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Book Review

G is for Genes

Kathryn Asbury, Robert Plomin. Chichester, UK: Wiley, 2014, pp. 197, £16.99, ISBN9781118482810

It is unfortunate that the authors of this book appear to assume that its readership will not be quite up to their 'level'. As a result, many 'facts' are stated dogmatically and without qualification, only to be contradicted by an equally dogmatic unqualified statement on the same issue later in the book. Given what the authors believe about the spread of ability, it is very hard for them not to assume that most people reading this book do not possess their intellectual ability.

I'll explain what I think the key errors and half-thoughts are later, but to understand why they matter so much, first consider the 11 recommendations the authors make. If the authors are mistaken, it really matters, because of the educational policies they propose and the damage many of those policies would cause. I directly quote from the book in many cases, or give page numbers for where I have paraphrased.

i. Reduce teaching for most children to a set of very basic skills. Use 'learning chips' to identify those few with the most promising genes and potential, and treat that subset very differently (pp. 161–62).
ii. Introduce a much wider range of choices in school, with teachers using genetic information about each child to decide which children should be directed towards what particular choices (pp. 163–64).
iii. Most children should return to receiving a school-leaving certificate (as was common before World War II). Alongside this certificate, 'Children who excel should also be offered the support and opportunities they need as a matter of course' (p. 166); presumably those few will be getting much more than just a certificate.
iv. A large team of psychologists should be employed in every school to incorporate information from 'each child's DNA sequence into their 'big picture' of each child's needs' (p. 168).
v. 'Within schools, teachers should use IQ tests and psychological measures of confidence and motivation to assess whether pupils are making progress' towards fulfilling a potential fixed by their genes. Very early on in their childhood, many children can be identified who 'will not require further funding at university' because they do not have it in them to benefit from university (p. 174).
vi. Every child should be allocated a keyworker who tracks the child throughout their entire education until exit, but children of 'low-SES [status] families should be offered extra support from birth' (p. 171). And for the low-socioeconomic-status children, a keyworker should be mandatory from around ages 2 or 3 years. The authors suggest: 'There is no doubt that our keyworkers will provide a five-star service' (p. 183).
vii. All children should be given extracurricular activities like horse riding in case they turn out to be: 'A child with the potential to be a jockey' (p. 172).
viii. Physical education at school should be segregated so that those who hate games don't hold those who are naturally sportier back; and in turn are not made to do 'humiliating football or netball sessions' (p. 173).
ix. While telling children that their potential is limited, we must give them respect even if they are not '. . .bright enough to do anything else' (p. 175); but they must not realize that the options they are being presented with are thought of as 'second best'.
x. The government should issue a call for tender so that groups wishing to design an education system along these lines can be funded by tax-payers' money which can be piloted with a single enormous school (p. 176 and 178).
xi. After this single pilot school is declared a success, governments should assign all the children of their respective countries, worldwide, into huge '. . .genetically

> sensitive schools and, if it is properly designed and run, they will all want to come' (p. 177).

The schools of the future would have to be, by Asbury and Plomin's own description, 'enormous' and would be '. . .built to accommodate every child in our local community' (p. 179). The book ends with a chapter entitled 'Education Secretary for a Day'. This would be funny if the authors had not been so closely connected with the former Education Secretary Michael Gove and his now infamous former adviser Dominic Cummings. Michael Gove had made more schools 'his'—directly accountable to him—than was thought possible when the academies programme was launched. That programme was created by Labour's Lord Andrew Adonis who, similarly influenced by writings of this kind, may also have had some sympathy with some of the views expressed in this book. The legislation Adonis steered through Parliament on academies allows them to be selective from age 16 onwards, so that former comprehensive schools can move towards being grammars, or secondary moderns, at least in the sixth forms. This book and its theories matter because today they are taken so seriously at the very top.

To get to the 11 conclusions of this book listed above, and realize what thoughts are now being whispered in education and shadow-education ministers' ears, requires wading through 12 chapters peppered with platitudes that can easily put the reader off-guard. Some very good research is cited, but a great deal of poor work is relied on, and even more is guessed at and supposed.

Plomin has studied twins since 1986 and heads the Twins Early Development Study (TEDS) whose subjects are now 18 to 20 years old. Central to the book are these twin studies where it is assumed that the differences observed between pairs of identical (monozygotic; MZ) twins and non-identical fraternal (dizygotic; DZ) twins reveal how much of a trait is genetic. If first impressions matter at all in how children are treated, then MZ twins are likely to show a high correlation in all kinds of outcomes that are influenced by looks, or any other trait correlated to some other similarity between them. If teachers give more attention to blond-haired children than black-skinned children (a pair of DZ twins can be very different), the effect of that additional attention on some ability will be incorrectly attributed to genes for that ability, and prejudices will be reinforced.

