Introduction

The purpose of this book is to consider the relationship between genetic variation and human behaviour in the context of ideas about human freedom and determinism. Achieving this aim requires a prior examination of the dichotomous language that has tended to shape discussion on this topic: nature and nurture; hereditarian and behaviourist; innate and learned; genes and environment. It will be suggested that all forms of dichotomous thinking have been thoroughly subverted by recent biological findings, generating a richer and more nuanced picture of human identity, impinging on our understanding of the human as a freely choosing biological organism. A survey of genetic variation amongst organisms possessing nervous systems rather less complex than our own informs the discussion, but certainly does not resolve it.

This is not primarily a book about philosophy, although philosophy is brought into conversation with biology in Chapter 11. The framework here is provided more by biology than by philosophy. Nevertheless, the word 'determinism' appears in the title and requires some definition. For the purposes of this book 'hard determinism' is defined not in the way generally used by philosophers, but rather as the thesis that 'given our particular genomes our lives are not really up to us and are constrained to follow one particular future', where the word 'genome' refers to the sum total of information contained in our DNA. There is also a softer form of genetic determinism which states that 'given our particular genomes our lives are more likely to follow one particular future', which arguably is not really determinism at all. In reality the various positions adopted are located somewhere on a spectrum lying between the two poles provided by these two definitions. We will leave these definitions as 'place holders' until they receive greater attention in later chapters, and in Chapter 11 in particular.

As a biologist, I see 'free will' as a Darwinian trait which all adult humans in good health display in the same kind of way that they are typically characterised by having two arms and two legs. It refers to the universal feeling of up-to-usness that all humans experience during the process of making a decision, unless, that is, they are under the influence of drugs, suffering from a debilitating illness or psychiatrically impaired. Of course, having an experience per se, even one as reliable and persuasive as the daily experience of up-to-usness, is no guarantee of its ontological status. More formally we will therefore define free will as the 'the ability to intentionally choose between courses of action in ways that make us responsible for what we do', and it is this definition which will be discussed in Chapter 11 in the light of genetics, with all that this entails for moral responsibility, the criminal justice system and the structure of human society more widely. In the interim the book focuses on one main question: Are there particular genotypes, that is, sets of genetic variants, that correlate so tightly with certain displays of human behaviour that we are led to the conclusion that we really are 'constrained to follow one particular future'?

Genetic Determinism in Contemporary Discourse

With possible rare exceptions (Cashmore, 2010), there are today no 'hard genetic determinists' as previously defined within the academic biological research community, although there certainly have been in the past, and there are without doubt examples of 'hard genetic determinism' relating to medical pathologies, which will be discussed later. Generally, biologists today take great pains to highlight the role of both genes and the environment in reporting their work, and no one doubts that gene-environment interactions are critical for the development of all living organisms, not least the human. So are we then tilting at windmills by including the word 'determinism' in a book about contemporary genetics? I suspect not. There are two issues here, one relating to the biological research community and the other to the public communication and understanding of science. As far as the research community is concerned, despite the care taken by most biologists to place the publication of their genetic results within a rich discourse of gene-environment interaction, one cannot avoid the impression that for some geneticists, at least, it is the particular genetic variation which is providing the 'real story' as to what is going on in terms of the animal or human behaviour under investigation. It is both the power and the peril of the methodological reductionism – without which biological scientific enquiry would cease to function – that the success of genetics

as an explanatory field can leave other valid and complementary levels of explanation unexamined or even unmentioned, thereby opening the way to an implicit, if not explicit, ontological reductionism, a philosophy parasitic on science, though not part of science. There can, therefore, be a creeping 'backdoor determinism' displayed in the language of some academic genetic discourse which gives primacy to the role of the genes almost as a matter of habit. 'Backdoor determinism' also crops up sometimes when geneticists are collaborating with economists, sociologists or criminologists. Academics not used to handling the complexities of quantitative genetics may be tempted to assign greater causative power to the genes than perhaps is warranted by the data.

