in subservience to fate. Powerlessness was complete and this coloured the response of affected individuals and their families. When the genetics behind many diseases began to be comprehended, new possibilities for actions and reactions started to emerge. Rational liberalism did not explicitly prescribe what to do. Still, it provided an intellectual and emotional framework for how to act on the received information.

Two American volumes on Huntington's disease illustrate how the increase in genetic knowledge, combined with a modern rational thought-mode, have changed how families approach this very sensitive situation.[464] In his *Bound for Glory* from 1943, the left-wing songwriter Woody Guthrie describes the mental decline, and death, of his mother from Huntington's disease in a situation where shame and sorrow were the only ways by which the family could respond. The possibility that the author himself might succumb to the affliction is not openly discussed in the book.[465]

When the historian Alice Wexler's mother was diagnosed with Huntington's in the 1960s, the situation was very different from that of the Guthrie family in the 1920s – economically, socially and with respect to what was known about the disease.[466] The reactions of the Wexler family members were correspondingly different. Alice Wexler's father, the Hollywood psychiatrist Milton Wexler, started a national campaign to support research about the disease. Her younger sister Nancy became a clinical psychologist and a co-author of the article that localized the culprit gene in the tip of chromosome 4; she later continued as an administrator and organizer of activities supporting families with diseased members. And then there was Alice Wexler, who among many other things wrote a very readable book about her mother and family, the disease, and the road to finding the disease gene – but also about the complex senti-

464. Huntington's disease, earlier called Huntington's chorea, is a dominant genetic affliction producing its symptoms relatively late in life. This implies that someone may well have had children before being diagnosed with the disease; the risk of contracting the disease is then 50% for every such child. The symptoms include uncontrollable movements (chorea), alongside cognitive problems and emotional/behavioural changes such as mood swings, irritability, depression, and social withdrawal. Symptoms may worsen over time and patients require around-the-clock care.

465. Guthrie (1943). Woody Guthrie did indeed get the disease and died in 1967 from associated complications.

466. Wexler (1995).

ments that come with 'being at risk'. In *Mapping Fate*, the reader can follow her deliberations about whether she should take a DNA test to learn whether she carries the disease-causing gene variant or not.

Families with Huntington have always been deeply affected by the disease. What the Guthrie and Wexler family stories illustrate is how many new questions the disease gives rise to today. There are so many decisions to be made, so many meetings to be organized, so much money to be collected, so many rational deliberations to ponder. Resolute responses are expected at every step, even when they concern deep existential matters. Alice Wexler writes that her sister Nancy carries a need 'to feel she was taking action', while she herself wants to destroy the cult of silence that so often becomes a part of the life of families with hereditary diseases.[467]

It would be wrong, however, to believe that such actions are easily performed. When knowledge changes, so do the external factors influencing expectations. With respect to the question of testing, Alice notes for example that

> … the media, and sometimes the doctors and counsellors who administered the test, engaged in subtle psychological pressure, portraying those who took the test as somehow stronger, braver, more optimistic, more 'normal' than those of us who chose not to know.[468]

Thus, an individual who wants to react with freedom to his or her unique personal situation is met with new social expectations insisting on being considered. Free, truly autonomous, reactions are rarely possible. Just as liberating liberalism finds it difficult to reach its goal via verbal interventions alone, rational liberalism finds it difficult to keep its deliberations free from external influences.

The last quote also illustrates how the increase in scientific knowledge about Huntington has given rise to a new world of advice and support to genetically affected individuals and their families. This phenomenon became even more pronounced after Mary-Claire King's research group in 1990 had identified the first 'breast cancer gene' (*BRCA1*) – a truly momentous event.[469]

From then on, various 'risk-genes' have been discovered at an increasing rate. *BRCA1* was followed by *BRCA2* and a multitude of other genetic

467. Wexler (1995), pp. xviii and 114.
468. Wexler (1995), p. 235.
469. Hall et al. (1990).

factors affecting the probability of developing breast cancer. Soon, gene variants for colorectal cancers became known, and from then on for every disease with at least some heritable component (more on this in the next chapter where genomic information is discussed). Every healthy individual in society today must consider the risk that he or she has of developing diabetes, high blood pressure, obesity, schizophrenia, dementia… Enlightened living has become synonymous with constantly managing probabilities for mortal illnesses. These considerations imply a stress on individual, autonomous choice, which is why I range them among the responses of rational liberalism to genetic results.

Freedom via consumer genetics

No subtle analytical problems are associated with my final illustration of how rational liberalism interacts with new genetic facts: Genetic information can be used to make money – potentially lots of money. It is as simple as that. If I previously discussed liberal approaches that take an interest in human beings as workers, as family members or – at the limit – as one's own bodily self, humans are here considered as *consumers*. Only two brief examples are needed.

The first example of genetic differences leading to profit-generating practices is nasty, though remarkably little discussed. It concerns how genetic information is used to make possible selective abortions of unwanted female foetuses. According to the United Nations Population Fund, this practice is one of the causes why the world today 'misses' more than 140 million women.[470]

It is hardly relevant to discuss the choices made by the pregnant women involved, since only rarely will they be in a situation where they can decide according to their own autonomous will. Instead, one should consider the system involved – the numerous facilitators, physicians, technicians, laboratories and clinics enrolled in the abortions. I have not seen any economic estimates, but it seems likely that we are dealing here with a billion-dollar business sector. Its functioning is very simple from our analytical viewpoint: A technical service is provided to families that are prepared to pay to reduce their social worries about having an unwanted female child. At the centre is a recognizable genetic difference – a foetus with or without a Y chromosome – easily detectable by those with proper technical proficiency. The rational liberal reaction is shown by

470. See https://www.unfpa.org/gender-biased-sex-selection (accessed 1 February 2022).

those involved in providing the service. We have here an explicit example of what it means to let the scientific knowledge of human beings come to direct social and economically profitable use.

The second example is a comic farce in comparison, but an instructive farce.

In spring 2002, the British cosmetic chain Body Shop launched a campaign promoting a test from a company called Sciona.[471] It claimed that, with a DNA test, it could advise customers about what they ought to eat. Just pay, send a mouth-swab to the testing company, and the dietary advice would soon appear in your letterbox, was the message.[472]

I cannot now recall where and when I stumbled upon this campaign, but I remember that I entered one of the shops and asked to see information about the test. I found it to be pretty harmless snake oil stuff. Someone was trying to earn money by selling a next to worthless (though not distinctly harmful) product to people who felt uncertain about their bodies and lives. The information they would receive after the swabbing and testing would, of course, not inform them about anything of genuine value.[473]

Thankfully, some of Body Shop's biggest retailers objected to the campaign, and by the summer of 2002 the company stopped selling the test.[474] It was a commercial flop, but it was indicative of what would come later. On the one hand, it showed that there is a huge market in selling genetic information to consumers and, if it is pitched the right way, many are willing to pay. On the other hand, it also showed some of the complications that such tests are associated with: How should their quality be assessed and controlled, and by whom? Who should own the right to the information obtained? And should the various individuals' DNA, now in the hands of Sciona, be free for the company to use for other purposes? The situation also raised concerns about how potentially sensitive genetic information should be communicated to tested individuals – and what about the relatives implicitly involved, but not informed, about the tests being made?

---

471. See *GeneWatch*: http://www.genewatch.org/sub-425647 (accessed 17 October 2021).
472. The company labelled this advice to the individual 'BodyBenefitsTM'; see Roberts & Grimaldi (2003).
473. An Editorial in *Nature Genetics* summarized the verdict: 'To call the predictive value of such tests uncertain and premature would be an understatement.' See *Nature Genetics* (2002).
474. According to the *GeneWatch* website referred to above.

In my next chapter, I will write more about DNA tests and their commercial implications. In the present context, let me just conclude with the recognition that the use of genetic information about others for profit-making purposes comes naturally in present-day society. Such initiatives are – at least in principle – considered entrepreneurial and conforming to the ideas and ideals of rational liberalism.

Fights all over the place

To summarize: For liberating liberalism, genetic differences between humans are of little importance, and stressing such differences is dangerous since it may strengthen liberty-limiting prejudices. For rational liberalism, on the other hand, the world is to be freely acted upon by energetic and enterprising individuals for what in the end will be to the benefit of all. If this implies accepting scientifically certified differences between humans, so be it.

The contradictions between these two spontaneous modes of responding to genetic results became increasingly noticeable after the Second World War. As discussed in the preceding chapter, all aspects of human differences then came up for review, in particular when they concerned political matters, Strong conflicts were played out in the media. These within-liberalism fights are what people today generally remember when asked about political conflicts over genetics. Their exact details are of less interest to us here than is the logic according to which they developed.

Unresolved liberal contradictions

One would expect that differences *between* ideologies would underlie most debates over genetics – as was the case with Lysenkoism in the 1940s and '50s. But the long-established ideologies analysed here are such solid intellectual and emotional constructs that they only rarely come into more than stylized skirmishes with each another. Their general differences in values and world views are so great that their divergent evaluations of genetic results usually do not play a role in their debates.

Still, matters are not the same when it comes to conflicts *within* ideologies. Different views of, for example 'human nature' may easily turn acrimonious among people who think similarly (or at least believe they do so). In earlier chapters we have encountered severe debates over genetically related issues among both conservatives, social democrats and communists. Thus, it is not surprising to find such conflicts among liberals, too.

While it is important to recognize the constitutive nature of these disagreements, it is important not to overdramatize their significance. True – genetic questions are important to liberals, but this does not imply that they thereby become existentially decisive. As far as I know, no liberal party has split because of disagreements over genetics. Liberals are used to internal conflicts – they arise more or less automatically within their ideology – and liberals are, in general, efficient at handling them. I therefore end this section on interactions between liberating and rational liberalism with a closer look at two important conflict-avoiding strategies used by liberals in potentially tricky situations involving genetics.

All against socialists

The easiest way to respond to a conflict among friends is to transfer the cause of the conflict to some actor(s) outside one's group. In accordance with this logic, a common reaction among liberals to differences over genetics has been to project the associated intellectual unease on to other targets – in other words, to rely on the age-old strategy of seeking unity among quarrelling friends by blaming their conflict on some external enemy.

If in earlier days the conservatives were the arch-enemies of the liberals, today, nothing comes more easily to a liberal than ascribing all faulty thinking to socialists, the worst of which are the Marxists. We find here the reason why what I have shown in the analysis above, namely that liberals have reacted in contradictory ways to genetics and thereby come into conflict with one another, has rarely been acknowledged as a fact. Instead, a belief has been promoted that the natural enemy of liberalism in heated debates over genetics during the last fifty-sixty years has been socialism/communism.

This is obviously wrong. If any long-term intellectual divide is to be identified in views on genetics, it does not run between liberals and socialists but between the historical Left and the historical Right. To the Left would then belong the radical parts of the liberals plus socialists of all kinds, while the conservatives and the more economically minded liberals would make up the Right. In other words: this divide splits the liberal ideology in two.

Still, the intellectual landscape after the Second World War has rarely been depicted this way. Those on the Right, in particular, have found it advantageous to attack their intellectual adversaries as socialists rather than as representatives of an alternative version of liberalism. An illustration of this sleight of hand is given by the strange fate that befell the French population geneticist Albert Jacquard.[475]

Jacquard had come to genetics via an unusual route. Well trained in mathematics at the prestigious École Polytechnique, he obtained a secure employment early in life as a high functionary of the French state. After a misguided suggestion as to how the country's hospital system should be reformed (his suggestion was far too rational), he was removed to the nation's demographic institute (*L'Institut national d'études démographiques*, INED) where he joined a small unit devoted to genetics. Then, at the beginning of the '70s, Jacquard was asked to evaluate the effect of genetic differences in IQ among children in the national school system. He reached the conclusion that that there was no reason to worry about heritable differences between the children but many reasons to worry about the schooling system as such. Interesting and provoking. Soon, he would be nationally known for his charismatic personality and many media interventions.

We now come to the point of my story. At about the same time, the major French newspaper *Le Figaro* put its weekly magazine into the hands of a group of right-wing intellectuals (constituting the kernel of *La Nouvelle Droite* [The New Right]). As a publicity stunt, they formed a 'club for reflection' whose goal was to hand out a yearly prize of infamy called The Lysenko Prize. The recipient had to be someone who was misleading the public with false scientific claims. In 1990, when the prize was launched to extensive media attention, Albert Jacquard was one of its two recipients.[476]

This decision was incorrect as well as unfair. Jacquard was an excellent populariser of genetics, knowledgeable in the field, and someone who had not shown any noticeable interest in either Lysenko or communism (unlike many others of his generation in France). Handing him a prize in the name of Lysenko was an insult and an instance of pure intellectual spite. It was also deeply misleading. Jacquard's views on inheritance, children, schooling and human dignity were quintessentially liberal – or

475. The following description is primarily based on Jacquard (1989). In 1973–74, Jacquard was my host at INED when I lived in Paris while writing my thesis.

476. See http://www.clubdelhorloge.fr/index.php?option=com_content&view=article&id=59:prix-lyssenko-1990-albert-jacquard&catid=19:prix-lyssenko (accessed 2 November 2021).

perhaps more accurately, left-liberal – and never anything else.[477] The story is informative, however, about the crudity with which arguments concerning genetics and geneticists came to be flung about in the dramatic decades after 1968. It shows a typical attempt by some right-wing activists to try to remove key ideas from the liberal ideology by labelling them as Marxist.

What happened to Albert Jacquard was not unique. In the English-speaking world, the criticism of biological determinism raised by scientists such as Steven Rose, Leon Kamin and Richard Lewontin was similarly often referred to as Marxist and attacked as such.[478] This is understandable from the fact that these authors, at least at some time in their lives, labelled themselves as Marxists, but again ideologically misleading. Their arguments over the interpretation of genetic differences belonged to the tradition of the anti-conservative liberal Left and had next to nothing to do with Marxism as such.

Making differences cultural, not genetic

A second method for liberals to downplay their internal conflicts over genetics has been to avoid genes and genetics as *explicit* subjects for discussion and thereby try to hide the source of contentious reactions. When I described the early post-war period in the preceding chapter, I mentioned that many ideas from then on had to be expressed in new terms to avoid their being considered as Nazi-tainted. In general, this meant that the old vocabulary of eugenics and race biology was unworkable. Thus, arguments based on the logic of 'this group of humans have these genes and that group have those genes, and therefore…' could not be used any more – at least not by liberals. New terms and new linguistic approaches had to be found.[479]

From this situation followed a most noteworthy fact, namely that the word 'gene' largely disappeared from political discourse, in particular that concerning immigration. The avoidance of explicit references to genetic differences was effectuated by a semantic switchover: differences between

---

477. Later in life, Jacquard became a social activist in the vein of Abbé Pierre (the originator of the Emmaus movement). He increasingly associated himself with his childhood's Christian values though remaining an atheist (Jacquard, 2012, pp. 24-29).

478. This applies for example to responses to their jointly published book, *Not in Our Genes*; see Rose, Kamin & Lewontin (1984).

479. The heritability concept, based on many assumed gene differences of very small individual effects, seemed more harmless and more 'scientific' and could therefore be used in arguments – though its use was seen as highly suspicious by more left-oriented liberals.

human groups were instead posited to exist in the *cultural* sphere. Thus, the strong biologization that had started in the nineteenth century lost its attraction after 1945 and its socially explanatory function was gradually taken over – at least at the surface level – by ethnological arguments.

It is interesting to see how the early ordo- and neo-liberal thinkers from the very start understood that Nazi-tainted words and notions could not be used – and this in spite of the fact that their elitism and concentration on the pre-eminence of the West over other parts of the world closely paralleled the classical views of eugenics and race biology. Typically, one finds in Friedrich Hayek's fundamental *The Road to Serfdom* from 1944 no explicit mention of genes or eugenics, but a strongly pronounced high opinion of 'Western civilization'.[480] Similarly, the Statement of Aims for the first meeting of liberal economists, historians and philosophers, organized by Hayek at Mont Pèlerin in 1947 talks about 'Western Man' but does not contain any obvious references to biological race differences. Thus, the task of distancing 'others' from 'us' was treated as belonging to the cultural and not the biological sphere.[481]

This replacement of genes by culture in the liberal discourse found its paradigmatic expression in a televised interview that Margaret Thatcher gave in spring 1978. As newly elected leader of the Conservative Party in Britain, she was at the time preparing for an upcoming election (which resulted in her becoming Prime Minister). One of her acute problems was to counter the spread of a newly founded anti-immigration movement (The National Front); she had therefore carefully worked out how she should express herself when asked about immigration. She started by quoting data claiming that there would soon be four million people from Pakistan/Bangladesh living in Britain, and from this she concluded:

> Now, this is an awful lot and I think it means that people are really rather afraid that this country might be rather swamped by people with a different culture …[482]

And she continued:

480. See, for example, Hayek (1944), p. 67. Ordoliberalism is a German variant of economic liberalism that emphasizes the need for government to ensure that the free market produces results close to its theoretical potential.
481. For more on the racial views among the early neoliberals, see Slobodian (2018). Biebricher (2011) discusses the biopolitics of the influential ordo-liberal economists Wilhelm Röpke and Alexander Rüstow. For the Pèlerin Society, see https://en.wikipedia.org/wiki/Mont_Pelerin_Society (accessed 22 October 2022).
482. The interview has been transcribed and is available at the Margaret Thatcher Foundation; see https://www.margaretthatcher.org/document/103485 (accessed 29 March 2022).

> The British character has done so much for democracy, for law, and done so much throughout the world, that if there is any fear that it might be swamped, [then] people are going to react and be rather hostile to those coming in.[483]

Thatcher's rhetorical skills are impressive. She talks about being 'swamped' and leads her listeners' thoughts in the biological direction. But she is careful to turn her attention to cultural differences instead and refers to 'people with a different culture'. In this way she manages to imply what she does not want to say openly: We don't particularly like these foreign people, and we certainly do not want our children marrying them.

Thatcher expressed these views as the leader of a conservative party. But she acted at the same time as a representative voice for many liberals, and she is still seen by many as a pillar of 'true' liberalism.[484] Thus, in this interview, known for the expression 'rather swamped', she outlined exactly how far liberals can go in the denigration of others without offending deeply held liberal principles: Disdaining the culture of others is OK, objecting to their genes – talking about them or even hinting at their existence – is taboo.[485]

Right-of-centre politicians knew from this time on how their policies should be pitched. All the old tropes about substantial race differences and the negative effects of race intermingling would be acceptable in modern liberal-dominated society if they were only expressed in terms of cultural, and not genetic, differences.[486]

If we retain our focus on mainline liberals, it is sufficient to conclude with a general observation: The problems caused by a science like genetics may be so severe as to transform certain topics into non-topics. They do not cease to exist, but the genetic terms involved are so tension-laden that they – whenever possible – are avoided.

---

483. For ease of understanding, I have added a comma after 'law'.

484. For the role of liberal and neo-liberal ideas in the British Conservative Party, see Dorey (2011).

485. Earlier, the British politician and professor of Greek, Enoch Powell, had tried various ways to express anti-immigrant ideas without sounding criminally racist, but had failed to find a tone acceptable to the British Establishment. See Corthorn (2019), chapter 3.

