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P A P E R S
towards a biblical mind

Genes, Determinism and God

by Denis Alexander

*We used to think that our fate was in our stars. Now we know, in large part,
that our fate is in our genes.*
James Watson¹

Summary

This paper has three main aims. The first is to provide biological information to help with interpretation of the latest genetic discoveries. The second is to argue that there is nothing in contemporary behavioural genetics that subverts the profoundly human experience of acting freely. The third is to show that the Judaeo-Christian conviction that humankind is made in God's image provides a firm basis for human freedom and for the absolute value of each human individual irrespective of their genetic status.

Introduction

For more than half a century (roughly 1880–1940) it was widely believed that heredity determined race, class, mental health, and intelligence. Eugenic legislation ensured the compulsory sterilization of hundreds of thousands of 'physical and mental defectives' in the USA, Denmark, Sweden and Germany. As late as 1940, an academic review writer declared that feeble-minded people should be prevented from reproducing because feeble-minded families 'are largely characterised by promiscuity, desertion, illegitimacy, crime, unhappiness, ill health and other associated pathological conditions'.² The writer was in no doubt that genes determined 'feeble-mindedness' and its associated pathologies. The Third Reich borrowed its sterilization legislation from the USA.³ The most extreme application of eugenics led to the gas ovens of Auschwitz and Buchenwald. Today such attitudes and practices are rightly viewed with horror. Surely the kind of genetic determinism that nurtured eugenics is a thing of the past? Yes and no. Today's genetic determinism is more of a creeping, insidious, back-door kind of influence, absorbed by a process of cultural osmosis from the media, by the abuse of genetic language in daily speech, and unfortunately also from the inaccurate statements of some academics.

As a recent News Feature in *Nature* reports:⁴ 'An increasing number of studies suggest that biology can exert a significant influence on political beliefs and behaviours', suggesting that 'genes could exert a pull on attitudes concerning topics such as abortion, immigration, the death penalty and pacifism.' 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.' Note the 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 can't even change our mind.

The sequencing of the human genome (the 3.2 billion 'genetic letters' in our DNA) published in 2004 accelerated the popularity of genetic language in daily discourse. 'Human genome encodes the blueprint of life' shouts the headline. The genome is often referred to as 'an instruction manual', giving the impression that the human body is assembled using the manual much as you might put together a piece of IKEA furniture using the kit and instructions supplied. The situation is not helped by the media constantly reporting the discovery of a gene 'for' this, that or the other: 'Teen survey reveals gene for happiness' (*New Scientist*),⁵ 'The Science of Stress – does your child have the 'worrier' gene?' (*The Times*),⁶ and so forth. Whereas in fact a gene is just a stretch of DNA that encodes a protein or an RNA⁷ regulatory molecule, and that's it. There is no single gene that encodes any kind of behaviour in any living organism, let alone humans.

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1 *Time*, 5 March, 1993.

2 *American Sociological Review*, August 1940, 5, p.658.

3 D. J. Kevles, *In the Name of Eugenics*, Harvard University Press, 1995, pp.116–118.

4 L. Buchen, *Nature*, 2012, 490, pp.466–468.

5 <http://www.newscientist.com/article/mg21028126.300-teen-survey-reveals-gene-for-happiness.html>. Accessed 12 March 2013.

6 B. McMahon, 'Body and Soul', *The Times*, 9 March, 2013, p.4.

7 RNA is a chemical molecule similar to DNA that conveys information from DNA to other parts of the cell.

Does it matter?

What's at stake? Does it matter if people think that their decisions are determined by their genetic endowment? The Christian conviction is that free will, implicit in hundreds of biblical passages,⁸ is critical in ensuring moral responsibility towards God and towards each other in ways that are entirely compatible with God's sovereign and providential ordering of human affairs.⁹ As Jesus warned us: 'I tell you that men will have to give account on the day of judgment for every careless word they have spoken' (Matthew 12:36).¹⁰ Jesus himself prayed 'Father, if you are willing, take this cup from me; yet not my will, but yours be done' (Luke 22:42). The assumption of human responsibility is central to Christian faith and an important glue maintaining social cohesion, underpinning the justice system and the choices that give value to relationships. Free will is a precious gift bestowed on us by God.¹¹

For Christians it is no surprise to find that social and mental health correlate positively with belief in free will, as shown by recent psychological and sociological studies. Beliefs concerning the fixity of human identity, be it for perceived genetic or environmental reasons, can have a remarkably negative impact on human flourishing.¹² Subjects previously exposed to pro-determinism texts rather than texts supporting free will are less likely to be pro-social and more likely to engage in antisocial behaviour. Possessing a strong belief in free will predicts better career attitudes and job performance¹³ and also appears to influence people's willingness to think independently of group opinions – a stronger belief in free will is associated with a higher measure of nonconformity.¹⁴ Genetically deterministic beliefs also correlate with non-egalitarian attitudes.¹⁵ What people believe about free will really makes a difference.