A news feature in the scientific journal *Nature*, titled 'The Anatomy of Politics – from Genes to Hormone Levels, Biology May Help to Shape Political Behaviour' (Buchen, 2012),well illustrates this point. The author writes that '[a]n increasing number of studies suggest that biology can exert a significant influence on political beliefs and behaviours', reporting that 'genes could exert a pull on attitudes concerning topics such as abortion, immigration, the death penalty and pacifism'. In the article, John Hibbing, a political scientist at the University of Nebraska-Lincoln, is quoted as saying that 'it is difficult to change someone's mind about political issues because their reactions are rooted in their physiology'. We note the dualist language involved and its assumption of determinism. Genes and physiology are seen as something different from 'us' and 'our mind', and they seem to be controlling us, so we cannot even change our mind.

Political commentators and historians appear to find genetic explanations for cultural and political differences particularly alluring, perhaps because their grasp of the genetics does not match their expertise in other academic disciplines. In his book *A Farewell to Alms* (2007), the economic historian Gregory Clark argued that the English came to rule the world because the rich out-bred the poor, contributing more of their 'superior' genes to the conquering nation. In 2014, *A Troublesome Inheritance – Genes, Race and Human History*, by Nicholas Wade, stirred up a hornets' nest with its suggestion that genetic differences between 'the three major races' help explain economic differences between races and 'the rise of the West'.[1] *Plus ça change, plus c'est la même chose*, and Chapters 1 and 2 will track the long historical background that provides the cultural context for such fallacious claims.

But scientists are also sometimes guilty of hyperbole, particularly when it comes to the publicising of notable scientific advances. The publication of the full human genome DNA sequence in 2004 provided ample

opportunity. Metaphors for the genome such as 'the Holy Grail', 'the Book of Life' and 'the Code of Codes' were all used. The 'blueprint' metaphor became very popular, replacing older, less deterministic terminology such as 'genetic lottery' (Condit et al., 2009). Walter Gilbert, who first used the phrase 'Holy Grail' to describe the genome at a conference at Los Alamos in 1986, and who was one of the foremost promoters of the Human Genome Project, described its potential with this graphic image: '[O]ne will be able to pull a CD out of one's pocket and say, "Here is a human being; it's me!" . . . To recognize that we are determined, in a certain sense, by a finite collection of information that is knowable will change our view of ourselves. It is the closing of an intellectual frontier, with which we will have to come to terms' (Gilbert, 1992, p. 96). No equivocation there. In 2012 the first wave of thirty papers reporting the results of the Encyclopedia of DNA Elements (ENCODE) project were published. ENCODE 'aims to map all the functional sequences of the human genome. The main introductory paper in this series begins its Abstract by emphasising that the "human genome encodes the blueprint of life" ' (Dunham et al., 2012). The genome in popular scientific literature is often referred to as 'an instruction manual', giving the impression that the human body is assembled from the manual much as you might put together a piece of furniture from the kit supplied.

Blatant narratives of genetic determinism are perhaps most clearly seen in the media reporting of the latest discoveries in genetics, and public assumptions about the deterministic roles of genes are proving remarkably resistant to change, even when those assumptions are no longer generally held within current academic biological discourse (Moore, 2008). The possible role of a variant gene in some variant human trait is often reported as the discovery of a gene 'for' this, that or the other – there are mean genes, gluttony genes, gangster genes, liberal genes which cause you to read *The Guardian* and even the whimsical suggestion of a 'geneticism gene' that predisposes some people to think that behaviour is caused by genes. Some sample media headlines illustrate the point: 'Binge-Drinking Gene Discovered';[2] 'Study Links Spread of Religion with "Believer Gene" ';[3] 'Study Shows How to Tell If that Man in your Life Has Caring Genes';[4] 'Teen Survey Reveals Gene for Happiness';[5] 'The Science of Stress – Does Your Child Have the "Worrier" Gene?';[6] 'Happiness Gene Is in Britain's DNA';[7] 'Exam Success May Be Due to a Handful of Genes';[8] and so forth. An interview with the singer Sinead O'Connor was headlined with a quotation from the singer: 'I have no shame. I don't have an embarrassed gene'.[9] In 2006 an Australian Associated Press article began by stating that 'New Zealand

Maori carry a "warrior" gene which makes them more prone to violence, criminal acts and risky behaviour, a scientist has controversially claimed' (Kowal and Frederic, 2012). Even sober academic journals such as *Nature* can seemingly not resist the temptation to compress a complex genetic finding into such attention-grabbing headlines as 'Ruthlessness Gene Discovered'[10] or 'A Gene for Impulsivity',[11] even though the authors of the scientific papers whose work is being publicised studiously avoid such language. Discussing the tendency that many people drink alcohol at times of stress, *Newsweek* reassured readers that 'if this is you, don't blame yourself. Blame your DNA'.[12] Another widely read newspaper asks, 'Could it be that binge eaters really can't help themselves? A new study says that weak genes – not weak willpower – may be the reason some people compulsively overeat'.[13]