486. This modern way of using culture as a way of avoiding talking about genes is described by the French philosopher Étienne Balibar as follows: 'Ideologically, current racism … fits into a framework of "racism without races"… It is a racism whose dominant theme is not biological heredity but the insurmountability of cultural differences, a racism which, at first sight, does not postulate the superiority of certain groups or peoples in relation to others but "only" the harmfulness of abolishing frontiers, the incompatibility of life-styles and traditions…'; see Balibar (1991), p. 21.

The US Supreme Court decides

This chapter is structured in such a way that it may give the impression that liberal conflicts over genetic results only occur with respect to divergent views of human variation. If this is the case, then I have been misleading. The fundamental ideas of liberalism are so many-faceted that they lead to all kinds of conflicts when applied to concrete situations. To give a fuller description of how liberals may react to genetics I therefore conclude this chapter with an outline of a different kind of conflict. It was initiated by some important gene sequencing results and ended with an unexpected official decision.[487]

Intellectual property rights

Intellectual property rights are central to liberal thinking, even though problematic. Many liberals find it natural that inventors and entrepreneurs should be able to legally defend their unique insights and bold investments so that they can benefit financially from them. Others would claim that with true intellectual freedom everyone should be able to use existing knowledge, independent of how this knowledge has been produced. Discussions over intellectual property rights are – in effect – fundamental to liberalism. At the overriding level, this has led to the right to patents being written into the US Constitution ('to promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries.'). And, at the concrete level, to daily conflicts in special courts over the rights to specific pharmaceutical substances, to clever computer algorithms, or to a few bars of music. Society's handling of patents has become a mega-business in itself.[488]

Patenting is the standard means by which property rights are awarded to scientific and technological inventions. It is, however, a method not particularly liked by biologists. Plant breeders, for example, have developed their own global protection system, called Plant Breeders Right, to better suit the particular needs of their field. The European coun-

487. For my description of the US history of patents on human genes, I rely on the detailed description given by Jorge L. Contreras (2021). For an earlier overview of patent rights to breast cancer genes outside the USA, see Zimmeren et al. (2014).

488. '700,000 US patent applications are filed every year. This work is done by about 3,500 law firms employing roughly 50,000 patent attorneys and agents. Add to that the 10,000 examiners at the Patent Office, and you get a market worth about $8.5 billion per year.' Contreras (2021), p. 157.

tries have also been historically less inclined to grant patents to living 'things' than the US; typically, the patent granted to Harvard University in 1988 for the 'OncoMouse' – a specially developed mouse strain prone to develop cancer – was never accepted in Europe. It was in the US that the Patent Office granted the first patents on genes and other DNA sequences. Researchers at MIT estimated in 2005 that more than 4,000 human genes were covered by patents.[489]

Given this background, the surprise was therefore great when the US Supreme Court in 2013 reached the decision that patent rights should not be granted over natural human genes. The history of this decision is worth an elaboration.

Myriad's patents on BRCA1 and BRCA2

The community of academic geneticists has always been sceptical towards patents. Complex, unwritten moral rules have characterized the exchange of experimental material and results from their research, favouring – at least in principle – open communication, even when the underlying competition over resources and fame has been severe.[490] Patents have not been seen as wrong as such but have been considered as belonging to the applied side of the scientific endeavour and far from the research front striving to understand basic scientific principles.

University administrators, on the other hand, have been much more interested. In the US, they even have a formal duty to seek patents on all new research results in attempts to recoup some of the federal outlays for education and research. Among the various biotech firms created around new genetic methods and results, opinions have been divided. Some see patents as a way to keep this business sector economically vigorous; for others, patents just artificially increase the cost of doing useful science.

Given this complex background, it is not surprising that the head-on challenge of patents on genes did not come from the scientists involved in genetic research. Instead, it was initiated by the classic bastion of US liberal consciousness, the American Civil Liberties Union (ACLU). It is well known from its actions against racial discrimination and for its many well-organized fights to promote the liberty of speech. In his book, *The Genome Defense*, Jorge L. Contreras, law professor at the University

489. Quoted from Contreras (2021), p. 75.
490. For the extension of this professional moral to the handling of DNA sequence information, see the description of 'The Bermuda Principles' in Contreras (2021), pp. 30–31.

of Utah, describes how the ACLU in 2005 decided to tackle the question of gene patents (a decision not easily made since the ACLU lacked biological expertise as well as patent law experience). It built a coalition of partners to help in the fight and succeeded in mobilizing an impressive number of well-known scientists (including some Nobel Prize laureates) and cultural personalities (including Michael Crichton of *Jurassic Park* fame), as well as an important group of professional organizations (like the American Society for Human Genetics, the American College of Medical Genetics and the Association for Molecular Pathology). The aim was to get a decision that would prevent all future patenting of natural gene sequences.

In this endeavour, ACLU had to determine which of the existing gene patents it should challenge. (They were in fact in the privileged situation of being able to choose their legal adversary.) The choice fell on Myriad Genetics, a Utah-based biotech society that owned many patents relating to the 'breast cancer genes' *BRCA1* and *BRCA2*. Based on these patents Myriad considered itself the only actor that legitimately could test for harmful mutations in these genes. By this monopoly, the company could charge a high price for its tests, with the result that many women could not afford them. Still, this was not a trivial situation of good scientific guys against bad economics guys. Originally, Mark Skolnick, cofounder of Myriad Genetics, had played an important role in identifying these genes and obtaining their DNA sequence. Likewise, the economic problems associated with the access to their tests was due more to the lack of a well-functioning health-insurance system in the US than to any unusually strong greediness on Myriad's side.

After various preliminary skirmishes in lower courts and with some interventions from the President's office, the case – which now carried the official name of *Association for Molecular Pathology (AMP)* v. *Myriad Genetics* – was heard by the Supreme Court on 15 April 2013. Less than two months later the verdict came, written by Justice Clarence Thomas. If we leave aside some of the subtleties involved, the verdict was clear: human genes are not patentable. For a court often riven by fights between liberal and conservative judges, the decision was remarkably univocal: 9 to 0 in favour of ending the granting of patents on natural genes.[491]

The effect on the biotech industry was smaller than expected (in particular compared to the horror scenarios outlined by some of the defend-

491. Supreme Court of the United States (2013). See also Zimmeren et al. (2014).

ants in the court's hearings). This reaction may be taken to indicate that neither the process of invention nor the ability to make gains from one's findings necessarily depend on patent law protection. The strongest effect of the judgement was instead a rather widespread feeling of relief. It indicated that at least some parts of life were not yet colonized by the capitalist machinery – a feeling also shared by many in favour of capitalism. It is nevertheless interesting to note the minor role that arguments in favour of 'the dignity of life' or any such metaphors based on religious or philosophical notions played in the court's deliberation. That indicates to me that the conflict, and its ultimate juridical resolution, instead grew out of contradictions within the liberal ideological sphere.

Sound and fury

Assessing how liberalism as an ideology has reacted to new genetic insights, my conclusion has been: with contradictions. One might have expected that liberals – given the long history of the ideology – would have known that genetics easily leads to controversy and conflicts, and that they therefore would tread lightly when genetic matters are approached. But – with the exception of when cultural differences are used to substitute for genetic race differences in debates about immigration (see above) – this has not been the case. Liberals have rarely missed a chance to proclaim their views on the bearing of new biological facts, be it on human variability or questions of economic importance, and even when they know that they will be contradicted.

This situation helps explain the liberal dominance over recent public debates concerning genetics, which will be further analysed in the next chapter.

11. Genetics under liberalism

A human genetics for individuals

Today, the whole world is imbued with liberal ideas. Even in non-liberal societies like China, capitalist principles structure part of the economy and bring with them elements of liberal thought. Such diffuse liberal ideas are rarely associated with specific actors – political parties or newspapers, for example – but they nevertheless constitute an important dimension of social life. It seems true to say that most of today's cultural, intellectual and scientific spheres function in 'liberal-compatible' ways. Being blind to the presence of liberalism in this form means ignoring important aspects of the ideology's reactions to genetics. I therefore devote this chapter to some of the indirect relations between liberalism and genetics in present-day society. I do so by concentrating on the specific process whereby the human genome was sequenced and interpreted. I also take a brief look at the paradoxical way that liberal media have approached new genetic results.

Two chapters ago I sketched how the genetic/medical interest in humans has evolved from pre-genetics times focusing on the *patient* in the hands of a local physician, via the *population* studied by race biologists in early Mendelian days, up to the immediate post-World War II period when the *family* became the object to which genetic counsellors attend. A further shift occurred at the start of the new millennium in this series of objects for genetic interest. Now, the *individual* stands at its centre. Today, new genetic facts – which in earlier days would have referred to diseases, populations or therapeutic family situations – concentrate on individuals, a development that is in perfect concordance with basic liberal principles.

Still, these varying interpretations of the 'human' in human genetics are not antithetical to one another but should be seen as adding different dimensions to the object for genetic knowledge. Debates still focus on human groups (local populations, ethnicities, ancestries) rather than on individuals, but most genetics-related discussions today are individual-centred. They often focus on the risk of disease that an individual carrying a particular gene variant has. Or what a person should do to reduce the disease risk when knowing one's specific genetic constitution.

The gene as explainer of life's mishaps

By placing the individual at the centre of human genetic research, genetics has become an integral part of the liberal meaning-organizing system of informed choice and personal autonomy, as discussed in the preceding chapter. This implies that the individual central to human/medical genetics today is not a passive person hit by an unforgiving fate but an active, autonomous individual constantly ready to weigh probabilities of possible outcomes against each other.

Information is necessary in this process. Only when trustworthy information is available is it possible to choose rationally by weighing different possibilities against each other. The liberal individual is therefore in constant need of updated knowledge about the networks that link cause and effect with respect to life events. Obviously, genes are perfect for this purpose. In the chapter on conservatism, we were able to follow early descriptions of how the world works based on Mendelian principles. Today's situation, dominated by liberalism, is, however, different. The genes are no longer some quasi-magical objects with almost supernatural power, but sequences of DNA acting via well-known mechanisms in the cell-biological machinery. It is as such that they turn out to be perfect for liberal approaches to the central questions of life. No longer are they used to justify social divisions or conflicts, as in the case of early conservatism, but to explain the vicissitudes that affect individual life-histories.

Why do people fall ill and die?

A number of years ago, I gave a seminar to a group of doctoral students in a department of public health economics. I spoke about Mendelian diseases such as PKU, about quantitative genetics, and about how difficult it is to find gene variants associated with disease. Afterwards some students approached me and asked if they could pose an awkward question. 'Try,' I said. So they asked: 'Is it really true that population geneticists like you believe that people fall ill and die *without any particular reason*?'

The question was much more interesting than my answer (in which I improvised something about old cars being prone to break down without anyone knowing exactly why). The question summarized succinctly what I take to be the liberals' archetypical approach to important phenomena in life: they must be based on a cause-and-effect relationship. If something important happens, then it must have an important cause, one that is well-defined and understandable. To react rationally to the vicissitudes of life thus requires information about why things like disease and death occur.

Genes as causes

There is a legal maxim, *Expressio Unius Est Exclusio Alterius*, which means that if a phenomenon is given an explanation, then this explanation – more or less surreptitiously – excludes other explanations. In the present context, this implies that if a particular human phenomenon can be given a genetic explanation, it not just welcome as such but it also functions as a protection against other explanations. This maxim describes well the role played in many current settings by modern genetic explanations.

It has not always been like this. In the chapter on conservatism, I described how the Swedish psychiatrist and race biologist Herman Lundborg explained a neurological ailment by a posited Mendelian gene variant. Still, this variant was only the last determinant among a host of explanatory factors, such as degeneration, inbreeding, racial miscegenation, alcoholism and high coffee-consumption. Soon, however, genes became *the* privileged explanatory factor to concentrate on. Sometimes the gene in question could be identified. At other times, it remained a phantasm to be revealed in the future – as illustrated by Ernst Rüdin's early studies on schizophrenia where no monogenic pattern of inheritance was found.[492]

The process whereby genetic variation became *the* cause of causes to explain life phenomena was driven by two parallel impulses. Society asked for clear and understandable cause-and-effect relationships that could be used for making informed choices – as illustrated by the question posed to me by the economy students. The geneticists, on the other hand, found scientific status and satisfaction from their determining such relationships, and loved to advertise the usefulness of their research. The outcome was the modern version of that special object: 'the gene for X'.

---

492. See Chapter 8.

This object – where X normally stands for a disease but may be a trait like height or BMI or IQ – has become central to all discussions concerning heredity in the last few decades. It is not as theoretically innocent as one may believe, and we need to consider its functioning before the liberal response to DNA information can be detailed.

When it comes to clear-cut Mendelian diseases, such as PKU (see Chapter 9), the notion of 'the gene for X' is not particularly problematic. Here, the variant gene is a direct causal factor: almost every child with a diagnosed PKU condition carries two damaged copies of the gene for phenylalanine hydroxylase, one inherited from the mother, the other from the father; and almost every child that carries two such variant copies has the disease. Thus, it is perfectly reasonable to talk about 'the gene for PKU'. The only difficulty that may arise comes from recessivity, which implies that it is not always possible (at least not in pre-sequencing days) to know whether a healthy individual carries a dangerous gene variant or not.

Also when it comes to traits determined by quantitative genetics, the fundamental theory again – at least in principle – leads to no particular complication: a very large number of gene variants, each with a very small effect, collectively influence the trait. In practice, however, such a description is unsatisfactory from an explanatory point of view, because it raises the question: Where in this is the exact *cause* that may be used for explanations, rational calculations and medical interventions? To say that a disease or a trait is strongly determined by genes, *without being able to pinpoint any of these genes*, is highly frustrating, to say the least. Can such a diffuse cause really be called a cause? Is an explanation based on an infinity of factors, each with miniscule effects, really an explanation?

This argumentative impasse found its resolution in a widening of the basic model underlying quantitative genetics. The change is logical and reasonable but has a substantial effect on how the genes involved are perceived. The modification is to assume that among the many genetic factors that affect the trait of interest, some have larger effects than others. This does not change the theory of quantitative genetics very much, but it changes how the situation may be described. The genes with relatively larger effects can now be seen as special 'risk factors', useful for all kinds of medical interventions. Finding and isolating these risk factors then becomes highly desirable. In other words, 'a gene for X' today most often means that this gene has a variant that significantly affects the trait under consideration. Knowledge about, say, a handful of these genetic risk factors may then produce a feeling that one has a grasp – even though incomplete – of the situation. The diffuse causality linked to the standard quantitative genetics model is, thus, replaced by a 'multifactorial' view of life, in which the chains of causality appear to be much more tangible.

Towards the sequence of the human genome

The story of PKU, as outlined in Chapter 9, shows the benefits to be won from relevant genetic/biochemical knowledge. With the continued development of molecular biology in the decades after the Second World War, most single-gene Mendelian diseases became understood in similar ways with respect to their genetic and biochemical background (though only rarely with as positive an outcome as in the PKU case).

Around 1980, the human genetics community realized that this burgeoning and highly promising research field needed improved knowledge of where on the human chromosomes the different genes were situated. A first step towards achieving this goal would be to find a set of (more or less) regularly spaced 'meaningless' DNA markers along the chromosomes that could act as anchor-points for further, more detailed gene studies. In order to do interesting and important investigative work, it was therefore necessary first to do a large amount of boring and time-consuming routine genetic mapping work.

Soon, however, an increasing number of scientists realized that what *actually* was needed was not just a map of DNA markers. It was the full sequence of the human genome – that is, of all its 3,000,000,000 base-pairs – together with some knowledge of the variation among the letters. Few dared to count on such a revolutionary development, but some prominent scientists decided to try to make it happen.

Their sources of inspiration were manifold. On the scientific side, the community of Drosophilists had over the years shown the strength that a tightly run scientific community had gained from mixing competition over status and resources with large-scale international collaboration.[493] On the administrative side, there were the big federal projects in the US to develop nuclear weapons and to take humans to the moon. That such large-scale technological research efforts could be within the scope of medical and biological sciences, too, had, at least in principle, been shown by the 'War on Cancer' launched by President Nixon in 1971.

493. The community that developed the human white blood group system HLA represents another example of a successful international scientific collaboration.

A number of highly positioned international scientist – many of them molecular geneticists and some of them Nobel Prize laureates – therefore collected all their arguments and all their clout and went to their respective governments and said: Don't hesitate – let there be a Human Genome Project! And to general surprise (I think it is fair to say), there was a Human Genome Project.

It had a formal beginning (in 1990) and a formal end (in 2003), but neither dates are of particular importance to us. Others have described the exciting scientific, economic and political intricacies of the endeavour.[494] For our present purpose, it is enough to say that a reasonably complete and accurate version of the human genome sequence was, in the end, not just known, but publicly available and free for everyone to access. A wonderful source of information, and a historic scientific achievement.

A side effect of the project was that it led to a tremendous reduction in the cost of DNA sequencing as well as an increase in the speed with which it can be performed. This means, for example, that clinical physicians today can send cell samples to DNA-sequencing at only limited cost. Bateson's dream of grasping 'the physical basis of heredity' as described in Chapter 2, has been fulfilled. Not just the material nature of inheritance is now understood 'in principle' – all its minute details have become unravelled.

An epic battle

Was there anything specifically liberal in this revolutionary development? Not perhaps in the science itself, but in the way the process evolved?

The Human Genome Project had a strong momentum of its own, leaving little room for outside influences. Most of the project's planning and performance took place in the US, with important contributions from Great Britain (represented by the Welcome Trust) and some other rich countries. This implied – but of course! – that the project was fully liberal-compatible, even if it was not directly shaped by the liberal ideology as such. Two aspects of its development are, however, worthy of comment in the present context. The first concerns the project's organizational form, the second its sales pitch.

494. See for example the book by Kevin Davies (2001), and the personal accounts and viewpoints of two of the key actors involved, John Sulston (2002; co-written with Georgina Ferry) and Craig Venter (2007).

In general, liberals find it difficult to agree on what role national governments, 'the State', should play in economic and political life. This is a constant source of conflict in liberal circles, though one that I – until now – have had no reason to bring into the analysis. At the start of the Genome project, everything seemed reasonably problem-free. After some initial inter-agency wrangling, the US Department of Health became its master. James Watson of DNA fame was appointed chief organizer of the project, though this task soon went to the more diplomatic Francis Collins, a medical scientist who had been involved in a number of earlier medical-genetic breakthroughs. He oversaw the administrative, economic and scientific US federal venture that was the dominant force in an international partnership, HUGO.[495] Collins guaranteed that the project's budget would hold and that the results would be presented within the allotted time-span (before 2005). All according to modern, state-run, socially responsible liberalism – in many ways indistinguishable from old-fashioned, efficient social democratic state planning.