Defining determinism

This is not a paper about the philosophy nor the theology of free will.¹⁶ Nevertheless, some working definition of the term 'determinism' is required for the biological discussion which follows. We can define determinism in its hard form as the thesis that 'given our particular genome some elements of our lives are not really up to us, including certain apparent choices.' 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.' Hard genetic determinism is most relevant within medical genetics where a particular pathology does indeed sometimes entail constraint, sadly, to a particular future. As far as soft determinism is concerned, it is the burgeoning field of behavioural genetics which is most relevant. But before considering behavioural genetics, it is important to appreciate how contemporary biology has radically changed our understanding of how genomes function.

Nature, nurture and DICI

Francis Galton first introduced the contrasting terms 'nature' and 'nurture' in his book *Of Men of Science: Their Nature and Nurture* (1874). As Galton pointed out, 'the phrase "nature and nurture" is a convenient jingle of words.' Galton favoured 'nature' as an explanation, emphasising that 'no carefulness of nurture can overcome the evil tendencies of an intrinsically bad physique, weak brain, or brutal disposition.' Dichotomous frameworks have dominated discussion of human behaviour ever since in various pairings, such as 'hereditarian and behaviourist'; 'innate and learned'; or, more common today, 'genes and environment'. Yet in public discourse the nature–nurture dichotomy remains remarkably resistant to change, despite biologists having regularly declared the phrase to be redundant for at least nine decades. Popular science books with 'nature' and 'nurture' in their titles continue to proliferate.¹⁷

The problem with such dichotomous language is that it both promotes and reflects a fragmented image of human personhood in which the reified¹⁸ forces of genes and environment tug in different directions as if the human personality were some battlefield of competing influences. The media talk about the 'nature versus nurture debate'¹⁹ as if there are two competing essences – one called 'nature' and one called 'nurture'. But contemporary biology subverts the idea that the genes are an 'instruction manual' determining human destinies. We need to reframe the discussion about genes and environments within a matrix that does more justice to the rich complexity of biological organisms.

The acronym that will help us on this journey of biological exploration is DICI, which stands for Developmental Integrated Complementary Interactionism, an acronym used here as a peg on which to hang these four key words that, taken together, help us to subvert all forms of dichotomous language. Each word (highlighted in bold below) can be illustrated by considering the complex development of an individual human being.

Let us start with a newly fertilized human egg – a zygote. What is inherited from the parents is not naked DNA, which by itself can do nothing, but a complex system of DNA, RNA, proteins and nutrients that together operate to regulate cell growth and division. The human egg just prior to fertilization contains at least 3,000 different proteins and thousands of RNA molecules involved in regulating gene expression (i.e. how genes are switched on/off).²⁰ All these components are **integrated** to organize foetal development. Genes, like people, function according to the company they keep. In the early zygote it's not the DNA which causes development to begin, but rather the proteins inherited from the mother, now inside the zygote, which regulate which genes in the DNA are switched on and off. Proteins are the players in the DNA orchestra that cause the genes to produce the **integrated** symphony of life.

From the beginning of **development** genes exist in two environments simultaneously: the microenvironment within the cell plus the macroenvironment outside the cell, first of the mother, then of the growing individual. DNA and these two types of environment **interact** from the moment of fertilization. Many **complementary** processes happen in parallel, subverting the language of linear causal relationships.

The infant brain is not a miniature version of the adult brain but a self-organising system that only assembles correctly if the right environmental inputs (like light, sound and language) are available at the right time. Continuing along our developmental trajectory into adulthood, the **integrated interactionism** between the genes, microenvironments and macroenvironments becomes

17 Try searching for nature+nurture on Amazon; the results are entertaining.

18 'Reify' means the attempt to 'thingify' that which is a process rather than an 'essence'.

