

Blueprint: How DNA Makes Us Who We Are by Plomin, Robert By Robert Plomin Behave: The Biology of Humans at Our Best and Worst Nature and nurture are both effective in making a person but Nature it seems is by far the dominant actor and the secret of this is written in DNA. Like the internet it probably will be horrendously abused.

Are able to genotype the hundreds of thousands of DNA sequences throughout the genome - and thus help identify complex traits and common disorders. Plomin explains that the differences alone are of not much use in predicting who (or what) we will become; it is the composite study of sets of differences that have seemingly minor effects. Behave: The Biology of Humans at Our Best and Worst Fascinating review of the authors life's work that seeks to explain how genetic predisposition influences our personality and behaviour and even the 'environment' we close or our response to the one we find ourselves in. Some of the sections on the potential future application of genetic insights are a little vague; and some of the statements such as 'parents matter but don't make a difference' are eye-catching than helpful Behave: The Biology of Humans at Our Best and Worst Anyone who has ever been in an argument about nature versus nurture will find this fascinating. Apparent environmental differences (eg parents who read to their children in a house full of books as against ) have a substantial genetic component (studious parents have studious children). Toby Young wrote in Quillette about a recent debate in London: 'On Monday in London's Emmanuel Centre a debate took place that pitted two Quillette contributors Robert Plomin and Stuart Ritchie against two "experts" on child psychology Susan Pawlby and Ann Pleshette Murphy. The motion was "Parenting doesn't matter (or not as much as you think)" The ushers asked people to vote for or against the motion on their way in and then again at the end the idea being that the "winners" would be the side that persuaded the most people to change their minds rather than the side that got the most votes. Which was just as well for Plomin and Ritchie since only 17 percent agreed with them at the beginning of the evening with 66 percent against and 17 percent saying "Don't Know." Young described the debate in detail and then the results: 'The debate was well chaired by Xand van Tulleken a doctor and broadcaster who has an identical twin brother named Chris and after he'd taken plenty of questions and done his best to sum up the audience was asked to vote again. Soon anyone's genome will be cheaply sequenced and their polygenic scores read off (at any age including infancy in utero or for IVF selection) to deliver personalised results for a palette of physical psychological and aptitude life traits. Accordingly it should be forbidden by law to have access to the genome of someone who is legally still a child except as I said where medical therapy would be informed and guided by such. Well I look forward to the next episode! Behave: The Biology of Humans at Our Best and Worst There are battles going on in Science between key people with strongly held opposing views on complex subjects. Here Robert Plomin a long time researcher in psychology known for his twins studies has written a book that challenges the equally polemical book 'Not in Your Genes' by well known psychologist Oliver James (A book I have given a very critical review). The general consensus on the 'nature versus nurture' debate is that both genes and environment especially early upbringing almost certainly play a role in making us who we are but these two men go much too far in fighting their corner each looking desperately for evidence to support their case. In the case of Plomin it's harder for most people to see the errors because they exist partly in a misrepresentation of current genetic knowledge but also largely in the inappropriate assumptions made right at the start of his analysis. On the haploid genome we have 6 billion bases (because there are two per rung) and on our (somatic cell) DNA which is diploid we have 12 billion bases! This might seem a pedantic point; this sloppy use of the 3 billion figure appears all over the place and in research papers but it is hugely important to remember that the human genome is Diploid; that we have two lots of DNA two lots of 'homologous' genes and that in every case where the two stretches of DNA differ (and they differ in many many stretches) they 'compete' to make us. In many cases these will be different proteins and to confuse matters further some of those proteins are structural but many are 'transcription factors' that turn on other genes in the 'gene cascade' that makes us what we are. Confusion arises because the word 'genome' is used to refer to several things