By this time, however, the human genome sequence information had become *hot*. Many saw huge commercial opportunities open to those first to identify genes of pharmacological interest. Another version of liberalism therefore soon appeared – the one arguing that government-run projects mean bureaucracy, delays and wasteful spending. What was needed was therefore instead an unfettered, go-get-it mentality, fuelled by resources from private investors. This alternative liberal view materialized itself in the form of Celera Genomics, a company with strong links to the builder of DNA-sequencing machines PerkinElmer and run by a dynamic and abrasive scientific leader, Craig Venter.[496]

The science journalist Kevin Davies summarizes the situation as it existed in 1998 as follows:

> By all appearances, the slow march to decode the sequence of the human genome had been transformed into an epic battle between two sides with vastly different strategies and agendas. Venter's intent was for his company, Celera Genomics, to sequence the human genome years before expectation (leaving thousands of gaps if need be), to be able to patent hundreds of genes and sell precious information about the genome sequence for a king's ransom to the pharmaceutical industry.

495. The scientist-run Human Genome Organisation, generally called HUGO, was started in 1988 to coordinate various genome initiatives in the world. HUGO is still active as a facilitator for international collaborations in genomics.

496. 'This new technology offered me precisely the kind of way that I wanted to deliver the genome – with a quick and aggressive campaign. There would be no better way to accelerate human medicine and science…'; Venter (2007), p. 233.

> Collins's task was to kick-start an unwieldy federal program to keep pace with Venter's private effort and deliver the complete, gold-standard sequence years earlier than projected, all the while releasing its DNA data every night to make the human genome unpatentable.[497]

This is a clear description of the kind of conflict that the different interpretations of liberalism may lead to.[498]

The final spurt of sequencing the human genome took place in a battle zone involving widely divergent ideas about how humankind best should develop knowledge about itself. In fact, the struggle threatened to become so harmful that an intervention from the highest political level was deemed necessary.

In a press conference via video-link on 25 June 2000, US President Bill Clinton and UK Prime Minister Tony Blair declared that the aim of the Human Genome Project had been reached. The sequencing of the human genome had been achieved. They did so in the presence of Francis Collins representing the federal and international consortium and Craig Venter representing Celera. No words were too pompous for the occasion. President Clinton set the tone by saying: 'Today, we are learning the language in which God created life.'[499]

Still, all scientists involved in the sequencing endeavour knew that the product presented at that moment was a poor-quality compromise result, prone to be misleading.[500] The non-commercial part of the project therefore continued until a much-improved version of the human genome could be presented in 2003. At that moment, the official Human Genome Project was declared completed, and the project was dissolved (though some particularly difficult bits of the genome remained uncharacterized – refilling these gaps is a still ongoing task). In summary, it seems fair to say that Celera's neo-liberal challenge to the federally dominated project led to an increase in sequencing speed and to a substantial reduction in the cost per identified DNA-letter. Still, the tenacity and

497. Davies (2001), p. 6.

498. When Craig Venter afterwards described the conflicts he and Celera had been involved in, his words were: 'a battle of ideologies, morals, and ethics'; see Venter (2007), p. 2. It is interesting to note that Venter chooses to highlight *ideological* differences when being involved in the fights over genome sequencing. In the terms of the present book, I take this to mean ideological differences within the broad framework of liberalism.

499. Davies (2001), p. 6.

500. For example: The first version of the sequence erroneously included some non-human sequences originating from lab bacteria used in the analysis. This error was short-lived but entered into at least one prominent textbook of genetics.

scientific solidity of the public effort came to characterize the project's final achievement and justify calling it a scientific landmark.

Gene optimism and precision bombing

Both the state-supported approach and the approach supported by venture capital relied on the same phenomenon to get the human genome sequencing done: Hype.[501] The project required that individuals who only had a scant knowledge of genetics – such as presidents, prime ministers, key politicians, high administrators, risk capitalists, important industrialists, private health economists and many other potential providers of money – should become convinced that the task was worth doing.[502] The period between 1985 and 2005 was therefore full of optimistic descriptions of the individual and social benefits that would follow from knowing the sequence of the human genome. The optimism over how rational actions may lead to improvements for humankind in its entirety – so characteristic of liberalism – here got a chance to express itself unfettered.

What I call 'gene optimism' infused all kinds of media. The popular press spread exaggerated stories for general consumption – there were innumerable newspaper headlines promising that the genes for aggression or high BMI were soon to be found. At the same time, scientific journals published papers on possible gene-disease associations; they were so blown-up in self-importance that they read more like investment portfolio proposals than scientific reports. To illustrate the strength of gene optimism at the turn of the millennium, I nevertheless prefer a more sober example:

In 2001 – in the last phase of the sequencing effort – the prominent US neuroscientist Nancy C. Andreasen published a book, *Brave New Brain: Conquering Mental Illness in the Era of the Genome*. It is rich in scientific facts, as well as in human compassion, and its fundamental gene optimism – as shown for example by the book's subtitle – does not appear opportunistic since it is grounded in feelings of sorrow and pain. The author is an expert on mental disorders, and she knows the misery they inflict on individuals and their families. She laments not only the

501. According to my dictionary, hype means 'extravagant or intensive publicity'.

502. 'The initially projected cost for the Human Genome Project was $3 billion, based on its envisioned length of 15 years. While precise cost-accounting was difficult to carry out, especially across the set of international funders, most agree that this rough amount is close to the accurate number.' Quote taken from https://www.genome.gov/about-genomics/educational-resources/fact-sheets/human-genome-project (accessed 9 October 2022).

lack of tools for healing, repairing and reducing the suffering of afflicted patients, but also her and her colleagues' inability to clearly describe the diseases they wish to tackle. Here, she argues, information about the genes involved will come in helpful and, in all likelihood, will restore that 'essence' of these diseases that has been lost in successive versions of psychiatric manuals.[503]

Genetics will, in addition, not only help in ascertaining diagnoses and in understanding what mental diseases *are* – it will also lead to better treatments:

> As we complete the mapping of the human genome, we will have the tools in our hands to identify the molecular mechanisms of disease, to learn how specific genes interact with their environments, and to understand how we can manipulate these processes to treat a variety of diseases. … Scientists will create medications that will correct the abnormal expression of disease-producing genes.[504]

Since genes are central to all biomedical investigations, genetic knowledge will be of key importance for all approaches to these diseases in the future:

> As these genes are identified, the task of figuring out how they work their mischief will be passed on to neuroscientists, psychiatrists, and neurologists, who will make the connection between genes, gene products, and human thought and behavior. The task of figuring out how the mischief can be reversed or prevented will fall into the hands of molecular and cell biologists, who will design chemical strategies to repair the damaged or dying nerve cells.[505]

Andreasen finally chooses a military metaphor – prominent in the US at the time – to express her vision of the future:

> The techniques of molecular biology will give us the capacity to do precision bombing, while our maps of brain terrain [produced by brain scanning] will give us the targets at which to aim.[506]

Thus, in the future and with new genomic knowledge, the effects of mental disease will be substantially reduced, if not completely eradicated. The optimism expressed by Andreasen – balanced in tone and not overtly sensational, though unlimited in its claims – perfectly captures the optimism

503. 'During the next several decades, scientists seeking the genes for various specific mental illnesses will continue to struggle with finding the best way to define the phenotype. In the process, the existing clinical definitions will probably be refined.' Andreasen (2001), p. 127.
504. Andreasen (2001), p. 129.
505. Andreasen (2001), p. 277.
506. Andreasen (2001), p. 320.

at this stage of the Human Genome Project. Hype, yes, but a heartfelt and convincing hype.

Such *unquestioned* optimism about the benefits that would emerge from the human genome sequence should be called an ideological response. And as such it must be seen as belonging to a liberal ideology that teaches that rationality – in this case, as support of cutting-edge science – will lead human society towards a better future.

A severely failed success

I had the opportunity to hear Francis Collins speak about the Human Genome Project to the International Congress of Genetics in Melbourne in 2003. It was a great event. By then, the international genetics community had access to the full sequence of the human genome, plus a fantastic set of new DNA technologies that could be applied to all kinds of interesting questions. Furthermore, legal openness to genetic information prevailed, with only a few conflicts over human gene patents remaining (boiling down, in the end, to the legal rights over the tests for breast cancer associated *BRCA1* and *BRCA2* variants, as discussed in the preceding chapter).

Still, Francis Collins's talk also included grave words of caution. To my ears, he said: Be prepared, because the Human Genome Project will not deliver what its hype has promised!

The promised genes do not exist

The first sequencing results already indicated troubles waiting ahead. It turned out that the number of genes in the human genome is around 20,000. Very, very, very much less than anyone (including myself) had expected. It was immediately clear that it was not the case that a handful of genes cause this disease and a handful of genes cause that disease, and so on – there was just not enough genes to go around. All phenotypic outcomes of the existing genetic variation must therefore be due to different kinds of interactions between sequence variants. Not necessarily between the structural genes identified, but between their controlling sequences hidden in the long DNA stretches between them (and notoriously difficult to analyse). The stream of incoming data confirmed this conclusion. When large-scale comparisons between patients and control groups were performed – called Genome Wide Association Studies, GWAS – no prominent differences in gene variants were normally found, only weak and dispersed DNA signals that often were difficult to replicate in later studies.

Thus, the risk genes everyone 'knew' would be there, were *not* there when actual data became available. The momentous achievement of sequencing the human genome failed to deliver what it had promised to do, that is, pinpoint the handfuls of genes that would explain most of the heritable part of the major common diseases plaguing society. In the language of the present book, one may say that this was yet another example of genetics failing to live up to ideological expectations.

Schizophrenia – a symbolic example

An illustration of this outcome is needed. Among the hundreds of possible examples where the GWAS methodology has been used to analyse diseases and traits, I have chosen to discuss schizophrenia.

Even since its recognition as a clinical entity, it has been known that there is a heritable component to this disease. Relatives of a person diagnosed as schizophrenic are more often affected by the ailment than would be expected by chance alone or by common environmental causes. As I described in the chapter on Nazism, understanding the nature of this genetic correlation became a central task for early clinical psychiatry. Interestingly, Ernst Rüdin's failure in the 1920s and '30s to find any single gene cause for the disease did not end speculations over its genetic basis – almost the reverse. Schizophrenia became *the* symbolic problem for all who wished to understand genetic influences on common diseases.[507]

The 'genes for schizophrenia' were therefore awaited as the crown jewels among the riches that the sequencing of the human genome would deliver. Some preliminary results arrived early, but a large well-supported analysis was not published until 2014, when the DNA sequences of 36,989 individuals diagnosed with schizophrenia were carefully compared to the sequences of 113,075 control individuals.[508]

The results were strong, convincing – and shattered all old presuppositions. Statistically significant genetic differences between the two

507. A review article from 1935 by the internationally respected Swedish psychiatrist Erik Essen-Möller, 'Schizofreniens ärftlighetsproblem' [The inheritance problems of schizophrenia], has been helpful to me in writing this section.
508. The research article was published by the 'Schizophrenia Working Group of the Psychiatric Genomics Consortium', composed of many scientists and consortia for other diseases; see Ripke and co-authors (2014).

groups were found at very many locations in the genome, confirming that the disease is indeed affected by genetic variation; the article presented evidence for 108 such chromosomal sites. Individually, however, the effects of the genetic differences involved were very small, miniscule, or next to insignificant.

Thus: There are no 'genes for schizophrenia'. Risk genes of the type discussed above with variants that at the population level are indicative for the disease, just do not exist. Nor will further studies find any.[509] Thus, knowledge about a handful of genes in a newborn child will *never* reliably estimate the risk of schizophrenia in this child – even if it is a large handful.[510]

Still, there are very many places in the genome with a statistically significant effect on the development of the disease, and even more such sites will be found when larger groups of patients and controls are analysed. And let there be no doubt about it: all of these sites are of interest for further biochemical and cell-biological investigations in the hope that they will point towards some biochemical pathway susceptible to pharmacological intervention.

This much about schizophrenia. The results for other common diseases differ in detail – here their specificities rule – but there is almost always the same underlying genetic structure: many genes are involved in the disease but the knowledge of them and their variation does not add up to any useful description of the disease's heritable component. Alzheimer's disease in old people and breast cancer in women are two particularly interesting examples. In both cases, prior knowledge existed about variants of one or two genes with substantial effects on the risk that individuals may develop the disease (*APOE* in Alzheimer and *BRCA1* and *BRCA2* in breast cancer). Such 'real' risk factors are however rare, and at the population level many other factors affect the disease risk, albeit with individually very small effects. The combined result is that even if all genetic information is considered in a joint analysis, only a small fraction of the genetic influence on the diseases is accounted for.

509. The results produced were based on a European-dominated sample, but no indications were given that the global pattern would be much different.

510. The next prominent paper on schizophrenia in *Nature*, based on 76,755 individuals with schizophrenia and 243,649 controls, confirms the earlier results and notes the limited usefulness of individual risk-indices: Even in European cohorts, the 'liability explained is insufficient for predicting diagnosis in the general population'; see Trubetskoy and co-authors (2022), p. 503.

To me, these are the most interesting results that human genetics has ever produced. The risk of developing diseases that are a terrible burden to humankind and which have a genetic component depends at the population level on a very large number of genetic differences – so many, and each of such miniscule effects, that knowing the status of, say, fifty of them in an individual is of no particular predictive value. Expressed differently: individuals with the same 'heritable disease' are often completely different in their genetic constitutions.

That this would apply to *some* diseases and *some* traits could perhaps be expected. However, what the colossal amount of DNA data has shown so far is that this description holds for the overwhelming majority of interesting human traits and diseases.

The feeling of mystery that followed from the fact that, even with knowledge about very many genes affecting a heritable trait, only a small fraction of the genetic causation of that trait is known, has been called the question of 'missing heritability'.[511] Genetics, for a while, entered an intellectual crisis with respect to this problem – do the tools of science to describe the world contradict each other? Further theoretical studies, supplemented by computer simulations of how the classic quantitative genetics model functions when combined with newly introduced deleterious mutations, seem, however, to have abated the crisis. Today, no one expects that any new, unknown explanatory principle is lurking in this conundrum.[512] The unavoidable conclusion is therefore that hundreds of genes may well be known to significantly affect the expression of an important trait – but the genetic causality of the trait will still be only incompletely understood.

These results, briefly summarized here, do not mean that it was not worth the effort to sequence the human genome. Rather, they indicate that the hype used to drive the project forward was based on erroneous presuppositions. The responsibility for the diffusion of such unbalanced presuppositions falls, as I see it, on the twin phenomena of liberal optimism and economic pushiness.

511. See Manolio and co-authors (2009).

512. The combination of quantitative and Mendelian genetics is, however, still not problem-free. '[A]lthough quantitative geneticists have long known that adaptive variation is highly polygenic, and that this is essential for efficient selection, this is only now becoming appreciated by molecular biologists – and we still do not have a good framework for understanding polygenic variation or diffuse function.' From a recent authoritative review by Nicholas H. Barton; see Barton (2022).

Revised business plans

As one could expect, this non-existence of the posited disease genes has had some direct economic consequences.

At the beginning of the sequencing effort, the story went that whoever managed to put their hands on an important disease gene was in for an economic windfall. There were two possibilities with such a catch. The first was that knowing the gene implied knowing its product, and this meant knowing why the altered gene variants would cause harm. From there on, it was 'just' a question of establishing the relevant biochemical pathway where this happened and find a pharmaceutical compound that could counteract the harmful effect of the non-perfect gene copy. This process would, of course, be laborious and cumbersome, but the potential profits waiting at the end of the road were huge: Imagine a pill that everyone with a common disease had to take over many years and for which the pricing was free (as long as the patent rights over the treatment were retained)!

The other possibility – not necessarily exclusive – was simpler and quicker but also worth investing in. Having the knowledge of an important gene, one could produce commercial DNA tests to score for harmful gene variants (a not very difficult task). The tests based on the *BRCA1* and *BRCA2* variants showed that such tools could generate substantial profit, even though testing in itself does not imply any healing.

Both these possibilities would fail, of course, if no convincing 'disease genes' could be identified. This was, in fact, what happened, and with some dire economic repercussions. Let me outline three case histories.

The Celera company, closely associated with Craig Venter, contributed to sequencing the genome, and none of its partners became impoverished in the process. But given the genome project's result – a dearth of gene information to commodify – investors and capital soon dwindled away. A science journalist in Washington summarized the situation in May 2005: 'With so much genome data *publicly* available, the company realized as early as 2002 that the promised profits were not going to materialize. Its high-profile president Craig Venter … resigned to pursue other genomics interests.' And by June 2005 Celera closed its last genomic information service.[513]

513. Information and quote from 'Free genome databases finally defeat Celera', written by Emma Marris, published in 2005 by *Nature* 435: 6. The italics in the quote have been added by me.

Highly prominent in the early analyses of genomic information was the Iceland-based company deCODE Genetics.[514] Started by another science-entrepreneur maverick, Kári Stefánsson, it had access to data and material collected via the Icelandic blood bank system and could benefit from the excellent pedigree information that exists in Iceland. The set-up was ideal, and large investments in the company were made. deCODE Genetics was very active in the early searches for 'disease genes' – and the outcome with its lack of 'useful' such genes was bitter. In late 2009, its holding company in the USA declared chapter 11 bankruptcy. The originally so promising business plan had collided with a hard fact: The genes that the company set out to find and whose sequences they planned to merchandise – for example 'the genes for schizophrenia' so central to the company's ambitions – do not exist and therefore could not be profited from.

Downscaling and reorganizations followed. The company is still, in its new form, involved in analysing human genome data for interesting information. But the original business vision has been totally repositioned.

My final example is the most interesting one, since it points towards future links between genetics and the business world.

In 2006, entrepreneurs closely associated with Google set up the company 23andMe.[515] Its business model was clear: 23andMe should provide genetic information directly to its customers. (In many ways, it was a professionalized version of the gene test proposed by Sciona and sold by Body Shop as discussed in the preceding chapter.) In my words, they said: Send us a swab of your throat, plus your money, and we will send you an analysis of your DNA where we outline whether you are particularly risk-prone for a number of important diseases, plus some advice and further information! From then on, it will be up to you to decide what to do. You have received your information; how you then use it is for you to determine (and for your wealth, your insurance company, and the health system where you live). All according to good liberal principles.

There is much to discuss about this offer, but I will not do so. My point here is, instead, that the outlined business plan did not work very

514. Some information in this paragraph has been taken from https://en.wikipedia.org/wiki/DeCODE_genetics (accessed 25 October 2022).

515. Some information in this paragraph has been taken from https://en.wikipedia.org/wiki/23andMe (accessed 25 October 2022).

well. To begin with, the transfer of information back to the DNA donor was problematic. Federal regulatory authorities raised objections to the proposed scheme and had views on how sensitive information of this kind should be certified and handled.

Still, these difficulties were soon sorted out when the company watered down its claims. A greater problem was instead the lack of real substance in the endeavour. It soon became clear that 23andMe did not have much of actual value to offer. In the absence of gene variants associated with clear and substantial disease risks – why should individuals let themselves be DNA-tested, spending some non-trivial amount?