Despite sporadic protests made by scientists and science communicators concerning the continuing prevalence of such misleading language, the fight for readers and the general 'dumbing down' of media stories in a news-hungry world together suggests that such stories and headlines may be difficult to dislodge. The public language of genetic determinism may therefore partially be blamed on the present parlous state of the news media with all the accompanying pressures to hype up stories in misleading ways, sometimes dubbed 'genohype'. Some attempts have been made to assess whether the presence of 'genohype' in the media has itself been over-hyped. In one study, an investigation was carried out on 627 newspaper articles from the more serious broadsheets produced in four different countries reporting on 111 papers published in 24 scientific and medical journals during the period 1995–2001 (Bubela and Caulfield, 2004). The investigators assigned the newspaper articles to one of three categories: 'moderately to highly exaggerated claims', 'slightly exaggerated claims' or 'no exaggerated claims'. Only 11 per cent of the articles were categorised as having moderately to highly exaggerated claims, with 26 per cent assessed as being in the slightly exaggerated category. Also of interest in the present context was the finding that stories about behavioural genetics or neurogenetics were over-represented in newspaper articles, comprising 16 per cent of the articles compared to a roughly estimated 1 per cent of all academic press genetic articles at the time being on these topics. This might help explain why the reader gains the impression that much of genetics research is directed towards explaining human behaviour; such copy makes newsworthy stories for obvious reasons.

The Influence of the Media on Public Attitudes

Sociological attempts have been made to assess the impact of the media language of genetic determinism on public attitudes. The Condit research group and others have shown that the public's view on the causes of behaviour are often confused and contradictory, as they seek to incorporate a number of media narratives, life experiences and scientific findings into their worldview (Condit et al., 2009; Condit, 2010; Jayaratne et al., 2009). Much data suggest that the stories promulgated by the kind of 'elite media' stories cited previously do not act like 'magic bullets' to be instantly absorbed by the reader, but rather are resisted, critiqued or accepted depending on the reader's economic interests, health and social status and access to competing discourses. A recurring theme is that people display a 'two-track model' in which they can readily switch between more genetic deterministic explanations for disease or different behaviours and those which favour environmental factors or human choice (Condit et al., 2009). The two 'tracks' are often presented in contradictory ways: one moment respondents agree with statements that genes are completely determinative causes in conditions such as heart disease or diabetes, whereas the next they are willing to state that such conditions can be avoided by diet or exercise (Condit, 2010). When people are forced to think about specific cases of known links between genetics and disease, they test higher on subsequently administered genetic determinism questionnaires (Smerecnik et al., 2009). Generally such studies find little appreciation of gene-environment interactionism, the 'two-track' discourse tending to see the two kinds of explanation as mutually exclusive. There is also a tendency to see the determinative contribution of genetics as being greater for bodily traits, whereas environmental influences are seen as more dominant for matters relating to the mind (Condit and Shen, 2011). Figure 1 illustrates this tendency by combining results from three different surveys.

On the particular question of the impact of media stories that highlight genetic determinism, people seem to deploy elements of fatalism or determinism into their worldviews or life goals when they suit particular ends, either in ways that are thought to 'explain' why other groups are the way they are or in ways that lessen their sense of personal responsibility (Condit, 2011).

The proliferation of direct-to-consumer (DTC) genetic testing companies has also contributed to the idea that it is the genes that are pulling the strings of human destiny. On the whole, statements on genetics in relation to the environment are made on company websites in a reasonably