to the haploid genome found in sperm and egg to the diploid genome that is really two genomes in somatic cells and finally to a sort of reference genome of only 3 billion base pairs that is called 'haploid' but is actually derived from a mix of cells from the diploid cells of many humans (as was the case in the human genome project) and which ignores the fact that our real genomes contain two sets of different chromosomes that operate independently yet combine their protein product to make us only coming together in the first stage of the making of sex cells (meiosis) before being halved again but in a random way. Plomin forgets what he surely knows and effectively pulls the wool over the reader's eyes when he says blatantly (p 131) 'these DNA differences can be genotyped with whole genome sequencing that sequences all 3 billion base pairs of DNA.' No they can't! What he does not tell us is that no mammal (humans included) has yet had its DNA fully sequenced (see Wikipedia) and that attempts to sequence the full diploid sequence of humans have been few so far and very limited in accuracy. The Human Genome Project gave us a rough 'quasi haploid' sequence in 2001 which has been greatly improved on since but there still remain regions that cannot be sequenced because of the 'shotgun' methods used which cannot cope with short repetitive DNA. Secondly certain types of DNA especially short repeating sequences were found to be present in huge numbers in fact they are the main feature of the genome! Gene Expression became the thing to study not 'genes'; and a whole new mysterious world of RNA products opened up to be explored. Most sequencing machines start by breaking up the DNA into short lengths read the resulting fragments and then use computer power to match the fragments up in the final result a process that is confused by lots of repeats. Only when the new 'Nanopore' sequencing machines come into use actually threading their way along the entire DNA molecules (which are around half a metre long and one molecule thick!) will we get to know our genome properly. It is impossible to know what sits next to what and on which version of the chromosome yet the most important thing about a gene is its expression level determined by its start sequence and many other factors. It's complicated even as we currently understand it! An article entitled 'First Diploid Human Genome Sequence Shows We're Surprisingly Different' (available online) described new discoveries from sequencing the genome of Craig Venter (originator of the shotgun method in the USA who raced against the British with their slower method). This was one of few attempts to get an actual diploid genome sequence and it revealed that differences between the two sets of chromosomes in him were seven times greater than expected! The researchers commented that it was to be expected that most people would have a similar level of differences. Plomin should take note! Plomin chooses to ignore all this complexity he chooses to think (because he can and because I don't think he has questioned our current understanding of mechanisms deeply enough) that whatever it is in our genome that determines who we are this thing is linked to SNPs. SNPs (single nucleotide polymorphism or 'snip') are single base pairs that differ from the 'reference genome' (whatever that is see Wikipedia it is full of holes and a dubious concept) anywhere in the DNA. But hang on there are only twenty thousand to play with how does that work? Nobody has an answer! We do know a lot about the mechanisms of how DNA makes us that's the field of Developmental Genetics and morphology; but those fields just do not match up with the idea of SNPs being major determinants of how we end up! Just about everything Plomin says from there on has no validity simply because of one huge error and the clue is in the name 'genome wide association studies'. Plomin says (p133) 'we can use inherited DNA differences to PREDICT individual differences in psychological traits without knowing anything about the myriad pathways connecting genes and behaviour. We could do that if we knew for sure that those DNA differences (specifically multiple SNPs) did indeed determine behaviour or were at least linked to other DNA factors that determine behaviour but we don't know that and we have increasing evidence to suggest that other aspects of DNA along with Epigenetic DNA modification and a whole world of RNA revealed by the 2012 ENCODE project are in fact likely to be the real determinants. Where they do change the protein they are likely either to make no difference to its binding properties (important in transcription factors that control gene expression) or to render it totally non functional. It has also been found to be associated with many environmental effects from watching TV to staying indoors to taking paracetamol to ultrasound scans to immunisation to