This led 23andMe to change its profile from being a genetic disease/health advisor into an expert on genealogical relationships within the framework of what has been called recreational genetics. They said (once more in my words): Sure, we can tell you something of potential health importance if you send us your DNA, but more importantly we can inform you about your ancestry!

This offer turned out to have a strong appeal, particular in the USA where ancestries are widely mixed. After testing, it was often possible to determine not only that a certain percentage of someone's genome could be traced back to individuals that relatively recently had lived in Africa, say, but also in which part of Africa they had lived. And the more customers that submitted their DNA to the company, together with information about themselves and their health status, the better and more informative the results from 23andMe's analyses became. The threat of a business collapse was avoided.[516]

What's more, in the running of this not very exciting scientific task, a new, alternative business opportunity opened up for 23andMe. When more and more people sent their DNA plus vital statistics about themselves and their health to the company, the commercial value of its bank of information also increased. This became clear in 2018 when the pharmaceutical giant GlaxoSmithKline invested $300 million in 23andMe and thereby gained access to the DNA and health data of the company's 5 million customers.

The dream of making money out of genetic sequence information thus received a heavy blow when it turned out that the posited 'genes for various common diseases' did not exist. Neither did the new genetic

516. This niche of commercial activity attracted other companies to enter it.

information lead smoothly to new pharmaceuticals. Even if it could be helpful in informing scientists of the biochemical pathways involved in causing a disease, the road from this knowledge to an efficient product released on the market has in many cases been both long and full of problems.

Still, there is another way to summarize this historical process. Market capitalism, ideologically supported by liberalism, has in this story shown itself to be an efficient mechanism for channelling, withdrawing and rechannelling investments into areas of promise for generating profit. Genetic information has – despite the scientific twists and turns discussed above – remained a rich resource to be used in multiple ways; it has also retained much of its public attractiveness. 'Gene optimism' may have changed in appearance, but it obviously still lives on.[517]

Liberal media and the genetic message

Compared to the revolutionary developments in the field of medical genetics, some surrounding social phenomena appear remarkably stable, for example the liberal press. *The New York Times*, *The Washington Post*, *The Times*, *The (Manchester) Guardian*, *Neue Zürcher Zeitung*, *Le Monde*, *Politiken*, *Dagens Nyheter*… have all been around for a long time. Collectively, they have continued to define the meaning of high-quality newspaper journalism.

Labelling these media liberal does not mean that all ideas that they present fall within this particular ideological framework. I instead use the term to refer to two of their defining properties. The first is that they function according to the liberal market logic. A newspaper running at a consistent economic deficit will soon be out of business; these media products must continue to attract readers and advertisers. The second is the central tenet under which they function: the liberal principle of promoting the liberty of expression. Let us see what effects these factors have had on liberalism's reactions to genetics.[518]

517. The history of genetic information in the capitalist marketplace is full of unexpected twists and turns. In 2021, the market value of 23andMe was estimated to be $6 billion. In the autumn of 2024, the corresponding value had decreased by 98%. A cause of this collapse was a major theft of its supposedly secure genetic information. See e.g. https://en.wikipedia.org/wiki/23andMe (accessed 2 December 2024).

518. Many studies have been published on the popular press's interest in modern genetics. One of the first was by Nelkin & Lindee (1995).

Genetics makes good news

Right from the beginning of scientific genetics, the press has liked genes and the different kinds of 'gene-talk' that they engender. This holds for the pre-WWII era as well as for the period after 1945. Even quite abstruse genetic results have often found their way into newsprint. It has also been fairly easy for geneticists (like me) to get popular science articles describing new genetic results published. Newspaper editors have generally considered topics related to genetics as promising material.

This willingness to transmit news about genes and genetics to their readers is well illustrated by the major newspapers' response to the early sequencing results. In late 1999, the news came that the first human chromosome, number 22, had been sequenced in its entirety.[519] This was regarded as highly newsworthy, despite the thinness of the accompanying analyses and despite the fact that the result represented but a small part of the complete human sequence that everyone was looking forward to. Thus, on 2 December 1999, *The New York Times* published a 900-word article: 'After 10 years' effort, genome mapping team achieves sequence of a human genome', while *The Washington Post* the same day printed a similar-sized article on 'Scientists decode layout of human chromosome'.

In Europe, the interest was great, too. Here, *Le Monde* in Paris published an entire page about the news and about sequencing in general (in collaboration with *El País* from Madrid), and *The Guardian* (London) went so far as to print a leading article entitled 'The mapping of Man. A triumph, but a humbling moment too'. Some sentences from this journal give a good description of the predominant message in these articles:

> It is fitting that the discovery was made public on the eve of a new millennium, a millennium that may be changed as no other has by the implications of these discoveries. There are 4,000 diseases each one of which is caused by a fault in a single gene. Chromosome 22, the second smallest of the 23 pairs of chromosomes, is one of the genes linked to schizophrenia and various cancers. Its mapping is merely the first step on a journey that could lead to the eradication or control of some debilitating and fatal diseases.

The quote illustrates how strong and unquestioned what I call 'gene optimism' was up to the achievement of the full sequence – and the subsequent collapse of the gene hype. We may also note the special attention given to schizophrenia. It was mentioned in all the articles despite being

519. Dunham and co-authors (1999).

based on next to no solid indication in the data. It was later shown to be factually wrong: the multitude of genes with miniscule effects influencing the risk of schizophrenia are scattered over the genome with no special concentration to chromosome 22. (The mix-up in the quote between genes and chromosomes is hardly worth commenting upon – but it is a reminder of how confusing the central concepts of genetics still are for non-professionals.)

From a wider perspective, this example is a good illustration of the 'pre-ideological' function of the liberal press. It is here that new genetic ideas and results are introduced and explained to the general public; they may then be adopted and utilized by various ideologies.

This does not imply that the press itself is ideologically neutral. Sometimes the media uniformly just 'know' how things are in society; they thereby promote ideological responses using not yet ascertained scientific results. In my chapter on conservatism, I showed what happened when excellent geneticists took as facts the prejudiced presuppositions of media stories about the poor, the downtrodden and the non-whites – this would lead them intellectually and morally astray. It is often difficult to pinpoint *where exactly* the ideological function starts to dominate in the interplay between media and science; here I just note the complex ideological effects of even high-quality news media.

In summary, we can say that the liberal press has helped inspire an interest in genetics in society, culminating in the decades around the millennium when gene optimism overflowed. In this process, there was neither bad faith nor a lack of trustworthy information. The outcome was, nevertheless, a diffusion of a stereotypical view of the power of genetics that in many ways turned out to be factually incorrect.

The value of controversy

In addition, liberal principles led to another, paradoxical, effect in various media. Journalists and editors see their task as promoting a free exchange of views and standpoints. Free media should be non-censoring media. This principle has in recent decades led liberal, often high-quality media, to become interested in also presenting anti-liberal ideas or ideas that most would consider beyond the limits of liberal decency.

I refer here to ideas that stress genetic difference between women and men, human races and social strata. They have been promoted by conservative intellectuals, far-right activists and liberals of the kind I have labelled 'rational' rather than 'liberating'. This has led to innumerable controversies in the post-WWII world over the existence and effects of human genetic differences, debates that have often been stoked by liberal media. (I know, because I have taken part in many such public debates, often acrimonious and only rarely of any lasting value.)

When trying to understand this curious phenomenon – that journalists and editors of a liberal bent have helped present views that they ideologically and personally find despicable – an observation by the French philosopher and historian Michel Foucault has come to my mind. In his writings about the history of sexuality, Foucault notes how often this topic was talked about in the Victorian era – despite the opinion that it was exactly what 'one should *not* talk about'. Or as Foucault expressed it:

> … the mechanisms of power were in fact used more to arouse and 'excite' sexuality than to repress it.[520]

It is as if some intellectual topics function as scabs that you cannot avoid scratching – and actually *long* to scratch. In the debates about human genetic differences, the liberal media have reacted in the name of the freedom of the press and given opportunities to anti-liberals to present their views – perhaps with the aim of debunking them but, in fact, giving them increased prominence.

It would be easy to ascribe this curious phenomenon solely to economic motives. Outrageous claims are always useful for increasing print runs (just as they function as efficient clickbait). Still, this explanation seems a bit too simple. It ignores what may be a deeply felt liberal uncertainty about whether it *really* is the case that all humans are born equal and should be treated accordingly. Therefore, debating outrageous anti-liberal claims, preferably concluding with a strong rebuttal of them, seems to produce a soothing effect. The values one really wishes to support are thereby reconfirmed, at least for the moment.

The paradox of liberal media promoting debates based on anti-liberal themes may, thus, be seen as an ultimate illustration of how complicated it is to be liberal.

520. Foucault (1976, 2020), p. 151.

12. Characterizing genetics

The importance of genetics and genes

It would, of course, be wrong to claim that genetics is the natural science that has most affected human life since the year 1900. The prime position in this contest must definitely go to nuclear physics – it has given the world atomic bombs as well as an enormous energy source. Computer science, involving software as well as hardware, must come next, as witnessed by today's digitalized world.

Compared to these developments, the substantial advances due to genetics – exemplified in the chapters above by the breeding of higher-yielding seed varieties (Chapter 6) and the explanation of why children have Down's syndrome (Chapter 9) – certainly appear less important.

In calling genetics a powerful science, as I do in the title of this book, I instead refer to something else and more. To me, its power follows from its impact on widely divergent kinds of thinking in modern society. It is in the arena of contested meanings that genetics dominates and shows its strength. In this concluding chapter I summarize the ideological reactions analysed above, discuss the evolution of genetics' research programme, and consider what new ideological reactions to expect.

Genetic discussions at all levels of society

In this book I have described a number of debates about genetics. It is striking how they often took place at the highest level of politics. Thus, Pope Pius XI in 1930 activated a conservative discussion about genetic suggestions to improve humankind (Chapter 5). The Swedish government, led by the Social Democratic Party, decided in the interwar years to give strong economic support to genetically informed plant breeding despite its only indirect importance for the working class (Chapter 6). Then there was Joseph Stalin, who played an active role in crushing all genetic teaching and research within the Eastern Bloc during the Cold War (Chapter 7). And a few decades later, we find US President Clinton involved in a complicated juridical melee occasioned by the knowledge of the human genetic sequence (Chapters 10 and 11).

What about Nazism, which I described in Chapter 8 as being relatively uninterested in genetics? Still, a later much-studied event involving their top leaders shows that they, too, were engaged in genetic discussions – but hidden from the public eye. The 'Nuremberg Laws', introduced in September 1935, forbade sex and marriage between Germans and Jews, with the goal of protecting 'German Blood and German Honour'. These laws were of prime importance for all anti-Semitic policies that followed. However, they led to many problems of implementation – because, who were the Jews? How were they to be recognized? And how was Jewishness inherited? To Hitler, Himmler and many of the old guard of the Nazi Party, Jewishness was contagious and impossible to eradicate from a line of descent. For more rational parts of the party, such views were ridiculous as well as impossible to implement in actual policy. The existing German-Jewish *Mischlinge* were far too many to be kept administratively distinct and under special rules.

This is the background to the infamous Wannsee Conference held outside Berlin in early 1942. The German historian of science Cornelia Essner gives an interesting reinterpretation of the aim of the conference.[521] According to her and her colleagues, the purpose of the meeting – which was to deal with 'the final solution to the Jewish question' – was not to discuss the extermination of all Jews. Instead, the goal of the conference was to find a workable administrative solution to the question left undecided by the Nuremberg Laws, namely which 'part-Jews' of various degrees of Jewishness should be classified as 'Jews'. Neither Hitler nor Himmler attended the conference, but their well-known thoughts about the contagious spread of Jewishness caused it to fail to reach a decision that would function in administrative terms. Nazi Germany therefore went to its collapse without having resolved the central question of the inheritance of Jewishness – but not for not having discussed it.

Thus, for all five major ideologies studied here, we can find historical examples of genetic questions being raised and discussed at the highest possible political level.

521. See Essner (2013).

The preceding chapters also give many examples of genetics being debated outside society's central power structures. Miranda in *Sex and the City* worries about what is in her DNA, as do parents who want their future children to be free from heritable disease (both examples from Chapter 9). Sports organizations must decide upon gender-ascertaining blood tests for the Olympic Games in a way that is non-discriminatory as well as scientifically acceptable (Chapter 10). And the media pitch countless news items about genetic risks in order to capture the interest of as many readers and listeners as possible (Chapter 11). Thus, genetic topics are likely to be raised wherever politics – large-scale or small-scale – is discussed and made.[522]

Political reactions analysed via ideologies

With the aim of capturing this range of discussions about genetics in society, I have relied on a method whereby I analyse the reactions of the five historically dominant political ideologies in the industrialized world. I have seen them as all-encompassing 'cultural systems' guiding social thinking (Chapters 1 and 4). This methodology has functioned reasonably well, I would claim. It has helped identify, classify and illustrate many significant responses to genetics over the years.

The analysis could perhaps have been even more extensive. In particular, I have not undertaken a closer analysis of the Green movement's ideological critique of genetically modified/manipulated ingredients in feed and food. This attitude represents a drastic change from earlier generations' positive meta-ideological view of scientific plant breeding (Chapter 6).[523] The anti-GMO movement has undoubtedly been the strongest ideological reaction to genetics during the last few decades.[524]

Another recent ideological reaction to genetics worth knowing more about comes from the far right.[525] A very marginal intellectual tradition

522. It is therefore interesting to notice the occasional *absence* of genetics from certain important political questions. This I do, for example, in Chapter 9 with respect to the anti-colonial movement.

523. Between 1994 and 1997 I was a member of the Swedish Parliament's Gene Technology Advisory Board as a representative of the Natural Science Research Council. I could there follow the growth of negative reactions against the use of DNA technologies in plant breeding (driven in particular by the environmentalist movement Greenpeace) until some political parties, led by the Greens, decided that they were totally against their use.

524. At the time of writing (spring 2024), the discussion continues unabated – now over various EU attempts to regulate DNA technologies such as CRISPR/Cas.

525. For a characterization of this ideology, see e.g. Mudde (2019).

had remained after the Second World War that tried to keep the ideas of pre-war race biology alive. As described in Chapter 10 above, representatives of this tradition were behind giving the Lysenko Prize to the French population geneticist Albert Jacquard. The movement has now re-emerged, particularly in the US, with attempts to forge a 'race science' primarily devoted to proving the existence of distinct human races and finding measures for their genetic differences. It hopes to gain recognition by publishing its results in scientific journals of high renown; when this fails, its interest turns to starting new journals and founding a new science of racial differences unrestricted by the 'political correctness' of standard genetics. There is a striking similarity to the situation about twenty-five years ago, when attempts were made to found a science of evolution based on 'intelligent design'.[526]

The future of this attempt to build an alternative science of racial differences is uncertain; I have not seen much of it in contemporary Europe, though it may well arrive. Let me just conclude that this response to genetics by the far right – caught in Thatcher's dilemma of what one thinks and what one may decently say (Chapter 10) – is almost predictable. When standard scientific genetics does not deliver the results expected by an ideology, then it must find a new science of inheritance as source of legitimation – a reaction that we have encountered a number of times earlier in this book (see Chapters 7 and 8).[527]

Still, it is important to remember that, even if I have shown that an overview of society's reactions to genetics may be reached via an analysis of ideologies, this methodology does not capture all the interactions between this science and political life. The ideologies – as meaning-stabilizing networks – may be good at picking up *pre-ideological* trends and questions in a society asking for interpretations. But such ideas are present before and, in some sense, independent of the ideologies. The complex interplay between such vague presuppositions – or 'self-evidences' as Louis Althusser and Roland Barthes call them (Chapter 5) – and the well-formed standpoints characteristic of mature ideologies is a central topic in

---

526. This part of my discussion owes much to Panofsky, Dasgupta & Iturriaga (2020).

527. The recent revelations by an investigating team of journalists about an international network of 'race science' activists primarily based in Germany and the UK and called the 'Human Diversity Foundation' do not change the conclusions of this paragraph. The attempts described to form a new race science are too amateurish to be taken seriously, while the endeavours to do so illustrate the arguments about ideological necessities that I outline here. See Pegg et al. in *Guardian Weekly*, 25 October 2024, pp. 30–32.

several of the analytical chapters above. My approach has been to refer to a possible 'resonance' between the meaning systems given by the science of genetics, on the one hand, and those of participants in the ideological sphere on the other (Chapter 5) – which is a vague but, I would claim, reasonably functioning solution to the problem.

Some social reactions to genetics will, nevertheless, always fall outside direct ideological influence. They must then be approached in other ways and may, for example, be analysed via literature. This task I leave for others to undertake, with the exception of a specific example to be discussed at the end of this chapter.

The undiminished power of genes

The wealth of reactions to genetics – spanning many different dimensions of social life – is, as I have shown, quite striking. There has been a strong feeling that genes and genetics are *powerful*. This impression was there from the beginning around the year 1900, and it is here today. If anything, it may have increased in strength. Reactions based on a combination of rationality and emotions are seen, for example, when the anti-GMO movement ascribes danger to 'new' genes in food and feed. (Similar reactions against GMO-produced pharmaceuticals hardly exist – probably since the power of the genes here largely appears to be potentially helpful.)

The sense of danger still associated with genes and genetics does not only refer to items in the material world. Genes seem even more threatening in some parts of the world of ideas, thoughts and meanings. A striking example is provided in the outburst by the British-American sociologist Deborah Lynn Steinberg who in 2015 wrote the following:

> I have an antipathy to genes, a profound phantasmatic desire to repudiate them. … I feel resistant to a world order that is genetic; it seems to me that there is a foundational dissonance between the redemptive narratives attached to genes and their governmentality. I do not want a government of genes.[528]

There is hardly a better illustration to the claim that genetics – still, and to many – is a dangerously powerful science.

528. From her book *Genes and the Bioimaginary. Science, Spectacle, Culture*, published in 2015, p. 165. Steinberg was professor of Gender, Culture and Media Studies at the University of Warwick, UK.

To sum up: Society has reacted in a rich and broad way to the results of genetics. Some responses have been predictable, others new and unforeseeable. Many have been channelled and elaborated upon by the major political ideologies. Nothing indicates that these, rational and emotional, responses will fade or disappear when new genetic results are produced and reach the public sphere.

Defining genetics

Let us therefore consider genetics itself. Will genetics live on – or will it disappear when the world becomes saturated with results from human genome analyses?[529] What do people talk about when so-called genetic results are discussed way outside their scientific setting? And is it reasonable to use the same word – genetics – for the analysis of plant-crosses in 1900 and for the estimation of breast-cancer risks today?

To the last question, I would unquestionably say: yes, it is. Positing the existence of a continuous intellectual tradition, called genetics, devoted to the scientific study of genes and inheritance is not misleading, neither historically nor intellectually. Still, my answer requires some clarification. This leads me to a discussion of the philosophical tools used in the analyses of this book.