Very early on in the book it is explained how a simple mathematical formula can be used to calculate relative influences of heredity and the environment:

> If MZ twins correlate 0.75 on a particular behaviour, say shyness, and DZ twins correlate 0.50, we double the difference between the two correlations (2×0.25) and estimate the heritability of shyness as 50%. This leaves the remaining 50% to be explained by the environment the children are growing up in (p. 16).

No mention is made of the fact that this formula is naïve and that, even according to the Wikipedia entry on twin study: 'since the 1980s these approximate statistical methods have been discarded'. Furthermore, the very choice of a particular complex social behaviour or specific academic ability in these studies involves key assumptions that, once questioned, cast doubt on the validity of twin studies as being as valuable as is suggested. Take the choice of shyness. It may well be that having acne or not affects how shy teenagers are. Undoubtedly there will be genes that affect the tendency to have acne, but in no way should those genes be called 'shyness genes', despite the correlation. A genetic component does not mean that genes specific to the trait being studied exist, nor does it imply a limit to potential. An effective treatment for acne could virtually eliminate that particular 'genetic component of shyness'.

Very occasionally *G is for Genes* does not rely on twin studies but on the actual (not assumed) DNA of large numbers of people. These then appear to explain up to 3.4% of the differences between people in activities such as maths (p. 51).[1] More recent studies find genome-wide effects that are not much greater in size. For example, in measured English ability for children aged 11–14 the genome-wide association is small: 'Put another way, these differences approximate to a tenth of that seen across the sexes for performance in English at this age.'[1] The twin studies reported in the rest of the book suggest genetic effects that are many times greater than those found in the genome-wide associations. It is time that twin studies of the supposed high hereditability of ability were critically re-evaluated in the light of genome-wide findings. Here is what those who find small effects say of twin studies:

> To this complicated and controversial field, estimates of the genetic contribution to educational attainment have suggested that up to 40% of the variance in existing measures may be explained by genetic factors. Some twin studies have suggested that genetic variation accounts for up to 60% of the variation in educational attainment, though these high heritability estimates may be inflated by genetic interactions.[2]

This group who report genome-wide associations then go on to report possible effects equal to being 3.5 weeks ahead at school for those children with possibly more favoured genetic dispositions to learning English, and to a lesser extent mathematics, or as they say: 'To put this into context, if a child's English level increases by 2 national curriculum levels between the ages of 11 and 14, then an increase of 0.045 levels is approximately equivalent to the increase that would be expected over

3.5 weeks within this period'. There are huge variations in the magnitude of effects between what academic papers such as this are reporting and the results of twin studies.

If a child's genetic advantage does give that child, in effect, a 3.5-week push forward in learning so that they are reading books with more complicated English some 24 days in class before other children, that advantage is likely to be further accelerated by teachers picking them out as able, putting them with other supposedly more able children and not labelling them as slow. A tiny genetic advantage giving a small head start at ages 11 to 14 can easily be amplified by the effect that then has on how a child's environment is altered. Similarly, a disadvantage, being a little slower than the rest, can result in you being put on the table for the slow readers at a young age, with obvious implications for future trajectories.

The book *G is for Genes* does not address complex issues and problems of positive and negative feedback. Nor does it even hint at the huge amount of criticism of work such as this.[3] It also often contradicts itself in favour of some of the suggestions I give above, but it comes out overwhelmingly against doubt despite expressing it. At one point a paragraph actually begins: 'The truth is that next to nothing is determined by genes, and our environments are hugely powerful' (p. 96). Does this reflect how fundamentally the two authors disagreed with each other, or was it put in to provide a counter quote to any criticism of the main thrust of the book?

The whole idea of adding the genetic component and the environmental components that create a person that then sum to 100% is dubious. The two things are not comparable and, in the context of achievement, neither can exist without the other. Central to the authors' particular use of twin studies is the concept of what they call the shared and unshared environments, for example whether you are brought up by the same parents and go to the same schools, or go to different schools and come home to different parents. However, even the parents of identical twins will admit that there is no way in which they can treat them identically, starting with who do you pick up first when they are both crying? To their parents the twins are not identical.

Parents notice little differences between their offspring that cause them to respond slightly differently and over time these differences magnify. One twin is inevitably slightly more dominant, the other more submissive which, over time, tends to be magnified in effect and alters how they behave in other ways. Hence small initial differences through feedback become magnified. We have approximately shared and approximately unshared environments because different parents and different schools still have many similarities. Your average chances depend crucially on socioeconomic factors, where you live, your parents' status and the schools you go to. But almost no one fits what is projected for them that well, and possibly the greatest reason for that is the un-shareable environment. The un-shareable environment is made up of all those little effects that cannot be planned for, those that we often say happen by chance.