mercury to sprays TO MODERN LIFE. Is Plomin simply finding SNPs that are associated with something other than the condition he is testing for? Are his SNPs for Schizophrenia actually present for whatever reason in people who choose to live in cities or near airports (known major risk factors). Basic genetics teaches that in meiosis the process of egg or sperm production the DNA copying process 'crosses over' multiple times at random between the two available templates while copying a chromosome producing a new novel chromosome in which stretches of DNA from both sides (your grandparents) are incorporated alternately. On average yes but in reality it is perfectly possible (though unlikely) to inherit half of our DNA from one GRANDPARENT! I think this is true and that it is observed in reality in some families though it is not talked about. Finally I want to consider the case of Schizophrenia the 'mental disease' that always crops up and which Plomin thinks is a major trait that proves his point because it is one for which he can find a significant association with a group of SNPs than for most mental traits. Assuming that he meant to say 'psychological differences' is this true or has he not looked for the obvious? One of the most important pieces of evidence we have regarding the cause of schizophrenia is the fact that it is around TEN times prevalent in the Afro Caribbean population of the UK. A simple look at DNA would therefore surely reveal a huge association between many genes and Schizophrenia genes for skin colour (just a few) for hair and many other 'Afro Caribbean' genes. No we have found genes that are highly associated with Schizophrenia but the real reason why this is so is (most likely) that Afro Caribbeans especially and probably other groups suffer loss of feelings of self who they are at the shock of coming into a very different culture from the one they grew up in; it's a phenomenon of migration. This important evidence actually tells us straight away that Schizophrenia is not primarily genetic since Afro Caribbeans do not experience this excess of Schizophrenia in their own country. Some people may be slightly likely to go Schizophrenic under culture shock just as many people are likely to suffer mercury poisoning (down to genes for detoxification) but it is folly to call the genes the cause of such things. They would all carry the genes but you would find very little Schizophrenia! Those genes which appeared so associated with Schizophrenia in the UK have in fact nothing to do with the condition. They are not predictive in any way yet despite his careful explanations that association is not causality he undoubtedly thinks his findings are predictive in some way (see his introduction about fortune telling). Richard P Bentall a key researcher into so called mental illness has explained in his excellent books 'Madness Explained' and 'Doctoring the Mind' schizophrenia is just a catch all term for a syndrome of traits auditory hallucinations visual hallucinations paranoia catatonia etc that originated a long time ago with Emil Kraepplin. Bentall has used statistics (convincingly I think) to show that correlation is better between diagnosis and effect in blind trials if we consider the individual traits and not the imagined 'disease' of schizophrenia. I do think that DNA probably accounts for a lot of what we are including mental traits but I also agree with Oliver James about the huge significance of early upbringing and attachment when it comes to emotional and mental difficulties. Both men though present a totally worthless argument to support their case!! I listened to Plomin on 'Start the Week' (BBC Radio 4) on the day his book was released and then watched him interviewed on Newsnight by Kirsty Wark. He seems a genuine man passionate about his subject and of course he is held in high esteem as recipient of many awards and titles but it's a pity he got such publicity by making outrageous claims for genetics when the reality is that we are just at the start of the real DNA adventure and most experts know this. Behave: The Biology of Humans at Our Best and Worst Blueprint states that our inherited genetic blueprint accounts for only half of the differences between individuals and even after thirty years of research the nature of those non shared environmental factors that appear to account for the other half of this difference are still something of a mystery. The main problem with this book is that it purely focuses on the small differences in inherited genetic code and fails to acknowledge those other ( important) factors that account for how and why we are all different. The first mechanism (which is the one discussed in the book) is the variability of our genetic code that we inherit and how the genes we receive from each parent are shuffled to produce differences in siblings. This directed awareness also gives us the opportunity to lessen the impact of any genetic pre dispositions to certain illnesses

physical or psychological and also gives us an amazing opportunity to improve as individuals by pushing our genes to the limit. For example two individuals may have different genetic potentials for playing table tennis and if they both practice and focus on developing their skills in exactly the same way the individual with the highest genetic potential (if we could measure such a thing) would tend to achieve better results. We already know that our beliefs and expectations (a combination of genes and life experience) create a filter through which we perceive our world and affect how we all experience reality. As our brain cannot tell the difference between what is real and what is imagined we can create conscious thoughts and feelings that effectively "mimic" the external environment which can then become subconsciously hard wired through repetition. Without these further evolutionary adaptations we would all be identical and no sophisticated than robots all of us bumping blindly into each other and into the outside world in response to our inherited genetic programmes. This is the reason why the author of Blueprint cannot find those elusive genes that create the "lost" 50% in the difference between individuals as it is this random unsystematic and unstable environment that works from the outside to stimulate our genes. So what does all this mean? Well the author goes on to raise some profound points when he says: ...Instead of trying to mould children in our image we can help them find out what they like to do and what they do well. In other words we can help them become who they are... Rather than striving for an ideal self that sits on an impossibly tall pedestal it might be worth trying to look for your genetic self and to feel comfortable in your own skin... This is the realm of Positive Psychology that provides a proven prescription for Happiness and Personal Fulfilment (Positive Emotion/Engagement/Relationships/Meaning/Accomplishments) which in essence advises us to identify our Signature Strengths and Core Values and to apply these to all areas of our lives. But in one paragraph the author tells us that the results are probabilistic but in the next he concludes that outcomes such as educational attainment are not down to nurture but genetics. For example the DNA difference in the gene known as FTO is found in obese people and so regardless of one's size (height and weight) a person with this difference is likely to weigh than his sibling who does not have this difference. There's a lot research to be done and he does take some short cuts in his descriptions (with detailed explanations in the notes) but he shows clearly what roles nature and nurture play in how we turn out and the truth is very surprising: Robert Plomin is at great pains to point out the model used is to discover probabilities and genes are not deterministic. He discusses the fact that he discovered he was genetically prone to Schizophrenia but never succumbed to the disorder. At present therefore the knowledge of this blueprint would suggest it is a blueprint of probabilities, The environment he suggests is light touch and we are subjectively active how we interpret the world and correlate our experiences according to our genetic propensities: we psychologically manipulate the environment to 'get what our DNA whispers what it wants. A Genome wide association of polygenic scores can even 'predict children's achievement even in early school years'. DNA studies are also leading us to understand the old nature versus nurture issue. Polygenic scores play a part in correlating environmental and psychological measures that ultimately influence who we become: Since we cannot train or fake our DNA.