19 http://en.wikipedia.org/wiki/Nature_versus_nurture.

20 mRNA refers to the 'messenger RNA' which contains the sequence information derived from the DNA, which specifies the amino acid sequence of the gene-encoded protein.

8 e.g. Exod. 19:5; Josh. 25:15; Acts 2:38; Gal. 5:13; 1 Pet. 4:3, and many more.

9 See, for example, D. A. Carson, *How Long O Lord?*, Inter-Varsity Press, 1990.

10 See also Rom. 14:12; Heb. 4:13.

11 This Paper is like a mirror image of a previous Cambridge Paper by David MacLroy entitled *Infinite Choice* (Vol.22, No.3, September 2013) which shows how the very act of choosing can become overvalued. Ironically such valorization of choice coexists in a society in which the very idea of free choice is threatened by the biological sciences.

12 Reviewed in Roy F. Baumeister and Lauren E. Brewer, 'Believing versus Disbelieving in Free Will: Correlates and Consequences', *Social and Personality Psychology Compass*, 2012, 6, pp.736–745.

13 T. F. Stillman, et al., 'Personal Philosophy and Personnel Achievement: Belief in Free Will Predicts Better Job Performance', *Social Psychological and Personality Science*, 2010, 1, pp.43–50.

14 J. L. Alquist, et al., 'Determined to conform: Disbelief in free will increases conformity', *Journal of Experimental Social Psychology*, 2013, 49, pp.80–86.

15 J. Castera, et al., 'Comparison of French and Estonian students' conceptions in genetic determinism of human behaviours', *Journal of Biological Education*, 2013, 47, pp.12–20; J. Keller, 'In genes we trust: the biological component of psychological essentialism and its relationship to mechanisms of motivated social cognition', *J Pers Soc Psychol*, 2005, 88, pp.686–702.

16 There is a huge literature on this topic e.g. Peter van Inwagen, *An Essay on Free Will*, OUP, 1986; J. K. Campbell, *Free Will*, Polity Press, 2011.

even more striking. The growing individual makes key lifestyle choices which epigenetically modify their DNA, switching genes on or off. If the genome is the hardware of inheritance, then epigenetic regulation represents the software, modifications that are preserved when cells divide; some can even be inherited across at least two generations in humans. Epigenetic regulation provides a key communication pathway leading from the macroenvironments via the microenvironments to the genome. The lifestyle choices we make can medically influence our grandchildren, a sobering thought.²¹

The DICI framework simply bypasses notions of ‘nature’ and ‘nurture’: the goalposts have been moved. There are no two separate reified entities that interact with each other – they don’t exist. The insight of DICI, the **developmental** approach, is that 100 per cent of the phenotype²² of any complex organism involves genetics and 100 per cent involves the environments. We are certainly not ‘blank slates’ at birth, but neither are we the product of a genetic instruction manual.

A simple metaphor might help: the developmental history of a Black Forest chocolate cake. Most of the cake is flour – more than 50 per cent; no flour, no cake. Less than 1 per cent is baking powder; no baking powder, no cake. Around 8 per cent is chocolate powder; no powder, no chocolate cake. No correct oven heat, no cake. So the cake is the product of a complex developmental process in which the proportions of the recipe are indeed critical to the eventual outcome, but it would be odd and indeed impossible to try and assign proportionality to the original components in the finished product – by that stage the initial components no longer exist. The cake as a whole has emergent properties which are non-reducible to its initial components.

Meditating on the development of the human individual – so vastly more complex than a cake! – should arouse our praise and awe along with the psalmist: ‘For you created my inmost being; you knit me together in my mother’s womb. I praise you because I am fearfully and wonderfully made; your works are wonderful, I know that full well’ (Psalm 139:13–14). We are so much more than the sum of our parts.

Behavioural genetics

When the media trumpet discovery of a new gene ‘for’ happiness or impetuosity or intelligence, the research being reported comes from the field of behavioural genetics. It is therefore important that we understand what this field does, and does not, claim.