How big is the effect of the unshared environment? Most traits will have a non-trivial genetic component and a non-trivial environmental component but, at the individual level, there is a very large component of chance.[4] To dismiss outcomes often greatly influenced by chance—the unshared environment—as the inevitable bottom and top ends of a (usually only very approximately) bell-shaped normal distribution is to trivialize something extremely important about the very nature of being human. We appear designed to respond differently to very similar events; it creates diversity and diversity may be protective to the group as a whole. The person of the moment, the so-called genius, the Nobel Prize winner, will often recount the chance events that altered the courses of their lives and their achievements. Would these winners be just as likely to emerge from a school that sorted children by their apparent genetic potential early on?

Numerous genetic disorders have been discovered that have a major impact on capacity to function socially and intellectually. It is probable that we all have genetic disabilities, things that make some things difficult for us which others find easy. Even the cleverest person, if honest, will admit to aspects of life that they find difficult. It is extremely unlikely that the person who finds some particular field easy has some super-gene for it; they are usually just one of many people who lack any relevant disability. It is in the nature of evolution that any highly advantageous genes become common genes. Future research might well identify those subtle genetic disabilities that make each of us find some things hard which many others find easy, and might even go further to explain how some people who have them better manage to overcome them. That would be an educational breakthrough. But it is not what is suggested in this book which veers from the misleading to the extremely worrying.

In the middle of *G is for Genes* (pp. 150–51), a suggestion is made that teachers should not teach children that much, but that children should be taught by computers with on-screen instructions for each child tailored to each child's individual genetic make-up. The authors' basic premise is that education needs to be matched to genetic make-up. They want to take streaming to a level far beyond anything currently practised, and have realised that even in their huge schools there frequently will be too few children to make up a viable specialized class.

They refer to computer-based learning as 'the most obvious solution currently available'. However 'computer-based teaching, even when highly individualized, has not yet been proven to increase achievement scores'. But the authors 'think that this should provide a spur to make such programmes'. They are suggesting that most learning (presumably excluding team sports) should be converted into single-player intellectual computer games, and the dynamic of peer-to-peer interaction should be eliminated from education.

Shortly after discussing whether children in future should be largely taught by machine, not by other humans, there is a discussion about the importance of having a growth mindset over a fixed mindset. 'Scores of experiments. . .have shown how a growth mindset [cf. a fixed mindset] yields better results for everybody'. 'People with a fixed mindset believe that intelligence and talent are innate and cannot be changed'. At this point I could not help feeling that one of the authors was deliberately poking fun at the other and that he (I guessed it was the he) had not even noticed (pp. 153–54).

Since the publication of this book, Kathryn Asbury has published articles entitled 'Twins show success at school is not just down to genes',[5] in which (in complete contradiction to much that is written in *G is for Genes*) she writes: 'There is a common misconception that genes are deterministic and that human potential is fixed at birth. This could not be further from the truth. We, as behavioural geneticists, see no evidence whatsoever for genetic determinism in how, what and why children learn.' A second article is titled 'Better at reading than maths? Don't blame it all on your genes'.[6]

The two authors of this book appear to be coming from different angles and stances. Plomin, the more established of the two, is an author of all five of the suggested readings given at the end of chapter 2 of this book, which is entitled 'How we know what we know'—to which the answer appears to be 'Because I have said so'. There is plenty of evidence to suggest that ability is not shaped in a one-dimensional bell-shaped curve, and no one is without merit.[7–14]

In the very centre of this book is a sentence that, taken out of its wider context, is spot on: 'Our aptitude for intelligence and achievement is not hard-wired and is subject to a panoply of experiences as well as our unique genetic code' (p. 97). But, if that is true, why start the book by claiming 'Genetic influence increases over time until, in later life, cognitive ability is almost as heritable as height'?

This book may usefully serve as a source of many examples of why modern day geneticism is often little more advanced than its precursor eugenics. Writing together, the authors still hope that 'the technology will soon be available, for example, to use DNA 'chips' to predict strengths and weaknesses for individual pupils' (p. 12), despite having to admit that 'once upon a time everybody [presumably meaning like-minded research teams and not really everybody] thought that if we could unravel our DNA and get a really good, close look at it we would be able to find the gene for math, the gene for writing, the gene for long legs, and the gene for a dazzling white smile. . .but that is not how things have played out' (p. 18).

As Mary Midgley has recently pointed out, the extreme claim that we can simply be decomposed and shown to be mainly outcomes of genetic influence is wrong and the '. . .notion that DNA somehow stands in for that cause is more overconfident still' (p. 87).[15] To do otherwise, she asserts, is to consign the vast bulk of other people 'to the bin' (*ibid* p. 150). The contradictions in this book help expose the error of its main thrust and illustrate both Midgley's point and her concerns. We all have our disabilities. No one is superhuman. There is no elite whom we will be able to identify in childhood from their DNA profiles and who we should individually nurture to save us all. I would not consign this book to the bin. I would use it as a warning of the greatest of errors we could still so easily make.

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