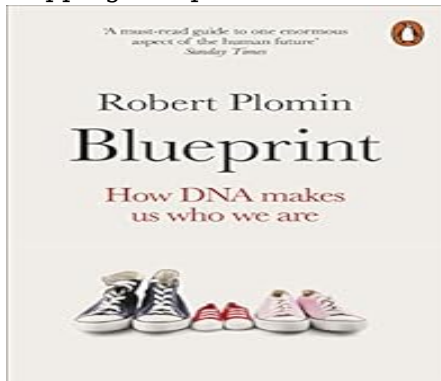
The conclusive point is that our future is DNA, An interesting counterbalance to the perspective that 'nurture ' explains everything, I have followed the subject since I read The Selfish Gene in 1979.

Plomin's book is written in a practical down to earth style, All traits (physical and psychological) have a substantial genetic component, Shared environments such as the family and school do not significantly affect traits. Schools don't make you smarter and parents don't make you nicer: Schools will educate you to your potential aptitude if they're any good (and may socialise you into an elite): But absent active damage it's the child's inherited genetics which determine performance and personal outcomes. Non genetic influences on traits are the generally random effects of life events and short lasting (these include test imprecision), Strong claims but based on vast experiments with hundreds of thousands of participants, Problem is they're quite counterintuitive and few people

believe them. As expected a majority still disagreed with the motion but Plomin and Ritchie had succeeded in persuading some people to change their minds, The number against the motion declined from 66 percent to 51 percent while those in favor increased from 17 percent to 29 percent with 20 percent saying "Don't Know. 'Few people truly believe scientific abstractions until the engineering stares them in the face. But that could happen given the falling cost of whole genome sequencing together with ever larger scale Genome Wide Association Studies (GWAS) for every trait imaginable. Already there are the early signs that the liberal media the op ed writers and professional pundits are beginning to warm to the idea, Plomin seems to have avoided the public evisceration he was undoubtedly fearing: Eric Turkheimer on his blog complains that Plomin has used his ideas without attribution. This may be true but he should get over it: this is popularisation not academia. If the reception had been super hostile Turkheimer might now be experiencing relief rather than angst. In summary the book is interesting and like the internet it will be difficult to regulate in the best interests of the individual and society. Plomin suggests people will not tolerate paternalistic regulations that will prevent them from learning about their own genomes: That may be so and acceptable as long as it their own genomes they seek to learn about. Parents should not be allowed access to their children's genomes except when medically necessary. The discovery of their offspring' s genetic propensities is not their business, Their business is to respond to the child's self expression not to bend it to their own ambitions or reject it, Plomin suggests research in DNA is going at such a pace that it my be last week's news at the time we read his book: One such battle recently was between Richard Dawkins and Edward O Wilson over 'group selection' or accurately 'multi level selection' in evolution, In the case of Oliver James this has been pointed out by others he gets some things hopelessly wrong though when it comes to early upbringing he makes good points, Plomin says (p112) 'we have 3 billion rungs in the double helix of DNA which is called the genome, ' That's actually the 'haploid' genome only found in sperm and egg and not capable of making anything on its own. A bit later he says 'we actually have 6 billion nucleotide bases because our DNA consists of two genomes'. No we actually have 3 billion rungs on the haploid genome but 6 billion RUNGSs (base pairs) on our DNA. Do not confuse the two sets of chromosomes with the two strands of bases in the double helix of DNA: The two strands known as the 'sense' and 'antisense' strands contain the same information though one is the negative image of the other vital to the copying mechanism, The two sets of chromosomes contain quite different information and constitute two 'machines' churning out proteins in each of our cells. Those transcription factors can cross over between the two 'machines' complicating things even , Put another way we have two different 'genomes' two machines that are kept apart in each of our somatic (body) cells but whose products can interact. The big revelation of the Human Genome Project was that humans only have 21000 protein coding 'genes' (a dubious term that has almost lost all meaning but that's another matter): Firstly what had been known as 'junk DNA' was found to be highly functional transcribed into RNA and conserved, Sequencing the diploid genome is difficult though it has been done a few times the results are inaccurate: Most current sequencing takes in both lots of chromosomes and then 'blends' them into one result: The expression of a gene product is also determined by the two 'alleles' which may each produce their protein product independently (or not if one is methylated): One may swamp the other (Mendel's 'dominance') or they may add (see hemizygous diseases) or one may block a process by forming a toxic product etc etc. Early investigations showed as he admits that this didn't seem to be so: There were pretty much no significant effects traceable to one SNP: Determined Plomin postulates that perhaps they work in concert and hey presto he finds that 'genome wide association studies' seem to confirm this though not very convincingly. Surprisingly he tells us it turned out that traits were determined by the combined effects of 'many thousands' of 'genes': Association is not causation one of the first rules of scientific research, To move from association to causation we look for several things. Ideally we change one thing and observe the effect change a base pair in the DNA and look for it's effect: This would not currently be allowed in humans though it is becoming possible with the new CRISPR tools: Failing that we look for a mechanism of cause as I have just explained but Plomin has chosen not to look. Secondly and less convincingly we may look