The aim of quantitative behavioural genetics²³ is to investigate how much of the behavioural variation in a specified human population is associated with genetic variation, using twin and adoption studies. Identical twins have their genome sequence in common, whereas non-identical twins share, on average, 50 per cent of their genes in common.²⁴ The aim is to separate out the influence of genes, shared environment and non-shared environment on variation in a particular population in a particular trait (e.g. IQ or personality). Shared environmental influences include factors such as socioeconomic status, diet or parenting style. Non-shared environmental influences are those that make a person different from others with respect to a certain trait, for example, bullying at school or differing levels of drug or alcohol intake.

The investigation measures the ‘heritability’ of a given trait, a technical term frequently misunderstood. Until the 1940s ‘heritability’ was a synonym for inheritance. Since that time it has gained an additional technical meaning, tricky to understand, but

worth the effort, because it helps us see why the media so often misreport genetic discoveries. A heritability study calculates the proportion of the total inter-individual variance²⁵ amongst identical twins or non-identical twins that is associated with either genes or the two types of environment. The three proportions of variance add up to 1. The heritability is defined as the proportion of the variance in a trait in a specified population that can be ascribed to genetic variation. Heritability can be written as a percentage, which is often misinterpreted as if it referred to the proportion of the *inheritance* of a trait, when all it represents is the percentage of the total *variance* in a particular population. Inheritance refers to the sets of genetic variants that we receive from our parents. It is about individuals. Heritability in its technical sense is about the level of relevant genetic variance in a population. Unfortunately the word now often elides from one meaning to another even within the same text, so that when, for example, a heritability value of 50 per cent is obtained, the impression is given that a particular trait in a particular individual is actually caused 50 per cent by their genes and 50 per cent by their environment, which is not what heritability is about. This is the source of much media miscommunication.

A simple example²⁶ may help. First, we notice that nearly all people have two legs. When they only have one leg it is nearly always due to an accident, in other words due to the environment. So the variation in leggedness in the population is 100 per cent environmental and 0 per cent heritable. That sounds odd because everyone knows that you need genes in order to have legs. It is just that in practice the genomic system responsible for leg-building during development nearly always encounters the same environmental context, and so the system invariably builds two legs. Likewise the heritability of having a brain is zero because there is no variation in a population in this particular trait. Heritability tells us nothing about the complex interplay of components as described by DICI that as a matter of fact leads to the development of traits.

Unfortunately the very method of calculation of heritability perpetuates the dichotomous linguistic distinction between genes and environment, nature and nurture, which tends to distort the unitary nature of human personhood. Once mathematical values are assigned to three different proportions of variation that, by definition, add up to 1, then it is inevitable that those proportions will come to be seen as reified entities that in some sense interact or compete in generating something. In reality, these proportions are statistical constructs, not physical entities, but the perception generated in the reports of heritability values is often along such lines.

We may therefore view behavioural genetics as an experimental approach involving a necessary fiction for mathematical purposes, particularly useful in flagging up the role of variant genes in medical conditions (such as autism). Just as Boyle’s venerable law of gases entails viewing air as made of non-interacting particles (which it is not), so behavioural genetics involves envisaging proportions of variance being assigned to different reified entities, which in reality don’t exist. DICI provides a very different picture. Thousands of genetic variants, different environmental inputs, subtle epigenetic changes and personal human choices, all interact developmentally to contribute to the rich diversity among human individuals. It is the complexity itself, together with its emergent properties, which is the key.

If we accept, as I certainly do, that the experience of personal freedom as we make our daily choices is one of the most consistent and convincing of all our basic human experiences, then

21 cf Exod. 34:5–7. Examples so far include smoking and gluttony.

22 The term ‘phenotype’ in biology refers to the observable characteristics of an organism.

23 For a fuller account see a standard textbook such as: R. Plomin et al, *Behavioural Genetics*, Worth Publishers, 6th edn, 2013. Critiques of the approach may be found in Evelyn Fox Keller, *The Mirage of a Space Between Nature and Nurture*, Duke University Press, 2010; D. Goldhaber, *The Nature–Nurture Debates: Bridging the Gap*, CUP, 2012.

24 In reality it varies within the range 37% – 62%. This means that an average 50% of their protein-encoding genes are identical.

25 A measure of the average distance between each of a set of data points and their mean value; equal to the sum of the squares of the deviation from the mean value.

26 Used by Patrick Bateson, Cambridge University.

there is nothing in contemporary behavioural genetics, barring some severe psychiatric pathologies ascribable to mutant genes, that render the reality of that experience less plausible. Indeed, it is the reliable biological knitting together (Psalm 139:13–14) of the human that occurs during development, including the generation of the large frontal lobes of our brains, that enable us to make free responsible choices. No DICI, no freedom. No freedom, no responsibility. No responsibility, no justice, divine or human, and no dignity. No dignity, no humanity.