Scientific certainties vs fruitful developments

A strong intellectual tradition, dominated by the Austrian-British philosopher Karl Popper, considers the main task for a philosophy of science to be to clarify and uphold the difference between science and ideology.[530] With strict prescriptions, the tradition tries to define a demarcation line between these two intellectual spheres. Basic is its attempt to outline a methodology with which knowledge about nature can be gained in a guaranteed rational way.

529. The title of a recent book by David B. Goldstein, *The End of Genetics* (2021), may hint in this direction. But typically, it ends instead with a plea for more genetic research to be done: 'we must truly understand how the genetic differences among the billions of people on earth influence their lives and health…'; p. 162.

530. The locus classicus for this tradition is Popper's *The Logic of Scientific Discovery* (1959), a translation of his 1934 book *Logik der Forschung*. Particularly important for spreading this tradition among English speaking scientists have been Peter Medawar's *The Art of the Soluble* (1967) and Alan Chalmers' *What is This Thing Called Science? An Assessment of the Nature and Status of Science and its Methods* (four editions, the first published in 1976, the last in 2013).

I know this tradition well, since before I turned to genetics I studied philosophy when it was intensely discussed in the mid-1960s. It was therefore interesting to later notice what little use there was for Popper's methodological prescriptions in the life of working geneticists, me and others. Popper's rules were not helpful in daily lab decisions, nor did they give a better understanding of the scientific process as such. But, yes – it has happened that I have asked the speaker after a seminar: 'And how would you try to falsify the claims that you just made?'

I have found the ideas of the Hungarian-British philosopher Imre Lakatos to be of much greater relevance. He was yet another political refugee from Central Europe who in the 1960s worked closely with Popper at the London School of Economics. In the course of time, he came to express a distinctly different kind of thinking about science and its progress.

For Lakatos, the central question for the philosophy of science was not to demarcate science from ideology, but to understand how well-functioning research programmes simultaneously manage to stabilize, and to renew, themselves. No one is more aware than Lakatos that good science normally is filled with errors, mistakes, misrepresentations and false presuppositions. (For example, he published a highly stimulating book about the effects of errors in informal mathematics.)[531] I hope that this awareness of 'non-truths' as both common and important in science permeates also the present book – from its first page, where I state that it is not until the last decade that data have become good enough for much of genetics to be understood, to Chapter 11 dealing with genetic hype, seen as a magnificent misrepresentation of the role of human DNA variation.

To recognize such errors and misjudgements in science is not to relativize the importance of science in relation to ideologies; errors come in all flavours – some are interesting, others not. It is instead important to realize – something which partly explains why Popper's prescriptions are of so little practical relevance – the fact that it is often impossible to decide directly upon scientific questions. Or in Lakatos's words:

> [A]ll these theories of instant rationality – and instant learning – fail. … [R]ationality works much slower than most people tend to think, and, even then, fallibly.[532]

531. Lakatos, *Proofs and Refutations* (1976). Lakatos was primarily interested in the heuristics of mathematics – the forward-looking practice of the mathematicians – and not in its formalism.

532. Lakatos (1970), p. 174; I have removed Lakatos's italics in the first line.

To insist on the correctness of scientific results is therefore futile. It is also irrelevant. Much more important is the path that science takes towards newer and better insights into how the world functions.

Here we come to a central – and problematic – point in Lakatos's thinking: the threatening similarity between good science and well-developed ideologies. As briefly described in Chapter 2, where I outlined the formation of the genetic research programme, all scientific programmes, in the terminology of Lakatos, contain a central kernel of ideas – 'a hard core' – around which scientists build 'a protective belt' of auxiliary ideas. Their role is to help scientists escape from time-consuming questions about their developing research programme by keeping key ideas free from pointless critiques.[533] Thus, if you work in the midst of a fruitful research programme with a solid training behind you, you know which problems, inconsistencies and questions to tackle and which to ignore.[534]

Still, a well-functioning natural science in this way becomes remarkably similar to a political ideology. Ideologies, too, are networks of meaning claiming to represent the world truthfully and relying on barriers to protect their key ideas. Hence and in Lakatos's view, the defining characteristic of a good natural science is not so much the logical status of its truth-claims but its continued ability to develop newer and better versions of its research programme. A good research programme is a *fruitful* research programme which – when threatened by stagnation due to a too rigid defence of its key ideas – manages to break through its protective belt and renovate itself (relevant here is my discussion of the results of Jacob, Monod and McClintock in Chapter 7), thereby making what Lakatos would call 'a progressive problemshift'. The research programme continues – with no 'scientific revolution' in the Kuhnian sense but with

533. The Austrian-US philosopher Paul Feyerabend summarizes Lakatos's views like this: 'Lakatos gives a theory time, he permits it to develop, he permits it to show its strength, and he judges it only "in the long run".' Feyerabend (1970), p. 215.

534. The French sociologist Pierre Bourdieu would say that this knowledge has become part of your *habitus* as a competent scientist. 'To reintroduce the idea of the habitus is to set up as the principle of scientific practices, not a knowing consciousness acting in accordance with the explicit norms of logic and experimental method, but a "craft" [*métier*], a practical sense of the problems to be dealt with, the appropriate ways of dealing with them, etc.'. Thus, in the habitus of a scientist lies not only knowledge about which problems to tackle, but also knowledge about which problems not to tackle. From Bourdieu (2001), p. 78. Quote taken from the English translation (2004), p. 38; for readability I have added a comma after 'method'.

some key 'truths' revised and reorganized.[535] Thus, the value of a research programme ultimately depends on whether its internal balance between stability and change is stifling, or productive.

Lakatos's feeling for the complexity of doing good natural science – navigating between empirical observations and theoretical ideas of various qualities – makes for a more realistic approach than what is found in most other theories of science; this is why I have chosen to base my analyses on his terminology. In my treatment of genetics, the focus therefore lies on what those regarding themselves as geneticists actually do or have done – one could say that I have taken an anthropological approach to the field. No attempt is made to define the subject as including an affirmation of its scientificity or distinctness relative to ideologies. This seems not only reasonable, but necessary given that the main problem in my book concerns the relationship between these two intellectual traditions. A relationship that must be historically determined; it cannot be determined by definition.

With Lakatos, we may, however, ask about the *quality* of the genetics research programme. Is genetics (still) a productive research programme?

Behind the progressive problemshifts

I do not understand how this claim could be negated or rejected. Anyone who today reads Bateson's outburst in 1900 (quoted in Chapter 2) about how little then was known about inheritance as a natural phenomenon and compares it with our present genetic knowledge cannot be but impressed by the many 'progressive problemshifts' made since then. In other words, genetics has been able to keep a productive balance between stability and change in its key ideas. There is a basic continuity, despite all the details being changed. Here, we do not need to consider the underlying technical breakthroughs (some are mentioned in Chapter 9). Three interconnected reasons why the genetics research programme has not stagnated but continued to renew itself while retaining many of its original characteristics are, nevertheless, interesting to point out.

The first reason for genetics' resistance towards stagnation has to do with its remarkable openness towards other biological traditions.

---

535. For Kuhn's theory of scientific revolutions, see his book from 1962 (or its second edition from 1970). Lakatos is today most often discussed as a commentator to the works of Popper and Kuhn, but I find this wrong. Lakatos is much more interesting as a philosopher in his own right, in particular with respect to his various post-Hegelian reactions.

Genetics did not come with much intellectual baggage at its start. Mendel's segregation rules are indeed fascinating but must also have appeared very limited for a full understanding of life (Chapters 2 and 4). In physics, progressive problemshifts have normally occurred in connection with new ways of seeing the world: Planck's quanta, Einstein's relativity theories, Bohr's atomic model … However, such shifts in background ideas have only rarely happened in genetics. Here, problemshifts have rather been due to genetics' stepwise incorporation of other parts of biological research – sometimes already well established – into its own specific realm. Looking backwards, it is, for example, fascinating to see how effortlessly early genetics made plant breeding theory a natural part of its arsenal (Chapter 6). And – in particular – how relatively easily a fusion was made with the already well-established field of cytology establishing the important special subfield of genetics called cytogenetics. (J. H. Muller and the Morgan group at Columbia played important roles in this process but so did many others; see Chapters 2 and 7.) From early on, therefore, all elementary genetic courses came to contain practical exercises in making and analysing chromosome preparations, something which – given the subject's start with only Mendelian segregation ratios among higher plants to build on – is not self-evident at all. In the later development of genetics, it is noticeable that the subject was not overrun by biochemistry or biophysics but instead managed to incorporate many of their key results and make them into basic truths of its own research programme (Chapter 9).

Genetics has sometimes shown itself conservative (for example, the early geneticists Johannsen and Bateson did not like 'the chromosomal turn'). At other times, genetics has been remarkably quick in accepting new and unexpected results. I am old enough to have experienced the remarkable ease with which the genetics community around 1977 took to the idea that genes in most organisms are broken up by introns. One could perhaps have expected such an unexpected idea to have been debated and fought over for a long period of time, but this was not the case. Very rapidly, introns became an accepted part of genetic theory.[536]

536. I am not aware of any study of this remarkable acceptance process; if I have missed one, I apologize to its author(s). For a brief 'official' history, see https://www.genome.gov/25520306/online-education-kit-1977-introns-discovered (accessed 22 October 2022). Relevant is also the press release published when Richard J. Roberts and Phillip A. Sharp were awarded the Nobel Prize in 1993; see https://www.nobelprize.org/prizes/medicine/1993/press-release/ (accessed 22 October 2022).

This situation is a good illustration of how easily 'standard genetics' may perform a problemshift to its research programme if the situation calls for it and thereby show its lack of the thought-restrictions typical of 'degenerating' research programmes.

A second, related, reason for the research programme's lack of stagnation is the strength of its practitioners. In Chapter 2 above I commented on the vigorous attitude of the early geneticists; many later spokespersons of genetics also lived up to this stance (two modern examples are Francis Collins and Craig Venter, described in Chapter 11).

This implies that my book is misleading in one important aspect: it is far too conflict-free when describing the genetics community as such. The book's main topic is how the surrounding world has reacted to the results of genetics; therefore, I have put little effort into describing clashes among its practitioners, despite the fact that they have been numerous and severe.

For example, early Mendelism in Britain had its fair share of such disputes – R. A. Fisher vs the biometricians was one; William Bateson vs W. F. R. Weldon another.[537] Lamarckism was intensely debated in France, and the importance of cytoplasmic inheritance was an infected topic in Germany.[538] These scientific disputes ended with a win for one of the conflicting sides – leading, in effect, to a new problemshift for the research programme of genetics itself.

If there ever was a feeling of stagnation in the genetic research programme, this may have been at the time when the human genome was being sequenced (Chapter 11). Genetics then came the closest to behaving like a political ideology – with much self-aggrandizing hype intended for the external word combined with little internal critical debate (since all geneticists wanted to know the outcome of the genome project, even if they did not support or believe in the hype). Today, when the initial results are in and thought-provoking data about human variation are produced *en masse*, this feeling of scientific stagnation seems all gone. Instead, many new problemshifts relating to genetic variation are on their way to be worked out.

The final, and most important, reason for the long-term vitality of the genetics' research programme is its base in a remarkable scientific concept

537. See e.g. Provine (2001) and Radick (2023).
538. See e.g. Buican (1984) and Sapp (1987).

– the gene. It is one of the most impressive scientific notions ever formulated. Nothing like it was predicted before 1900. Since then, so many diverse aspects of the gene have been studied: its position in the cell, its biochemical nature, its function in regulating the cellular biochemistry, its variation relative to diseases, and so on.

It actually appears that genetics, over the last decades, has become increasingly gene-centred – one only has to look at the standard textbooks in the field.[539] Authors, having to explain genetics from scratch are often put in a conundrum – where to begin? What is the natural starting point from where the whole of genetics can be seen to develop? After the post-WWII molecular breakthroughs (described in Chapter 9), when the physical nature of the genetic material was elucidated together with its functioning, it seemed fresh and revolutionary to start the description of genetics with DNA's double-stranded spiral and leave Mendel's peas for later. Many textbooks therefore did exactly this.

However, once knowledge about DNA had spread into society at large, many felt that the intellectual specificity of eukaryotic genetics needed to be stressed. The textbooks went back to starting with Mendel's pea experiments, leaving the molecular details for later. In this way, the genetic pursuit today is not dominated by DNA, chromosomes, the broader principles of life, nor the human genome in its totality – but by the genes. So simple to talk about, so rich in their meanings.

Renewed ideological reactions

Hence, we can be certain about the genes' continued centrality, and also that most emerging social reactions to genetics will be recognized as similar to earlier ones. One does not have to be a geneticist of long standing to see that the topics now taken up for political discussion are much the same as those discussed decades ago.

Sometimes, however, some genuinely new questions – or questions that have not been considered for a long time – are brought up for debate. My book builds on this unpredictability: even if there is a definite political logic to many ideological reactions to genetics, there is also an important element of openness. Some important responses cannot be predicted in advance. Let me discuss a final example.

539. In the department where I work, we have a collection of almost one hundred such textbooks.

The strength of filiations

One reaction to inheritance that has surprised me by its long-term absence in ideological debates is the role of filiations (heritable links) in structuring social relations.

Several classic anthropological studies of indigenous societies have shown how people there use ideas about filiation, kinship and inheritance to organize their relationships with the surrounding world. Proscriptions about who may marry whom, or at least whom one *may not* marry, are found in all societies, expressed via rules, customs and knowledge encoded in language-use. For example, it is normally forbidden for a man to marry any of his sisters – expressed and explained by local interpretations of inheritance and filiation (even though the definition of 'sister' may deviate from our idea based on reproductive biology).[540]

In her book on the basis for social living, *Purity and Danger* (1966), the British anthropologist Mary Douglas extends this observation further. To her, the central function of social life, 'to impose system on an inherently untidy experience', is given to the rules that regulate marriage patterns, together with notions about right and wrong, clean and filthy. For there to be 'a semblance of order' in society, there must be a 'difference between within and without, above and below, male and female, with and against'.[541] Douglas, thus, not only stresses the importance of marriage rules for social order, but also names a set of dichotomies that genetics repeatedly has been called upon to explain, such as the differences between males and females, and between 'within and without', i.e. between those that belong to one's own group and those that are outsiders. Thus, deep social and existential tensions in need of resolution seem to call out for explanations based on how things in this world are linked to each other via inheritance – that is, are filiated.

Still, such questions have more or less disappeared from modern societies. Most of us do not even know who our cousins three times removed are, while in many pre-modern societies such knowledge would have been

540. The literature on consanguinity, incest taboos and marriage structures is enormous, with *Les Structures Élémentaires de la Parenté* by Claude Lévi-Strauss (1947) as an undisputed classic. In his attempt to characterize and classify relationships of consanguinity, Lévi-Strauss even refers to Mendel and his inheritance rules (p. 127). Sarah Franklin (2013) makes an interesting analysis of how the thinking about consanguinity changed when the underlying essential, explanatory matter shifted from blood to genes.
541. Douglas (1966), p. 4.

absolutely essential. There are many reasons for this erosion of social relationships, one of which is standard Mendelian knowledge – the 'scrambling' of genetic material during recombination weakens all feelings that transmission of something essential occurs during reproduction.

This situation may, however, be changing. Today, genome sequence information can re-establish filiations with great exactitude, of a kind never possible before. There have, for example, been some highly publicized criminal cases where blood from a perpetrator has led to his or her identification via genome information from distant relatives stored in DNA data banks. Can this logic be turned around and be used instead to *unite* individuals that according to genetic information are (relatively) closely related?

A recent literary example illustrates what I am talking about. In the last pages of her book, *Girl, Woman, Other*, Bernadine Evaristo lets one of her characters, Penelope, take a genetic test (like the ones discussed in Chapter 11 that predicts one's degree of relationship to humans in various parts of the world).[542] The result fascinates Penelope, who with some help goes on to check whether there are other tested individuals with genomes similar to her own.

Like a *Deus ex machina*, the commercial genetic algorithm then introduces Penelope to a woman in the north of England who must be her unknown mother, lost due to complications in the apartheid world of South Africa. A train journey brings Penelope to this woman, and the book ends with the lines:

> Penelope had worried she would feel nothing, or that her mother would show no love for her, no feelings, no affection
>
> how wrong she was, both of them are welling up and it's like the years are swiftly regressing until the lifetimes between them no longer exist
>
> this is not about feeling something or about speaking words
> this is about being
> together.[543]

The importance of this quote in the present context is that it employs genetics not to establish differences between individuals but to let a proven genetic similarity form the basis for deep feelings of togetherness and solidarity.

542. Evaristo (2019), *Girl, Woman, Other.*
543. Evaristo (2019), p. 452.

Judging from the current interest in media stories about using gene tests to find unknown sibs and other relatives (in situations of adoption or impregnation with an anonymous sperm donor), we see that detailed genetic information has great potential to generate combinations of rational calculations and deeply felt emotions. This, to my knowledge, has not been used in any ideological arguments so far.

In a society permeated by liberal ideas, there is not much that organically unites individuals. But what would happen if a charismatic leader started preaching about the importance that 'we who on chromosome 6 carry the sequence AACTCTCGA…ATTGGCC are all related and ought to stick together'? Or some version thereof. Could such propaganda, suitably packaged, be attractive and gain adherents? Could DNA-sequence identity form the basis of an 'imagined community'?[544] If so, we have not seen it yet. The untapped capability of genome sequences to create links between individuals still awaits its popular political formulation – but it would be surprising if it did not appear.

This book therefore does not end here. It just stops too soon.

---

544. The term is taken from Benedict Anderson's book, *Imagined Communities: Reflections on the Origin and Spread of Nationalism* (1983).

Postscript

Bengt Olle died on January 20, 2025, a week after he had finished writing this book. He entrusted me, his wife, with the final polishing of the manuscript and preparing the book for publication. It has been a privilege to do so, despite the sadness and loss involved.

Bengt Olle was a scientist and an intellectual. Over the years he shared his understandings, enthusiasms and concerns about science and politics – and music, history and literature – with others, in many settings and circumstances. Here, I will only mention two of the many colleagues that he enjoyed interacting with: the late professor of the History of ideas in Lund, Gunnar Broberg, and Torbjörn Säll, Bengt Olle's successor at the chair of Genetics in Lund. Their friendship and discussions were a great joy to him.

The publication of this book has been made possible by generous financial support from Olle Engkvists stiftelse, Sven och Dagmar Saléns stiftelse and Längmanska kulturfonden. Bengt Olle's research for the book was supported by Fysiografiska sällskapet, Lund. Thanks also go to four anonymous reviewers for their encouraging comments on earlier versions of the manuscript and to David Lindberg at Arkiv förlag for support and professional editorial work.

Lund, January 2026
Boel Berner

References

Adams, Mark B., 1989. The politics of human heredity in the USSR, 1920–1940. *Genome* 31: 879–884.

Althusser, Louis, 1970, 2014. Idéologie et appareils idéologiques d'état. Originally published in *La Pensée*; reprinted in *Penser Louis Althusser*, Pantin: Le Temps des Cerises, 2006. [Translated in *On the Reproduction of Capitalism: Ideology and Ideological State Apparatuses*, 2014, Verso.]