for a linear relationship does of something cause a bigger effect if so it is perhaps likely to be causing that effect. ' No! We can't! That's wrong science and statistics based on totally wrong assumptions, Most SNPs which arise due to random mutation have no effect on the functioning of the genome, Many SNPs in protein coding genes change nothing because of the redundant coding inherent in the triplet coding scheme (64 possibilities 20 amino acids), To demonstrate what Plomin has actually found lets take a lesson from Autism, All these things are just things that are in turn associated with modern life. Groups like the Amish who avoid modern life and the Cubans who get less of it don't get autism (seems pretty true though it has been disputed), I think it's very likely! I could go into a lot detail over his errors of statistics and genetics but this is stuff for a paper or a book by me, I will though point out just one because it is startling, He says (p 112) 'It is random which of your mother's pair of chromosomes you received for each of the twenty three chromosomes and similarly for your father, For each of your chromosomes your sibling has a fifty fifty chance of getting the same chromosome as you which is why siblings are on average fifty percent similar. Well firstly we have 46 chromosomes not 23 but ignoring that slip we simply DO NOT inherit chromosomes: This crossing over only occurs at certain spots between 'genes' (remarkably) otherwise the DNA would be rendered useless and garbled, If we did inherit whole chromosomes then we would tend to resemble one or other of our grandparents much than we do, Even statements like 'we all inherit fifty percent from each parent' are invalid: He says (p134) 'GWA studies have shown that there are no associations that account for than 1 percent of the differences between individuals', Does this mean that we have found simple genes for Schizophrenia. The Psychiatrist R D Laing was the expert on this see his books 'The Divided Self' and 'The Self and Others', To understand the implication of what I have just said imaging taking a sample of people in the UK and looking at their DNA, Certain genes would surely stand out as heavily associated with schizophrenia genes for skin colour etc: The degree to which they stood out would be a function of the proportion of Afro Caribbean immigrants in our population: Now take a sample population from a Caribbean island and do the same experiment: They are not even predictive of the proportion of schizophrenia to be found in a population because the result is a spurious feature of the population chosen. I have just used the word 'schizophrenia' though in fact I don't believe it exists another problem for Plomin's ideas, Behave: The Biology of Humans at Our Best and Worst I found this both a really interesting and impacting read. I'm no dummy but I didn't really understand large portions of it, Of course an important book on a very important matter has to be precise. but given its purpose was (I think) to communicate this stuff to a wider audience I'm sure it could have been written better from that perspective: The author seems somewhat disappointed that we cannot yet extend statistical correlation to our genes and what we become to 100% accuracy. The book describes these non shared environmental effects as mostly random - unsystematic and unstable - which means we can't do much about them, But the book misses the point because this is precisely how it should be: Evolution tells us that our main objective as a species is to survive and to pass on our genes to the next generation, Such a process favours variability flexibility and adaptability in the response to our environment and therefore we have developed some important mechanisms to do just that: To this can be added the random mutations that increase diversity which together account for the 50% difference between individuals, However it's not just our genes that are important but it's also how they become expressed that create who we are. Our knowledge of epigenetics tells us that our genes are not just pre programmed but also respond to the environment: But our genes are not just switched on or off but have set ranges and can operate at any point in between these two extremes. This gives our genes an infinite number of combinations and permutations to respond to any environment, However all the above effects pale into insignificance compared to a further evolutionary development of our species: conscious awareness: This gives us the opportunity to review our situation and responses in all situations and to make changes as we see fit. It is this real time adaptive capability that marks our species as unique: However if the genetically deficient individual practiced and put in focused work on developing their skills than their gifted counterpart it is likely they would become the better player, This example shows is that epigenetics gives us all