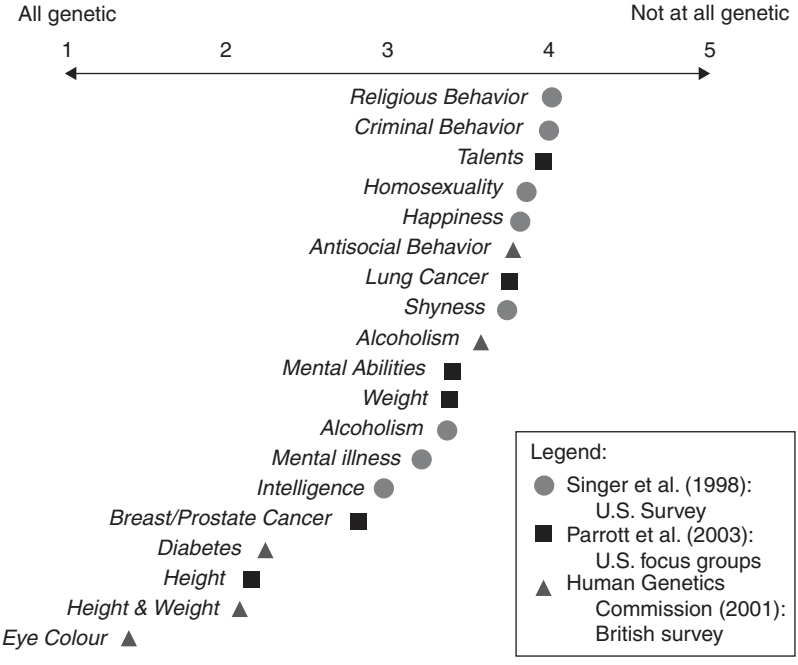

FIGURE 1. Results of three studies of public understandings of the role of genetics and non-genetic factors in the causation of human characteristics and behaviours transformed to a common standard to facilitate comparison. (From Condit, 2011 fig. 1, p. 625).

judicious way. But occasionally claims are made with distinctly deterministic overtones. As the Map My Gene website assures us: 'Genes have also been found to dictate the talents and abilities of people, which serve to explain why some people appear to be naturally-gifted in performing certain tasks while others apparently cannot get the same done despite persistent attempts'.[14] The idea of a genetically determined destiny is reinforced by sperm banks that suggest that prospective users should consider the donor's educational record, his athletic prowess, hobbies and favourite foods, as if these were somehow written into the genetic script provided by the sperm. Human eggs can likewise be purchased online with accompanying details about the donors.

Besides the company websites that provide information about DTC testing, traditional mass media are the other main source of information. '*Time* and *Newsweek* magazines have devoted numerous covers to the subject, typically framing it as a miracle technology that will

revolutionize the practice of medicine' (Rahm et al., 2012). News stories are presented using multiple different frames, such as a progressive frame (genetics as miracle cures), an empowerment frame (testing allows you to take control of your health) or a deterministic frame (genes are all-powerful): 'Studies of DTC genetic testing websites and DTC advertising of genetic tests have . . . found excessive use of empowerment framing' (Rahm et al., 2012).

Genetics, Education and Social Attitudes

Education provides a further domain in which concerns have been raised about narratives implying either strong or weak forms of genetic determinism. The dominant approach still used in the teaching of genetics in schools involves an introductory explanation of Mendel's laws of inheritance, leading the pupil to the idea that a single gene encodes a single protein which in turn controls one particular trait. Unfortunately, Mendelian ideas as stated in their simplest forms can be misleading and can lead to an assumption of genetic determinism, unless students continue on with more advanced biological education, when they will (hopefully) acquire a more nuanced picture. A study of French textbooks 'found that direct, linear and causal genetic determinism is the interpretative model most often associated with genetic diseases', although more recent textbooks spoke more of polygenic disease and the role of the environment (Castera et al., 2008). A comparison of school pupils in France and Estonia in the sixteen to eighteen age range found that there was a greater level of genetically deterministic beliefs amongst the Estonian compared to the French students (Castera et al., 2013). For example, 32 per cent of the Estonians but only 10 per cent of the French 'agreed or rather agreed' with the statement that 'Ethnic groups are genetically different and that is why some are superior to others', whereas 40 per cent of Estonian students 'agreed or rather agreed' with the statement that '[i]t is for biological reasons that women more often than men take care of house-keeping' compared to 10 per cent for the French. In general the investigators found a correlation between genetically deterministic beliefs and traits such as sexism and racism, speculating that the lower correlations found in France may partly be explained by the fact that philosophy is a compulsory course in the last grade of French secondary school, a course that tackles the topic of determinism. An alternative genetic pedagogy has been suggested from within the UK educational system that might give a more nuanced perspective as to how genes work in the development of traits (Jamieson and Radick, 2013).