Althusser, Louis, 1974, 2011. *Philosophie et philosophie spontanée des savants (1967)*, François Maspero. [English version *Philosophy and the Spontaneous Philosophy of Scientists*, 2011, Verso.]

Anastasi, Anne, 1958. Heredity, environment, and the question 'How?' *Psychological Review* 65: 197–208.

Anderson, Benedict, 1983. *Imagined Communities: Reflections on the Origin and Spread of Nationalism*, Princeton University Press.

Andreasen, Nancy C., 2001. *Brave New Brain: Conquering Mental Illness in the Era of the Genome*, Oxford University Press.

A. N. F., 1945. Book review of Race, Reason and Rubbish. *The Journal of Nervous and Mental Disease* 101: 394–395.

Anonymous, 1942. The study of race. *Nature* 150: 192–193.

Aristotle, 1981. *The Politics*, Penguin.

Assouline, Pierre, 1996. *Simenon*, Julliard.

Babkov, V. V., 2013. *The Dawn of Human Genetics*, Cold Spring Harbor Laboratory Press.

Bachelard, Gaston, 1938. *La Formation de l'esprit scientifique*, Vrin.

Bakewell, Sarah, 2016. *At the Existentialist Café: Freedom, Being & Apricot Cocktails*, Chatto & Windus.

Balibar, Étienne, 1991. Is there a 'Neo-Racism'?, pp. 17–28 in Étienne Balibar & Immanuel Wallerstein, *Race, Nation, Class: Ambiguous Identities*, Verso.

Bangham, Jenny, 2020. *Blood Relations: Transfusion and the Making of Human Genetics*, University of Chicago Press.

Barkan, Elazar, 1988. Mobilizing scientists against Nazi racism, 1933–1939, pp. 180–205 in George W. Jr Stocking & George W. Stocking, eds., *Bones, Bodies and Behavior: Essays in Behavioral Anthropology*, University of Wisconsin Press.

Barkan, Elazar, 1992. *The Retreat of Scientific Racism: Changing Concepts of Race in Britain and the United States between the World Wars*, Cambridge University Press.

Barthes, Roland, 1957, 2014. *Mythologies*, Éditions du Seuil.

Barton, Nicholas H., 2022. The 'New Synthesis'. *Proceedings of the National Academy of Science* 119 (30) e2122147119.

Bateson, William, 1901. Problems of heredity as a subject for horticultural investigation. *Journal of the Royal Horticultural Society* 25: 54–61.
Baur, Erwin, 1910/11. Kleiner Mitteilungen. *Zeitschrift für induktive Abstammungs- und Vererbungslehre* 4: 292.
Baur, Erwin, Fischer, Eugen & Lenz, Fritz, 1921. *Grundriss der menschlichen Erblichkeitslehre und Rassenhygiene*, Lehman.
Bearn, Alexander G., 1993. *Archibald Garrod and the Individuality of Man*, Oxford University Press.
Beauvoir, Simone de, 1949, 2011. *Le deuxième sexe I & II*, Gallimard. [English translation: *The Second Sex*, 2011, Vintage.]
Beauvoir, Simone de, 1960. *La Force de l'Âge*, Gallimard.
Beauvoir, Simone de, 1998. *A Transatlantic Love Affair: Letters to Nelson Algren*, Free Press.
Bengtsson, Bengt Olle, 1981. Biological journals in China 1973–1978. Lund: *RPI China Acquisition List*, No 8.
Bengtsson, Bengt Olle, 1999. *Genetik och politik: Berättelser om en vetenskap mitt i samhället*, Norstedt.
Bengtsson, Bengt Olle, 2006. *Genetiska konflikter: Polemiska artiklar från trettio år*, ellerströms.
Bengtsson, Bengt Olle, 2022. Vetenskap och ideologi: Kommunismens reaktion på genetiken. *Arkiv. Tidskrift för samhällsanalys*, No 14: 53–88.
Bengtsson, Bengt Olle, 2024. I begynnelsen var ordet och ordet var "gen": Om tillkomsten av det genetiska forskningsprogrammet. *Sveriges Utsädesförenings Tidskrift*, No 2: 6–16.
Bengtsson, Bengt Olle & Broberg, Gunnar, eds., 2013. *Bortom det acceptablas gränser: Bengt Lidforss och Lundaradikalismen*, ellerströms.
Bengtsson, Bengt Olle & Tunlid, Anna, 2010. The 1948 International Congress of Genetics in Sweden: People and politics. *Genetics* 185: 709–715.
Berg, Raissa L., 1990. The grim heritage of Lysenkoism: Four personal accounts. V. In defence of Timoféeff-Ressovsky. *The Quarterly Review of Biology* 65: 457–479.
Berglund, Tobias & Sennerteg, Niclas, 2017. *Finska inbördeskriget*, Natur & Kultur.
Berner, Boel, 2015. Det ligger i blodet? Vetenskap och ideologi i mellankrigstidens blodgruppsundersökningar. *Ikaros* 12: 23–26.
Beyer, Nils, 1968. *Bengt Lidforss: En levnadsteckning*, Norstedts.
Biebricher, Thomas, 2011. The biopolitics of ordoliberalism. *Foucault Studies* 12: 171–191.
Boaz, Rachel E., 2012. *In Search of 'Aryan Blood': Serology in Interwar and National Socialist Germany*, Central European University Press.
Bodmer, Walter F. & Cavalli-Sforza, Luigi Luca, 1970. Intelligence and race. *Scientific American* 223: 19–29.
Bokholm, Rune, 2001. *Tisdagsklubben: Om glömda antinazistiska sanningssägare i svenskt 30- och 40-tal*, Atlantis.
Bonnier, Gert & Larsson, Robert, eds., 1949. *Proceedings of the Eighth International Congress of Genetics*. *Hereditas* Supplementary volume.
Böök, Jan A., 1956–1957. Gunnar Dahlberg. In Memoriam. *Acta Genetica et Statistica Medica* 6: I–III.
Borinskaya, Svetlana A., Ermolaev, Andrei I. & Kolchinsky, Eduard I., 2019. Lysenkoism against genetics: The meeting of the Lenin All-Union Academy of Agricultural Sciences of August 1948, its background, causes, and aftermath. *Genetics* 212: 1–12.

Bourdieu, Pierre, 2001. *Science de la science et réflexivité*, Raisons d'Agir. [English translation: *Science of Science and Reflexivity*, 2004, Polity.]
Box, Joan Fisher, 1978. *R. A. Fisher: The Life of a Scientist*, Wiley.
Brattain, Michelle, 2007. Race, racism, and antiracism: UNESCO and the politics of presenting science to the postwar public. *American Historical Review* 112: 1386–1413.
Braund, James & Sutton, Douglas G., 2007. The case of Heinrich Wilhelm Poll (1877–1939): A German-Jewish geneticist, eugenicist, twin researcher, and victim of the Nazis. *Journal of the History of Biology* 41: 1–35.
Broberg, Gunnar, 1988. Statens institut för rasbiologi – tillkomståren, pp. 178–221 in Gunnar Broberg, Gunnar Eriksson & Karin Johannisson, eds., *Kunskapens trädgårdar: Om institutioner och institutionalisering av vetenskapen och livet*, Atlantis.
Broberg, Gunnar, 1995. *Statlig rasforskning: En historik över Rasbiologiska institutet*, Lunds universitet, Avdelningen för idé- och lärdomshistoria.
Broberg, Gunnar & Thydén, Mattias, 2005. Eugenics in Sweden: Efficient care, pp. 77–149 in Gunnar Broberg, & Nils Roll-Hansen, eds., *Eugenics and the Welfare State: Sterilization Policy in Denmark, Sweden, Norway, and Finland*, Michigan State University Press.
Buican, Denis, 1984. *Histoire de la génétique et de l'évolutionnisme en France*, PUF.
Bulgakov, Michail, 1925, 2011. *A Dog's Heart*, Rosetta Books.
Carlson, Elof Axel, 1981. *Genes, Radiation, and Society: The Life and Work of H. J. Muller*, Cornell University Press.
Carson, John, 2007. *The Measure of Merit: Talents, Intelligence, and Inequality in the French and American Republics, 1750–1940*, Princeton University Press.
Cavalli-Sforza, Luca, Piazza, Alberto, Menozzi, Paolo & Mountain, Joanna, 1988. Reconstruction of human evolution: Bringing together genetic, archaeological, and linguistic data. *Proceedings of the National Academy of Science, USA* 85: 6002–6006.
Chadarevian, Soraya de, 2020. *Heredity under the Microscope: Chromosomes and the Study of the Human Genome*, University of Chicago Press.
Chalmers, Alan F., 1978. *What is This Thing called Science? An Assessment of the Nature and Status of Science and its Methods*, The Open University Press.
Chamberlain, Houston Steward, 1899. *Die Grundlagen des neunzehnten Jahrhunderts*, F. Brückmann.
Charlesworth, Brian, 2017. Haldane and modern evolutionary genetics. *Journal of Genetics* 96: 773–782.
Chevassus-au-Louis, Nicolas, 2004. *Savants sous l'Occupation: Enquête sur la vie scientifique française entre 1940 et 1944*, Média Diffusion.
Clark, Ronald, 1968. *J. B. S. The Life and Work of J. B. S. Haldane*, Hodder and Stoughton.
Cobb, Matthew, 2017. 60 years ago, Francis Crick changed the logic of biology. *PLoS Biology* 15(9): e2003243.
Contreras, Jorge L., 2021. *The Genome Defense: Inside the Epic Legal Battle to Determine Who Owns your DNA*, Algonquin Books.
Cooper, Colin, 1999. *Intelligence and Abilities*, Routledge.
Corthorn, Paul, 2019. *Enoch Powell: Politics and Ideas in Modern Britain*, Oxford University Press.
Cottebrune, Anne, 2009. Franz Josef Kallmann (1897–1965) und der Transfer psychiatrisch-genetischer Wissenschaftskonzepte vom NS-Deutschland in die USA. *Medizinhistorisches Journal* 44: 296–324.

Crew, F. A. E., Darlington, C. D., Haldane, J. B. S., Harland, S. C., Hogben, L. T., Huxley, J. S., Muller, H. J., Needham, J., Child, G. P., David, P. R., Dahlberg, G., Dobzhansky, Th., Emerson, R. A., Gordon, C., Hammond, J., Huskins, C. L., Koller, P. C., Landauer, W., Plough, H. H., Price, B., Schultz, J., Steinberg, A. G. & Waddington, C. H., 1939. Social biology and population improvement. *Nature* 144: 521–522. [Also known as 'The Geneticists' Manifesto'.]

Crick, Francis, 1958. On protein synthesis. *Symposia of the Society for Experimental Biology* 12: 138–163.

Crick, Francis, 1970. Central Dogma of Molecular Biology. *Nature* 227: 561–563.

Crow, James F., 1993. N. I. Vavilov, martyr to genetic truth. *Genetics* 134: 1–4.

Dahlberg, Gunnar, 1940. *Arv och ras*, Kooperativa förbundet.

Dahlberg, Gunnar, 1942. *Race, Reason and Rubbish: An Examination of the Biological Credentials of the Nazi Creed*, George Allen & Unwin Ltd.

Dahlberg, Gunnar & Tingsten, Herbert, 1937. *Svensk politisk uppslagsbok*, Svensk Litteratur.

Darlington, Cyril D., 1943. Race, class and mating in the evolution of man. *Nature* 152: 315–319.

Darlington, Cyril D., 1949. The working units of heredity, in Gert Bonnier & Robert Larsson, eds., *Proceedings of the Eighth International Congress of Genetics*. *Hereditas* Supplementary volume.

Darlington, Cyril D., 1969. *The Evolution of Man and Society*, Allen & Unwin.

Darwin, Charles, 1859. *On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life*, John Murray.

Darwin, Charles, 1868. *The Variation of Animals and Plants under Domestication*. Volumes 1 and 2, J. Murray.

Davenport, Charles, 1919. *The Trait Book*. Eugenics Record Office, Bulletin No. 6, 2nd edition.

Davies, Kevin, 2001. *Cracking the Genome: Inside the Race to Unlock Human DNA*, Free Press.

de la Chapelle, Albert, 1986. The use and misuse of sex chromatin screening for 'gender identification' of female athletes. *The Journal of the American Medical Association* 256: 1920–1923.

Debré, Patrice, 1996. *Jacques Monod*, Flammarion.

Deichmann, Ute, 1996. *Biologists under Hitler*, Harvard University Press.

Deutscher, Isaac, 1966. *Stalin: A Political Biography. Revised edition*, Pelican Books.

Dickinson, Edward Ross, 2004. Biopolitics, fascism, democracy: Some reflections on our discourse about 'modernity'. *Central European History* 37: 1–48.

Dobzhansky, Theodosius, 1937. *Genetics and the Origin of Species*, Columbia University Press.

Dorey, Peter, 2011. *British Conservatism: The Politics and Philosophy of Inequality*, I. B. Tauris.

Douglas, Mary, 1966. *Purity and Danger: An Analysis of the Concepts of Pollution and Taboo*, Routledge & Kegan Paul.

Dronamraju, Krishna, 2010. J. B. S. Haldane's last years: His life and work in India (1957–1964). *Genetics* 185: 5–10.

Dunham, Ian, et al., 1999. The DNA sequence of human chromosome 22. *Nature* 402: 489–499.

Dunn, Leslie C., 1956. G. Dahlberg, human geneticist. *Science* 124: 1195–1196.
Dunn, Leslie C., 1965. *A Short History of Genetics*, McGraw-Hill.
Dunn, Leslie C. & Dobzhansky, Theodosius, 1946. *Heredity, Race, and Society*, Penguin.
Essen-Möller, Erik, 1935. Schizofreniens ärftlighetsproblem. *Nordisk Medicinsk Tidskrift* 10: 2103–2110.
Essner, Cornelia, 2013. Nazi Anti-Semitism and the question of 'Jewish blood', pp. 227–243 in Christopher H. Johnson, Bernhard Jussen, David Warren Sabean & Simon Teuscher, eds., *Blood & Kinship: Matter for Metaphor from Ancient Rome to the Present*, Berghahn Books.
Evaristo, Bernardine, 2019. *Girl, Woman, Other*, Penguin.
Fairbanks, Daniel J. & Abbott, Scott, 2016. Darwin's influence on Mendel: Evidence from a new translation of Mendel's paper. *Genetics* 214: 401–405.
Falconer, Douglas S., 1960. *Introduction to Quantitative Genetics*, Oliver and Boyd.
Falconer, Douglas S., 1965. The inheritance of liability to certain diseases, estimated from the incidence among relatives. *Annals of Human Genetics* 29: 51–76.
Fangerau, Heiner & Müller, Irmgard, 2002. Das Standardwerk der Rassenhygiene von Erwin Baur, Eugen Fischer und Fritz Lenz im Urteil der Psychiatrie und Neurologie 1921–1940. *Nervenarzt* 73: 1039–1046.
Fanon, Franz, 1952. *Peau noire, masques blancs*, Seuil.
Federley, Harry, 1919a. Demokratiska idéer i biologisk belysning. I. Den allmänna rösträtten. *Nya Argus*, No 6: 42–45.
Federley, Harry, 1919b. Demokratiska idéer i biologisk belysning. II. Den sociala nivelleringen. *Nya Argus*, No 7: 53–55.
Fedoroff, Nina Vsevolod, 1994. Barbara McClintock (June 16, 1902 – September 2, 1992). *Genetics* 136: 1–10.
Feyerabend, Paul K., 1970. Consolation for the specialist, pp. 197–230 in Imre Lakatos & Alan Musgrave, eds., *Criticism and the Growth of Knowledge*, Cambridge University Press.
Fischer, Ernst Peter, 2007. Max Delbrück. *Genetics* 177: 673–676.
Fisher, R. A., 1918. The correlation between relatives on the supposition of Mendelian inheritance. *Transactions of the Royal Society of Edinburgh* 52: 399–433.
Fisher, R. A., 1930. *The Genetical Theory of Natural Selection*, Oxford University Press.
Fisher, R. A., 1951. Statistical methods in genetics. *Being the Bateson Lecture delivered at the John Innes Horticultural Institute on Friday, 6th July 1951.* Reprinted 2010 in *International Journal of Epidemiology* 39: 329–335.
Fisher, R. A., 1957. Methods in human genetics. *Acta Genetica et Statistica Medica* 7: 7–10.
Foucault, Michel, 1963. *Naissance de la clinique*, Presses Universitaires de France. [English translation: *The Birth of the Clinic*, 1994, Vintage Books.]
Foucault, Michel, 1976. *Histoire de la sexualité 1. La volonté de savoir*, Gallimard. [English translation: *The History of Sexuality. Volume 1. The Will to Knowledge*, 2020, Penguin Classics.]
Foucault, Michel, 1997. *'Il faut défendre la société': Cours au Collège de France 1976*, Gallimard.
Franklin, Sarah, 2013. From blood to genes? Rethinking consanguinity in the context of geneticization, pp. 285–306 in Christopher H. Johnson, Bernhard Jussen, David Warren Sabean & Simon Teuscher, eds., *Blood & Kinship: Matter for Metaphor from Ancient Rome to the Present*, Berghahn Books.

Freeden, Michael, 1996. *Ideologies and Political Theory: A Conceptual Approach*, Clarendon Press.

Freeden, Michael, 2003. *Ideology: A Very Short Introduction*, Oxford University Press.

Freeden, Michael, Sargent, Lyman Tower & Stears, Marc, eds., 2013. *The Oxford Handbook of Political Ideologies*, Oxford University Press.

Freud, Sigmund, 1905, 2016. *Three Essays on the Theory of Sexuality [Drei Abhandlungen zur Sexualtheorie]*, Verso.

Freud, Sigmund, 1974. *The Standard Edition of the Complete Psychological Work*, Volume XXIV: Indexes and Bibliographies. Compiled by Angela Richards, The Hogarth Press.

Galton, Francis, 1865. Hereditary talent and character. *Macmillan's Magazine* 12: 157–166, 318–327.

Galton, Francis, 1869, 2006. *Hereditary Genius: An Inquiry into its Laws and Consequences*, Prometheus Books.

Galton, Francis, 1873. Hereditary improvement. *Fraser's Magazine* 7: 116–130.

Garrod, Archibald, 1909, 1963. *Inborn Errors of Metabolism: The Croonian Lectures delivered before the Royal College of Physicians of London, in June, 1908*, Oxford University Press.

Gaudillière, Jean-Paul, 2002. *Inventer la biomédecine: La France, l'Amérique et la production des savoirs du vivant (1945–1965)*, Éditions de la découverte.

Gautier, Marthe & Harper, Peter S., 2009. Fiftieth anniversary of trisomy 21: Returning to a discovery. *Human Genetics* 126: 317–324.

Geertz, Clifford, 1973. *The Interpretation of Cultures: Selected Essays*, Basic Books.

Giddens, Anthony, 1998. *The Third Way: The Renewal of Social Democracy*, Polity Press.