Genetics and humankind made in the image of God

As far back as we can look in human history we find a fascination with the factors that determine human fate – astrology, curses and the powers of the gods. For many ancient Mesopotamian societies, their fates were in the stars together with the planets, the sun and the moon. In such stratified societies, rulers and serfs had fixed social roles, and the sociopolitical order was seen as a microcosm of the larger world of the gods. For the mass of humankind, the idea of taking on personal responsibility for a possibly different kind of future was unthinkable.

The contrast with the revelation given by the one true God and his egalitarian vision for humankind mapped out in the early chapters of Genesis is startling. Here humankind made in the image of God (Genesis 1:26–27), created with dignity and worth, are called to play a delegated kingly role, male and female alike, in ruling over the earth and caring for the created order. For ancient readers, that understanding of their role, derived from the Genesis text, would have been reinforced by the many contemporary texts referring to the king as being in the divine image of one of the panoply of polytheistic gods that were revered by the surrounding nations.²⁷ Being ‘in the image of God’ was kingly language. In Genesis, the kingly and priestly roles allocated to the privileged few by a pantheon of gods in the rival polytheistic world-view, are delegated instead by the one creator God to the whole of humanity.

This understanding places human freedom and responsibility squarely in the centre of God’s plans for humanity. This might seem obvious to us now, but the very suggestion posed a profound threat to the reigning Mesopotamian ideology in its original context. Any deviation from the original divine pattern was seen as regression and so was to be resisted. Free choice did not come into it. By contrast in Genesis the delegated responsibility of subduing and caring for the earth was given to the whole of humankind. Furthermore, a clear choice was presented. The command is given in Genesis 2 not to eat of the tree of the knowledge of good and evil. The command is disobeyed; human autonomy seems much more alluring. There are terrible consequences: separation from the tree of life. The assumption of genuine human responsibility is inescapable.

Today this clash of world-views is still being played out,

27 J. Richard Middleton, *The Liberating Image: the Imago Dei in Genesis 1*, Grand Rapids, MI: Brazos Press, 2005.

albeit in a completely different context, yet with some remarkably similar parallels. The genetic determinists such as Prof. Hibbing, quoted above, who really do seem to think that our destiny lies in our genes, with little hope of change, contrast with those who see genetic variation as part of God’s great ‘knitting exercise’ in which genes are integrated with hundreds of other components during development to generate a rainbow array of distinctive personalities, each one of whom has the responsibility of ploughing their own particular furrow through life under God’s providential guidance.

Humankind being made in God’s image also highlights the value and status of each human individual in a way that is irrespective of their genetic profile. There was a time when the idea of the image of God was perceived more as a list of characteristics such as rationality and creativity that distinguish humankind from the rest of the animal kingdom. Valid though that list may be, it doesn’t really get us to the heart of the idea as we see it in Genesis. Instead we see more the idea of a delegated value and status bestowed by God that exists irrespective of the frailty and transience of human life. So the value and status of humankind is established not by intrinsic capabilities but by divine decree (Genesis 1:26–27). Those who live in a monarchy are citizens of the monarch by virtue of their citizenship, though of course different people will vary in how much they obey their monarch – but even if their personal beliefs happen to be republican, they remain citizens. Applying the idea of the *Imago Dei* as a divinely-bestowed status rather than as a personal achievement means that those whose genetic endowment entails that they suffer some handicap in life, be it physical or mental or both, are as much sharers of the image of God as anyone else. The fact of humankind being made in God’s image subverts any move to make distinctions between people based on their genetic endowment.

Conclusions

There is nothing in contemporary genetics that subverts our very genuine sense of personal freedom and human responsibility. We really are responsible to each other and to God. We can be held to account – we could have done otherwise – and we should hold each other to account. For that reason we should resist rhetorical narratives that portray humans as helpless pawns of their genes and their environments. And we should critique attempts to fragment the biology of human personhood into competing elements, remembering that God creates us whole persons, integrated and woven together in a rich tapestry in and through which God exerts his providential will. Only in that way will we express the reality of being made in the image of God, as individuals and in relational communities.

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