Similar correlations between beliefs in genetic determinism and intolerant attitudes have been reported amongst university students. Assessed according to a social dominance orientation (SDO) scale, which is said to measure 'the degree to which individuals desire and support group-based hierarchy and the domination of "inferior" groups by "superior" groups' (Sidanius and Pratto, 1999, p. 48), beliefs in genetic determinism ('geneticism') in a group of German university students was found to strongly correlate with a variety of ideologies including sexism, racism and high scores on the SDO scale (Keller, 2005). Participants who were psychologically primed to be more open to genetic explanations for human differences also displayed more prejudice and in-group bias. Similar results were reported based on studies of groups of students from Blaise Pascal University in France (Dambrun et al., 2009). The more the participants believed in genetic determinism, the higher their SDO scores and the greater was the correlation with prejudice towards Arabs and the poor, together with support for the death penalty. Because in the social sciences there is more of a focus on social and environmental factors compared to genetic factors, the investigators predicted that university exposure to a psychology course would lead to the perception that genetic variables play a less important role than environmental ones, and their results confirmed this hypothesis. While genetic determinism scores of first-year students were significantly higher in psychology than in biology, after three years of university exposure they were significantly lower in psychology than amongst those studying biology, for whom determinism scores stayed the same (Dambrun et al., 2009).

These and many other reports suggest that beliefs in the power of the genes to determine social identities and future destinies are not merely neutral, but correlate with a broad array of social and political attitudes. Of course, correlation should not be equated with causation, a recurring theme throughout this book, and one can argue that people with particular social and political beliefs may be attracted to genetic determinism precisely because it provides apparent justification for those beliefs. But results from the kind of longitudinal studies cited previously from the work of Dambrun et al. do support the idea that beliefs about genetic determinism play a causal role in changing social attitudes. On the other hand, people with racist attitudes can shift from genetic to cultural accounts for perceived differences among groups without decreasing their level of racism (Ramsey et al., 2001; Lynch et al., 2008), so if someone really wants to be a racist, then it seems that they will draw their justification from any convenient resources that may be available.

More powerful (in this context) than formal education is the process of 'cultural osmosis' whereby knowledge of, and attitudes towards, genetics are absorbed from many sources. In a critique of what he dubs 'genetic essentialism', one reviewer comments that '[l]earning about genetic attributions for various human conditions leads to a particular set of thoughts regarding those conditions: they are more likely to be perceived as (a) immutable and determined, (b) having a specific etiology, (c) homogeneous and discrete, and (d) natural, which can lead to the naturalistic fallacy' (Dunham et al., 2012). In a U.S. study based on focus groups, participants cited a wide range of media that impinged on their understanding of genetics (Bates, 2005). Participants drew, for example, on sci-fi texts. Others cited television. One participant reported that she had watched a TV news magazine show on genetics, saying, 'I think it was Dateline or something like that, and they were talking about genetic makeup, where they wanted the blue eyes, blonde hair.... They can make sure that that would happen. It's all taken care of. I mean you can determine what your child looks like.' Another participant explained that it was likely that parents would choose Nordic traits for their children and deselect other traits in a quest for 'perfection'. Certain films had also clearly influenced participants' opinions in the direction of genetic determinism. Several cited the film *GATTACA*, one participant remarking, 'I don't know if anyone saw the movie *GATTACA*, where, basically, if you aren't the best, then people start to manipulate their children's genes and almost order what they want, like a package deal.' The author of this study emphasises the nuanced way in which focus group participants weave genetic narratives out of a wealth of cultural referents which are processed to support their claims, not simply absorbed as 'bare facts', suggesting that linear assumptions of media influence on the public understanding of genetics may be overstated (Bates, 2005). Yet despite or perhaps because of such processing, many of the comments made did display a strong subtext of genetically deterministic thinking.

One indication of the iconic profile of DNA language in public cultural discourse is that the phrase 'it's in his/her DNA' has come into common usage in all kinds of contexts, some rather odd. As Brad Pitt told the *Daily Mail* in 2012 whilst discussing U.S. gun control: 'America is a country founded on guns. It's in our DNA' (Pitt, 2012). The Cloud Computing service provider Oxygen assures us that 'for Oxygen, security is in our DNA. The security of you and your company's data will always be our priority' (Mak, 2011). In 2012, the year of the London Olympics, the director of the Design Museum, Deyan Sudjic, suggested that 'London as a whole has been strengthened in its claims to be