Gillham, Nicholas Wright, 2001. *A Life of Sir Francis Galton: From African Exploration to the Birth of Eugenics*, Oxford University Press.

Glad, John, 2003. Hermann J. Muller's 1936 letter to Stalin. *The Mankind Quarterly* 43: 305–319.

Glass, Bentley, 1990. The grim heritage of Lysenkoism: Four personal accounts. I. Foreword. *The Quarterly Review of Biology* 65: 413–421.

Gobineau, Arthur de, 1853–55. *Essai sur l'inégalité des races humaines*, Librairie de F. Didot frères.

Goldstein, David B., 2021. *The End of Genetics: Designing Humanity's DNA*, Yale University Press.

Gorlizki, Yoram & Khlevniuk, Oleg, 2004. *Cold Peace: Stalin and the Soviet Ruling Circle, 1945–1953*, Oxford University Press.

Gottfredson, Linda S., 1997. Mainstream science on intelligence: An editorial with 52 signatories, history, and bibliography. *Intelligence* 24: 13–23.

Gould, Stephen Jay, 1981. *The Mismeasure of Man*, Norton.

Greene, John C., 1981. *Science, Ideology, and World View: Essays in the History of Evolutionary Ideas*, University of California Press.

Grunberger, Richard, 1971. *A Social History of the Third Reich*, Weidenfeld and Nicolson.

Gustafsson, Åke, 1947. Mutations in agricultural plants. *Hereditas* 33: 1–100.

Gustafsson, Åke, 1960. *Harmoni i atomåldern*, Bonniers.

Gustafsson, Åke, 1972. Herman Nilsson-Ehle. *Levnadsteckningar över Kungliga Svenska Vetenskapsakademiens ledamöter* 175: 279–293.

Guthrie, Woody, 1943, 1970. *Bound for Glory*, Dutton.

Hacking, Ian, 1990. *The Taming of Chance*, Cambridge University Press.

Hagemann, Rudolf, 2002. How did East German genetics avoid Lysenkoism? *Trends in Genetics* 18: 320–324.
Hagerman, Maja, 2015. *Käraste Herman: Rasbiologen Herman Lundborgs gåta*, Norstedt.
Haldane, J. B. S., 1945. Miss E. R. Saunders. *Nature* 156: 385.
Haldane, J. B. S., 1949. *What is Life?*, Lindsay Drummond.
Hall, Jeff M., Lee, Ming K., Newman, Beth, Morrow, Jan E., Anderson, Lee A., Huey, Bing & King, Mary-Claire, 1990. Linkage of early-onset familial breast cancer to chromosome 17q21. *Science* 250: 1684–1689.
Hall, Kersten & Müller-Wille, Staffan, 2024. Legumes and Linguistics: Translating Mendel for the Twenty-First Century. *Cold Spring Harbor Perspectives in Biology* 16.12: a041811.
Hansen, Bent Sigurd, 1996. Something rotten in the state of Denmark: Eugenics and the ascent of the welfare state, pp. 9–76 in Gunnar Broberg & Nils Roll-Hansen, eds., *Eugenics and the Welfare State: Sterilization Policy in Denmark, Sweden, Norway, and Finland*, Michigan State University Press.
Hanson, Hertha, 1994. *Alkemi, romantik och rasvetenskap*, Nya Doxa.
Harris, Harry, 1974. Lionel Sharples Penrose (1898–1972). *Journal of Medical Genetics* 11: 1–24.
Harwood, Jonathan, 1985. Geneticists and the evolutionary synthesis in interwar Germany. *Annals of Science* 42: 279–301.
Harwood, Jonathan, 1993. *Styles of Scientific Thought: The German Genetics Community 1900–1933*, University of Chicago Press.
Hatje, Ann-Katrin, 1974. *Befolkningsfrågan och välfärden*, Allmänna förlaget.
Hayek, Friedrich A., 1944, 2007. *The Road to Serfdom*, G. Routledge & Sons.
Haynes, Robert H., 1998. Heritable variation and mutagenesis at early international congresses of genetics. *Genetics* 148: 1419–1431.
Herrnstein, Richard J. & Murray, Charles, 1994. *The Bell Curve: Intelligence and Class Structure in American Life*, N. Y. Free Press.
Hillel, Marc & Henry, Clarissa, 1976. *Of Pure Blood*, McGraw-Hill Companies.
Hirsch, Jerry, 1963. Behavior genetics and individuality understood. *Science* 142: 1436–1442.
Hirschman, Albert O., 1970. *Exit, Voice, and Loyalty: Responses to Decline in Firms, Organizations, and States*, Harvard University Press.
Hirschman, Albert O., 1991. *The Rhetoric of Reaction: Perversity, Futility, Jeopardy*, Belknap Press.
Hitler, Adolf, 1925. *Mein Kampf*. [2016. *Eine kritische Edition, Band I & II*. Im Auftrag des Instituts für Zeitgeschichte München-Berlin, https://www.mein-kampf-edition.de/?page=band1%2Fp302.html, accessed 15 December 2024.]
Hitler, Adolf, 1939, 2011. *Mein Kampf*. The Official 1939 Edition, Coda.
Hobsbawm, Eric, 1987. *The Age of Empire: 1875–1914*, Weidenfeld and Nicolson.
Hofstadter, Richard, 1944. *Social Darwinism in American Thought*, University of Pennsylvania Press.
Höglund Mattias & Bengtsson, Bengt Olle, 2014. The origin of the Mendelian Society in Lund and the start of *Hereditas*. *Hereditas* 151: 110–114.
Hossfeld, Uwe & Thornström, Carl-Gustaf, 2002. 'Rasches Zupacken': Heinz Brücher und das botanische Sammelkommando der SS nach Rußland 1943, pp. 119–144 in Susanne Heim, ed., *Autarkie und Ostexpansion: Pflanzenzucht und Agrarforschung im Nationalsozialismus*, Wallstein. [For a shorter version of this paper translated into

English, see Carl-Gustaf Thornström & Uwe Hossfeld, 2002. Instant appropriation – Heinz Brücher and the SS botanical collecting commando to Russia 1943. *Plant Genetic Resources Newsletter*, No. 129: 39–42.]

Hunt, Nigel, 1967. *The World of Nigel Hunt: The Diary of a Mongoloid Youth. Foreword by Professor L. S. Penrose*, Darwen Finlayson.

Hutton, Christopher, 2005. *Race and the Third Reich: Linguistics, Racial Anthropology and Genetics in the Dialectic of Volk*, Polity Press.

Ibsen, Henrik, 1881, 1964. *Ghosts, A Public Enemy, When We Dead Awake*, Penguin.

Ings, Simon, 2016. *Stalin and the Scientists: A History of Triumph and Tragedy 1905–1953*, Faber & Faber.

Iskander, Fazil, 1966–73, 1977. *The Goatabex Constellation*, Abrams.

Jackson, Jr., John P. & Weidman, Nadine M., 2004. *Race, Racism, and Science: Social Impact and Interaction*, ABC-CLIO.

Jacob, François, 1973, 1993. *The Logic of Life: A History of Heredity*, Vintage books.

Jacob, François, 1987. *La statue intérieure*, Odile Jacob/Seuil.

Jacob, François & Monod, Jacques, 1961. Genetic regulatory mechanisms in the synthesis of proteins. *Journal of Molecular Biology* 3: 318–356.

Jacquard, Albert (& Hélène Amblard), 1989. *Idées vécues*, Flammarion.

Jacquard, Albert, 2012. *Dans ma jeunesse*, Stock.

Jensen, Arthur R., 1969. 'How much can we boost IQ and scholastic achievement?' *Harvard Educational Review* 39: 1–123.

Johannsen, Wilhelm, 1905. *Arvelighedslærens Elementer*, Gyldendalske boghandel.

Johannsen, Wilhelm, 1909. *Elemente der exakten Erblichkeitslehre*, Fischer.

Johannsen, Wilhelm, 1918. *Eugenik*, pp. 550–552 in *Salmonsens Konversationsleksikon*, Copenhagen.

Jordanova, Ludmilla J., 1984. *Lamarck*, Oxford University Press.

Judson, Horace Freeland, 1979. *The Eighth Day of Creation: Makers of the Revolution in Biology*, Simon and Schuster.

Kant, Immanuel, 1775, 2007. Of the different races of human beings, pp. 82–97 in *Anthropology, History, and Education*, eds. Günter Zöller & Robert B. Louden, Cambridge University Press.

Kater, Michael H., 2000. *Composers of the Nazi Era: Eight Portraits*, Oxford University Press.

Kay, Lily E., 1993. *The Molecular Vision of Life: Caltech, The Rockefeller Foundation, and the Rise of the New Biology*, Oxford University Press.

Kay, Lily E., 2000. *Who Wrote the Book of Life? A History of the Genetic Code*, Stanford University Press.

Keller, Evelyn Fox, 1983. *A Feeling for the Organism: The Life and Work of Barbara McClintock*, W. H. Freeman.

Kershaw, Ian, 2008. *Hitler: A Biography*, W. W. Norton & Company.

Kevles, Daniel J., 1985. *In the Name of Eugenics: Genetics and the Uses of Human Heredity*, University of California Press.

Kilbey, Brian J., 1995. Charlotte Auerbach. *Genetics* 141: 1–5.

Kingsbury, Noel, 2009. *Hybrid: The History and Science of Plant Breeding*, The University of Chicago Press.

Klausen, Susanne M., 2018. Eugenics and the maintenance of white supremacy in modern South Africa, pp. 289–309 in Diane B. Paul, John Stenhouse & Hamish G.

Spencer, eds., *Eugenics at the Edges of Empire: New Zealand, Australia, Canada and South Africa*, Springer International Publishing.

Klemperer, Victor, 1947, 2018. *The Language of the Third Reich*, Bloomsbury. [English translation of *LTI: Notisbuch eines Philologen*.]

Koch, Lene, 2014. *Racehygiejne i Danmark 1920–1956*, Gyldendal.

Kohler, Robert E., 1994. *Lords of the Fly: Drosophila Genetics and the Experimental Life*, The University of Chicago Press.

Kotek, Joel & Kotek, Dan, 1986. *L'Affaire Lyssenko*, Editions complexe.

Krementsov, Nikolai, 1996. A 'second front' in Soviet Genetics: The international dimension of the Lysenko controversy, 1944–1947. *Journal of the History of Biology* 29: 229–250.

Kuhn, Thomas S., 1957. *The Copernican Revolution: Planetary Astronomy in the Development of Western Thought*, Harvard University Press.

Kuhn, Thomas S., 1962, 1970. *The Structure of Scientific Revolutions*, University of Chicago Press.

La Mettrie, Julien Offray de, 1748, 1999. *L'Homme machine*, L'imp d'Elie Luzac, fils. [English version: *Man a Machine*, Hackett Publishing Company.]

Lackerstein, Debbie, 2012. *National Regeneration in Vichy France: Ideas and Policies, 1930–1944*, Ashgate.

Lakatos, Imre, 1970. Falsification and the methodology of scientific research programmes, pp. 91–196 in Imre Lakatos & Alan Musgrave, eds., *Criticism and the Growth of Knowledge*, Cambridge University Press.

Lakatos, Imre, 1976. *Proofs and Refutations: The Logic of Mathematical Discovery*, Cambridge University Press.

Lakatos, Imre, 1978. *The Methodology of Scientific Research Programmes: Philosophical Papers Volume 1.* Edited by John Warrall and Gregory Currie, Cambridge University Press.

Lang, Anton, 1987. Elisabeth Schiemann: Life and career of a woman scientist in Berlin. *Englera* 7: 17–28.

Larvor, Brendan, 1998. *Lakatos: An Introduction*, Routledge.

Laxova, Renata, 1998. Lionel Sharples Penrose, 1898–1972: A personal memoir in celebration of the centenary of his birth. *Genetics* 150: 1333–1340.

Lévi-Strauss, Claude, 1947, 1967. *Les Structures Élémentaires de la Parenté*, Presses universitaires de France.

Li, C. C., 1961. Genetics. *The China Quarterly*, No 6, April–June 1961, pp. 144–152.

Lidforss, Bengt, 1904. *Fragment och miniatyrer: Uppsatser i skilda ämnen*, Bonnier.

Lidforss, Bengt, 1908. *Naturvetenskapliga kåserier*, Framtiden.

Lidforss, Bengt, 1913. Resumé seiner Arbeiten über Rubus. Mitgeteilt von W. Johannsen. *Zeitschrift für induktive Abstammungs- und Vererbungslehre* 12: 1–13.

Locke, John, 1689, 2016. *Second Treatise of Government*, Oxford University Press.

Lundborg, Herman, 1913. *Medizinisch-biologische Familienforschungen innerhalb eines 2232 köpfigen Bauerngeschlechtes in Schweden (Provinz Blekinge)*, Fischer.

Lundborg, Herman, 1920. *En svensk bondesläkts historia: Sedd ur rasbiologisk belysning*, P. A. Norstedt & söner.

Lush, Jay L., 1941. Methods of measuring the heritability of individual differences among farm animals, in R. C. Punnet, ed., *Proceedings of the 7th International Congress of Genetics, 1939. Journal of Genetics, Supplementary Volume*, p. 199.

Lush, Jay L., 1949. Heritability of quantitative characters in farm animals, in Gert Bonnier & Robert Larsson, eds., *Proceedings of the Eighth International Congress of Genetics. Hereditas* Supplementary volume.
Lyon, E. Stina, 2007. Gunnar Myrdal, pp. 124–128 in John Scott, ed., *Fifty Key Sociologists: The Formative Theorists*, Routledge.
Lysenko, Trofim D., 1948. Address delivered by Academician T. D. Lysenko on the situation in biological science *plus* Concluding remarks by Academician T. D. Lysenko, pp. 11–50 and 605–617 in Lenin Academy of Agricultural Sciences of the U.S.S.R, 1949, *The Situation in Biological Science: Verbatim report*. [Also: Lysenko, T. D., 1949, *The Situation in Biological Science*, Foreign Languages Publishing House.]
MacKenzie, Donald A., 1981. *Statistics in Britain 1865–1930: The Social Construction of Scientific Knowledge*, Edinburgh University Press.
Macpherson, C. B., 1962. *The Political Theory of Possessive Individualism: Hobbes to Locke*, Oxford University Press.
Manolio, Teri A. et al., 2009. Finding the missing heritability of complex diseases. *Nature* 461: 747–753.
Marks, Jonathan, 2008. The construction of Mendel's laws. *Evolutionary Anthropology* 17: 250–253.
Marris, Emma, 2005. Free genome databases finally defeat Celera. *Nature* 435: 6.
Marx, Karl & Engels, Friedrich 1848, 2017. *Das Kommunistische Manifest*, Klassiker der Philosophie, CreateSpace [English version *The Communist Manifesto*, 1973, Penguin.]
Mattila, Markku, 1996. *People of Good Quality: Eugenics in Finland before the State Became Interested.* English summary of licentiate thesis, University of Tampere.
Mazumdar, Pauline M. H., 1996. Two models for human genetics: Blood grouping and psychiatry in Germany between the world wars. *Bulletin of the History of Medicine* 70: 609–657.
McGuinness, Brian, 1988. *Wittgenstein: A Life: Young Ludwig 1889–1921*, Duckworth.
Medawar, Peter, 1967. *The Art of the Soluble*, Methuen.
Medvedev, Zhores A., 1969, 1971. *The Rise and Fall of T. D. Lysenko*, Columbia University Press.
Medvedev, Zhores A., 1978. *Soviet Science*, Norton.
Mendel, Gregor, 1866. Versuche über Pflanzen-Hybriden. *Verhandlungen des Naturforschenden Vereines in Brünn* 4: 3–47.
Meyers Lexikon, 1936–1942, Leipzig, 8th edition.
Mill, John Stuart, 1873, 1989. *Autobiography*, Penguin.
Montagu, Ashley, 1972. *Statement on Race: An Annotated Elaboration and Exposition of the Four Statements on Race Issued by the United Nations Educational, Scientific, and Cultural Organization, Third Edition*, Oxford University Press.
Morange, Michel 1994. *Histoire de la biologie moléculaire*, La Decouverte.
Morange, Michel 2002. *Les mousquetaires de la nouvelle biologie*, Pour la Science.
Morgan, Thomas Hunt, 1917. The theory of the gene. *The American Naturalist* 51: 513–544.
Morgan, Thomas Hunt, Sturtevant, Alfred H., Muller, Hermann J. & Bridges, Calvin B., 1915. *The Mechanism of Mendelian Heredity*, Holt.
Mudde, Cas, 2019. *The Far Right Today*, Polity Press.
Muller, H. J., 1936. *Out of the Night: A Biologist's View of the Future*, Victor Gollancz.
Müller-Hill, Benno, 1998. *Murderous Science: Elimination by Scientific Selection of Jews, Gypsies, and Others in Germany, 1933–1945*, Cold Spring Harbor Laboratory Press.

Müller-Wille, Staffan, 2007. Race et appartenance ethnique: La diversité humain et l'UNESCO. Les Déclarations sur la race (1950 et 1951), pp. 211–220 in *60 ans d'histoire de l'UNESCO: Actes du colloque international, Paris, 16–18 novembre 2005*, UNESCO.

Müller-Wille, Staffan & Rheinberger, Hans-Jörg, 2012. *A Cultural History of Heredity*, The University of Chicago Press.

Munnisch, Arnold, 1999. *La rage d'esperér*, Plon.

Myrdal, Alva & Myrdal, Gunnar, 1934. *Kris i befolkningsfrågan*, Bonnier.

Myrdal, Gunnar (with the assistance of Richard Sterner and Arnold Rose), 1944. *An American Dilemma: The Negro Problem and American Democracy*, Harper & Brothers.

Nature [anonymous editorial], 2018. Anatomy does not define gender. *Nature* 563: 5.

Nature Genetics [anonymous editorial], 2002. What's brewing in genetic testing. *Nature Genetics* 32: 553–554.

Neel, James V., 1983. Curt Stern, 1902–1981. *Annual Review of Genetics* 17: 1–10.

Nelkin, Dorothy & Lindee, M. Susan, 1995. *The DNA Mystique: The Gene as a Cultural Icon*, Freeman.

Neumann, Franz, 1942 and 1944, 1963. *Behemoth: The Structure and Practice of National Socialism 1933–1944*, Harper & Row.

Nilsson-Ehle, Herman, 1919. *Något om Ärftlighetsvetenskapens praktiska och ekonomiska betydelse*, Landskrona tr.-ab.

Nilsson-Ehle, Herman, 1928. Teorier och verklighet. *Det nya Sverige*, 22, h. 1, 18–20.

Olsson, Gösta, ed., 1986. *Svalöf 1886–1986: Research and Results in Plant Breeding*, LT.

O'Sullivan, Noel, 2013. Conservatism, pp. 293–311 in Michael Freeden, Lyman Tower Sargent & Marc Stears, eds., *The Oxford Handbook of Political Ideologies*, Oxford University Press.

Overy, Richard, 2009. *1939: Countdown to War*, Penguin.