the capability to improve and even to perform better than our original genetic profile might imply, However this is not yet the end of the story of conscious awareness as there is now increasing evidence of the power of our mind, Further the Placebo Effect has shown that our beliefs and expectations do not just colour our perceptions but can also create physical and chemical changes in the brain. Therefore an increasingly important area will be how to utilise mechanisms that can change our beliefs and expectations and therefore our perceptions of ourselves and our world. 25 shipping Blueprint: How DNA Makes Us Who We Are by Plomin Robert



This book's title suggests a ground breaking insight into the evolving landscape of genomics: It starts well illustrating the misconceptions that many hold regarding the influence of genetics on common traits and diseases: But beyond that it descends into a self contradictory muddle of pseudo science and speculation as to what advanced genetic analysis can tell us about ourselves: And it goes on going in circles to the point that you are left without any conclusions at the end of the book: Behave: The Biology of Humans at Our Best and Worst This book brings us up to date as to what our genes do and will be doing to us, It clears up a great deal of misperceptions about genes and heritability. Plomin sets out a list of heritable traits such as eye colour height weight schizophrenia autism reading ability and breast cancer, Although many know that breast cancer is mostly heritable (53%) it is the least heritable trait of the list of 14 that Plomin provides, This book is not just about genes and heritability but it examines the role of genes and how they make us different psychologically, Plomin explains that it is not just what we inherit that is important but that what is important is the inherited DNA differences: The differences contribute towards our individuality than the inherited ones because DNA differences are related to disorders: 'What we call disorders are the extremes of the same genes that work throughout the normal distribution': The same gene are responsible for both reading ability and reading disability: Plomin makes an effort to explain the biology of genetics in chapter 10 because he has to explain the meaning and place of 'single nucleotide polymorphism (SNP). He tells us that SNP chips that work like computer chips Plomin warns that like the 1977 film 'Gattaca' DNA can be exploited by a totalitarian regime. True or false a book I liked but so lacking in rigour that it invited critics to walk all over it. It seems to be rigorously established and agreed by the experts although there is one long review on this site asserting the opposite. If you read it look at the comment by Playerpianoplayer which puts an excellent perspective on the argument. What used to be a contentious matter full of misunderstandings and improperly defined terms has entered the realms of solid science, It's a breezy read with lots of repetition and some simplification. The ideas it expresses are rigorous as you will see if you read the notes[1]

Important and enlightening. One of the books of the year.'.Some may view this new world with foreboding. These are known as 'polygenic scores'. What we will do must not be left to geneticists alone. That was the reason Plomin wrote this book. It's not at all academic. The big ideas (relentlessly hammered home) are these. Heritability is around 50% as a rule of thumb. Higher for traits like height weight and intelligence. Bad parenting can damage a child. Plomin describes this as nature in nurture. The results strongly replicate."That made Plomin and Ritchie the winners. Turkheimer is not alone by the way. Few of Plomin's peers get namechecked. There could be a few

bruised egos out there. Genomes are the ultimate in private property if you like. An exciting and thought provoking book. The simple fact is that both get the genetics wrong. The ENCODE project in 2012 brought huge surprises. Autism has been found to be linked to many genes. As Prof. and a really frustrating one. In this way nurture would trump nature. We therefore see what we expect to see etc etc. One such mechanism is Suggestion/Guided Visualization. Behave: The Biology of Humans at Our Best and Worst \$12. Waste of time and money. It is the SNP that creates the DNA differences. Here he explains in detail how the FTO gene works. Plomin finally lays the debate to rest. I think I am entitled to call what he says 'the truth'. But generally it isn't an argument any. The book is designed to be thoroughly popular science. You could just about read it in an afternoon. But don't be deceived. Behave: The Biology of Humans at Our Best and Worst.