Page, Ellis B. with 49 co-signers, 1972. Behavior and heredity. *American Psychologist* 27: 660–661.

Panofsky, Aaron, 2014. *Misbehaving Science: Controversy and the Development of Behavior Genetics*, University of Chicago Press.

Panofsky, Aaron, Dasgupta, Kushan & Iturriaga, Nicole, 2020. How White nationalists mobilize genetics: From genetic ancestry and human biodiversity to counterscience and metapolitics. *American Journal of Anthropology* 175: 387–398.

Paul, Diane B., 1979. Marxism, Darwinism, & the theory of two sciences. *Marxist Perspectives* 2: 116–143.

Paul, Diane B., 1984. Eugenics and the Left. *Journal of the History of Ideas* 45: 567–590.

Paul, Diane B. & Brosco, Jeffrey P., 2013. *The PKU Paradox: A Short History of a Genetic Disease*, JHU Press.

Paul, Diane B. & Falk, Raphael, 1999. Scientific responsibility and political context: The case of genetics under the swastika, pp. 257–275 in Jane Maienschein & Michael Ruse, eds., *Biology and the Foundation of Ethics*, Cambridge University Press.

Paxton, Robert O., 2004. *The Anatomy of Fascism*, Allen Lane.

Pegg, David et al., 2024. Revealed: The international 'race science' network funded by US tech boss. *Guardian Weekly*, 25 October 2024: 30–32.

Penrose, Lionel S., 1938. *A Clinical and Genetic Study of 1280 Cases of Mental Defect*, Special report series, Medical Research Council.

Pick, Daniel, 1989. *Faces of Degeneration: A European Disorder, c. 1848 – c. 1918*, Cambridge University Press.

Pope Pius XI, 1930. *Encyclical on Christian marriage to the venerable brethren, patriarchs, primates, archbishops, bishops, and other local ordinaries enjoying peace and communion with the apostolic see*.
Popper, Karl, 1959. *The Logic of Scientific Discovery*, Basic Books. [English translation of *Logik der Forschung*, 1934.]
Porter, Theodore M., 2018. *Genetics in the Madhouse: The Unknown History of Human Heredity*, Princeton University Press.
Pringle, Peter. 2008. *The Murder of Nikolai Vavilov: The Story of Stalin's Persecution of One of the Great Scientists of the Twentieth Century*, Simon & Schuster.
Proust, Marcel, 1918, 2003. *In Search of Lost Time. Volume 2: In the Shadow of Young Girls in Flower*, Penguin.
Provine, William B., 1986. Geneticists and race. *American Zoologist* 26: 857–887.
Provine, William B., 2001. *The Origins of Theoretical Population Genetics*, University of Chicago Press.
Punnett, Reginald C., 1907. *Mendelism*, *Second edition*, Macmillan.
Punnett, Reginald C., ed., 1941. *Proceedings of the Seventh International Genetical Congress. Supplement to Journal of Genetics.*
Radick, Gregory, 2023. *Disputed Inheritance: The Battle over Mendel and the Future of Biology*, The University of Chicago Press.
Rheinberger, Hans-Jörg, 1997. *Towards a History of Epistemic Things: Synthesizing Proteins in the Test Tube*, Stanford University Press.
Richmond, Marsha L., 2001. Women in the early history of genetics: William Bateson and the Newnham College Mendelians, 1900–1920. *Isis* 92: 55–90.
Rieger, Rigomar, Michaelis, Arnd & Green, Melvin M., 1976. *Glossary of Genetics and Cytogenetics: Classical and Molecular. Fourth Completely Revised Edition*, Springer-Verlag.
Rieger, Rigomar, Michaelis, Arnd & Green, Melvin M., 1991. *Glossary of Genetics and Cytogenetics: Classical and Molecular. Fifth Edition*, Springer-Verlag.
Ripke, Stephan et al., 2014. Biological insights from 108 schizophrenia-associated genetic loci. *Nature* 511: 421–427.
Roberts, Gareth & Grimaldi, Keith, 2003. Sciona and genetic testing. *Nature Genetics* 22: 121.
Rose, Steven, Kamin, Leon J. & Lewontin, R. C., 1984. *Not in Our Genes: Biology, Ideology and Human Nature*, Penguin.
Rosenvinge, Lauritz Kolderup, 1927/28. Mindeord over afdøde Medlemmer. Wilhelm Ludvig Johannsen. Liv og Personlighed. *Det Konglige Danske Videnskabernes Selskabs forhandlinger* 1927/28: 43–63.
Rousseau, Jean-Jacques, 1755, 2011. *Discours sur l'origine et les fondements de l'inégalité parmi les hommes*. [*Discourse on the Origin of Inequality*, Bedford/St. Martins.]
Rousseau, Jean-Jacques, 1782, 2008. *Les Confessions*. [*Confessions*, Oxford University Press.]
Rüdin, Ernst, 1916. *Studien über Vererbung und Entstehung Geistiger Störungen. 1. Zur Vererbung und Neuentstehung der Dementia Praecox*, Springer.
Sapp, Jan, 1987. *Beyond the Gene: Cytoplasmic Inheritance and the Struggle for Authority in Genetics*, Oxford University Press.
Sartre, Jean-Paul, 1946, 1954. *Réflexions sur la question juive*, P. Morihien. [English version *Anti-Semite and Jew*, 1948, 1995, Schocken Books.]
Schappacher, Norbert, 2005. Felix Bernstein. *International Statistics Review* 73: 1. 3–7.

Scheich, Elvira, 2002. Elisabeth Schiemann (1881--1972). Patriotin im Zwiespalt, pp. 250–279 in Susanne Heim, ed., *Autarkie und Ostexpansion: Pflanzenzucht und Agrarforschung im Nationalsozialismus*, Wallstein.

Scherfig, Hans, 1965. *Naturens uorden og andre essays*, Gyldendals uglebøger.

Schneider, William H., 1990. *Quality and Quantity: The Quest for Biological Regeneration in Twentieth-Century France*, Cambridge University Press.

Schneider, William H., 1996. The history of research on blood group genetics: Initial discovery and diffusion. *History and Philosophy of the Life Sciences* 18: 277–303.

Schrödinger, Erwin, 1944. *What is Life? The Physical Aspect of the Living Cell*, Cambridge University Press.

Shannon, Claude E. & Weaver, Warren, 1949. *The Mathematical Theory of Communication*, University of Illinois Press.

Simenon, Georges, 1931. *La Guinguette à deux sous*, Presses de la cité.

Simenon, Georges, 1931. *La Nuit du carrefour*, Presses de la cité.

Simenon, Georges, 1931. *Le chien jaune*, Pocket.

Simenon, Georges, 1931. *Monsieur Gallet, décédé*, Presses de la cité.

Simenon, Georges, 1932. *L'affaire Saint-Fiacre*, Pocket.

Simenon, Georges, 1932. *Le fou de Bergerac*, Presses Pocket.

Simenon, Georges, 1934. *Maigret*, Fayard.

Slobodian, Quinn, 2018. *Globalists: The End of Empire and the Birth of Neoliberalism*, Harvard University Press.

Smith, Adam, 1776, 1999. *The Wealth of Nations*, Penguin.

Smith, J. D. & Wehmeyer, M. L., 2012. Who was Deborah Kallikak? *Intellectual and Developmental Disabilities* 50(2): 169–178.

Soyfer, Valery N., 1989. New light on the Lysenko era. *Nature* 339: 415–420.

Soyfer, Valery N., 2003. Tragic history of the VII International Congress of Genetics. *Genetics* 165: 1–9.

Stamhuis, Ida H. & Monsen, Arve, 2007. Kristine Bonnevie, Tine Tammes and Elisabeth Schiemann in early genetics: Emerging changes for a university career for women. *Journal of the History of Biology* 40: 427–466.

Stamhuis, Ida H. & Vogt, Annette B., 2017. Discipline building in Germany: Women and genetics at the Berlin Institute for Heredity Research. *The British Journal for the History of Science* 50: 267–295.

Steinberg, Deborah Lynn, 2020. *Genes and the Bioimaginary: Science, Spectacle, Culture*, Routledge.

Stern, Curt, 1949, 1960. *Principles of Human Genetics*, W. H. Freeman.

Subramanian, Samanth, 2020. *A Dominant Character: The Radical Science and Restless Politics of J.B.S. Haldane*, W. W. Norton & Company.

Sulloway, Frank J., 1979. *Freud, Biologist of the Mind*, Burnett Books.

Sulston, John & Ferry, Georgina, 2002. *The Common Thread: Science, Politics, Ethics and the Human Genome*, Joseph Henry Press.

Supreme Court of the United States, 2013. *Association for Molecular Pathology et al.* v. *Myriad Genetics, Inc., et al. Syllabus and Opinion of the Court.*

Svensson, Kristian, 2001. *Kravaller och steriliseringar: Vem har fått skriva vänsterns historia?* Skrivareförlaget.

Teicher, Amir, 2020. *Social Mendelism: Genetics and the Politics of Race in Germany, 1900–1948*, Cambridge University Press.

Therborn, Göran, 1992. A unique chapter in the history of democracy: The Social Democrats in Sweden, pp. 1–34 in Klaus Misgeld, Karl Molin & Klas Åmark, eds., *Creating Social Democracy: A Century of the Social Democratic Labour Party in Sweden*, Pennsylvania State Univ. Press.

Thiolay, Boris, 2012. *Lebensborn: La fabrique des enfants parfaits*, Flammarion.

Tingsten, Herbert, 1957. Editorials. *Dagens Nyheter*, 17 and 19 December 1957.

Torrey, E. Fuller & Yolken, Robert H., 2010. Psychiatric genocide: Nazi attempts to eradicate schizophrenia. *Schizophrenia Bulletin*, 36: 26–32.

Trägårdh, Gustaf, 1879. *Några ord om sjukdomars ärftlighet*, Lindstedt.

Tredoux, Gavan, 2018. *Comrade Haldane is Too Busy to go on Holiday: The Genius who Spied for Stalin*, Encounter Books.

Trotsky, Leon, 1924. *Literature and Revolution*, https://www.marxists.org/archive/trotsky/1924/lit_revo/ch08.htm (accessed 15 December 2024).

Trubetskoy, Vassili et al., 2022. Mapping genomic loci implicates genes and synaptic biology in schizophrenia. *Nature* 604: 502–508.

Tucker, William H., 1994. *The Science and Politics of Racial Research*, University of Illinois Press.

Tunlid, Anna, 2004. *Ärftlighetsforskningens gränser: Individer och institutioner i framväxten av svensk genetik*, Diss. Lund.

Tydén, Mattias 2002. *Från politik till praktik: De svenska steriliseringslagarna 1935–1975*, Almqvist & Wiksell International.

Venter, J. Craig, 2007. *A Life Decoded: My Genome: My Life*, Viking.

Voinovich, Vladimir 1969, 1995. *The Life and Extraordinary Adventures of Private Ivan Chonkin*, Northwestern University Press.

Washington Post, 25 February 2021.

Watson, James D. & Crick, Francis H. C., 1953a. Molecular structure of nucleic acids: A structure for deoxyribose nucleic acid. *Nature* 171: 737–738.

Watson, James D. & Crick, Francis H. C., 1953b. Genetical implications of the structure of deoxyribonucleic acid. *Nature* 171: 964–967.

Watt, David C., 1998. L. S. Penrose FRS (1898–1972): Psychiatrist and professor of human genetics. *The British Journal of Psychiatry*, 173: 458–461.

Wehler, Hans-Ulrich, 1985. *The German Empire, 1871–1918*, Berg.

Weindling, Paul, 1989. *Health, Race and German Politics between National Unification and Nazism, 1870–1947*, Cambridge University Press.

Weininger, Otto, 1903, 2005. *Sex and Character: An Investigation of Fundamental Principles*, Indiana University Press.

Weiss, Sheila Faith, 2005. *'The Sword of Our Science' as a Foreign Policy Weapon: The Political Function of German Geneticists in the International Arena During the Third Reich*. Ergebnisse 22. Forschungsprogramm, Geschichte der Kaiser-Wilhelm-Gesellschaft im Nationalsozialismus.

Weiss, Sheila Faith, 2010. *The Nazi Symbiosis: Human Genetics and Politics in the Third Reich*, The University of Chicago Press.

Wells, H. G., 1909, 2005. *Ann Veronica*, Penguin.

Werskey, Gary, 1978. *The Visible College: A Collective Biography of British Scientists and Socialists of the 1930s*, Allen Lane.

Wexler, Alice, 1995. *Mapping Fate: A Memoir of Family, Risk, and Genetic Research*, University of California Press.

Williams, Raymond, 1976. *Keywords: A Vocabulary of Culture and Society*, Fontana.
Wobus, Ulrich & Schubert, Ingo, 2002. Science and politics: Hans Stubbe and the Institute of Plant Genetics and Crop Plant Research at Gatersleben. *Trends in Plant Science* 7: 418–420.
Zimmeren, Esther van et al., 2014. The BRCA patent controversies: An international review of patent disputes, pp. 151–174 in Sahra Gibbon, Galen Joseph, Jessica Mozersky, Andrea zur Nieden & Sonja Palfner, eds., *Breast Cancer Gene Research and Medical Practices: Transnational Perspectives in the Time of BRCA*, Routledge.
Zola, Émile, 1893, 1993. *Doctor Pascal*, Gallimard.

Index of names

Bengt Olle Bengtsson (1946–2025) was a professor of genetics at Lund University in Sweden. He has published widely in the area of population genetics (including the book *Understanding Population Genetics*, with Torbjörn Säll, Wiley 2017) and on questions of science and society. Among his works in Swedish are *Genetik och politik* (Norstedts 1999), *Genetiska konflikter* (ellerströms 2006) and *Bortom det acceptablas gränser* (ed. with Gunnar Broberg, ellerströms 2013).

Previously published in the Pandora Series

Boel Berner, *Perpetuum mobile? Teknikens utmaningar och historiens gång* (1999)

Johan M. Sanne, *Creating Safety in Air Traffic Control* (1999)

Sabrina Thelander, *Tillbaka till livet. Att skapa säkerhet i hjärtintensivvården* (2001)

Kerstin Sandell, *Att (åter)skapa "det normala". Bröstoperationer och brännskador i plastikkirurgisk praktik* (2001)

Viveka Adelswärd & Lisbeth Sachs, *Framtida skuggor. Samtal om risk, prevention och den genetiska familjen* (2002)

Boel Berner (ed.), *Vem tillhör tekniken? Kunskap och kön i teknikens värld* (2003)

Christer Eldh, *Den riskfyllda gemenskapen. Att hantera säkerhet på ett passagerarfartyg* (2004)

Ericka Johnson, *Situating Simulators. The Integration of Simulations in Medical Practice* (2004)

Tora Holmberg, *Vetenskap på gränsen* (2005)

Staffan Wennerholm, *Framtidsskaparna. Vetenskapens ungdomskultur vid svenska läroverk 1930–1970* (2005)

Elin Bommenel, *Sockerförsöket. Kariesexperimenten 1943–1960 på Vipeholms sjukhus för sinnesslöa* (2006)

Robert Hrelja, *I hettan från ångpannan. Vetenskap och politik i konflikter om tekniska anläggningar* (2006)

Jonas Anshelm, *Bergsäkert eller våghalsigt? Frågan om kärnavfallets hantering i det offentliga samtalet i Sverige 1950–2002* (2006)

Christer Nordlund, *Hormoner för livet. Endokrinologin, läkemedelsindustrin och drömmen om ett botemedel mot sterilitet 1930–1970* (2008)

Mats Brusman, Tora Friberg & Jane Summerton (eds.), *Resande, planering, makt* (2008)

Johan Wänström, *Samråd om Ostlänken. Raka spåret mot en bättre demokrati?* (2009)

Ingemar Bohlin & Morten Sager (eds.), *Evidensens många ansikten. Evidensbaserad praktik i praktiken* (2011)

Maria Björkman, *Den anfrätta stammen. Nils von Hofsten, eugeniken och steriliseringarna 1909–1963* (2011)

Annemarie Mol, *Omsorgens logik. Aktiva patienter och valfrihetens gränser* (2011)

Boel Berner, *Blodflöden. Blodgivning och blodtransfusion i det svenska samhället* (2012)

Olof Hallonsten (ed.), *In Pursuit of a Promise. Perspectives on the Political Process to Establish the European Spallation Source (ESS) in Lund, Sweden* (2012)

Boel Berner & Isabelle Dussauge (eds.) *Kön, kropp, materialitet. Perspektiv från fransk genusforskning* (2014)

Lisa Lindén, *Communicating Care. The Contradictions of HPV Vaccination Campaigns* (2016)

Anders Lundgren, *Kunskap och kemisk industri i 1800-talets Sverige* (2017)

Kristofer Hansson & Markus Idvall (eds.), *Interpreting the Brain in Society. Cultural Reflections on Neuroscientific Practices* (2017)

Frida Wikström, *Att skriva sig ut. Nya terapeutiska miljöer och tvångsvårdade patienters subjektsformering 1967–1992* (2018)

Karl Bruno & Per Lundin (eds.), *Önskad och ifrågasatt. Lantbruksvetenskapernas akademisering i 1900-talets Sverige* (2020)

Malin Henriksson & Christina Lindkvist (eds.), *Kollektiva resor. Utmaningar för socialt hållbar tillgänglighet* (2020)

Martin Hultman, Ann-Sofie Kall & Jonas Anshelm, *Att ställa frågan – att våga omställning. Birgitta Hambraeus och Birgitta Dahl i den svenska energi- och miljöpolitiken 1971–1991* (2021)

Josefin Persdotter, *Menstrual Dirt. An Exploration of Contemporary Menstrual Hygiene Practices in Sweden* (2022)

Boel Berner, *Mat, misär och ett medicinskt mysterium. Historien om pellagra* (2024)

Arne Kaijser, Gustav Sjöblom, Johan Gribbe & Per Lundin, *Maktens maskiner. Hur stora datorer moderniserade folkhemmet* (2024)

Ingemar Pettersson & Daniel Normark (eds.), *Sinnen i arbete* (2025)

Books in the Pandora Series focus on technology and society – possibilities, risks and uncertainties.

A new science focused on *the gene* – a term coined in 1909 – entered the Western intellectual scene at the start of the twentieth century. It was based on the rediscovery of Gregor Mendel's experiments and soon attracted popular and political attention. Since then, the gene has been variously embraced and rejected, honoured and ignored as the crucial factor behind social inequality, racial differences, individual intelligence and much more. Today, we all talk about what is in our DNA.

In this extended personal essay, Bengt Olle Bengtsson reflects on the power of the gene. He does this via a thorough analysis of the how the five main ideologies of our time – conservatism, social democracy, communism, Nazism and liberalism – have reacted to, and acted on, genetic ideas and results. As he shows, this has been a controversial and often passionate relationship. It has shaped politics, justified both social exclusion and unjust hierarchies and inspired ideas of community and identity.

Bengt Olle Bengtsson (1946–2025) was professor emeritus of genetics at Lund University, Sweden.

ARKIV