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Book Review

It Takes a Genome. How a clash between our genes and modern life is making us sick
Greg Gibson
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Books about science for the general public are abundant. They are either written by scientists, keen on explaining what it is that they do and why this is so important, or by (science) journalists and writers, attempting to convey insight into how the world works. The former are sometimes bad writers and the latter are sometimes badly informed. Equally, the opposite is often true. However, Greg Gibson is a full professor of genetics both in the USA and in Australia. He knows his science and he demonstrates this by including a very long list of references. Furthermore, he is not at all a bad writer. The problem of this book is of a different character.

Let us first turn to the book's content and the claims Gibson makes. The book's mission, in Gibson's words, is "to explain how our genes make us sick. Secondly, it is to advance the thesis that they do so in large part because the genome is out of equilibrium, with itself and with the environment." (p. ix) Not only is this an ambitious goal, it remains somewhat unclear what Gibson means by this. His attempt to clarify is not very helpful: "Our genes are 'not in a happy place.'" (p. ix) The author promises a lot of examples though, which might help shed some light on the matter.

Before Gibson embarks on a discussion of many classes of diseases, he introduces the notion of the *adolescent genome* to the reader. The adolescent genome is not the genome of an adolescent, but rather an indicator, Gibson's evaluation of the evolutionary status of the human genome as compared to other species and their surroundings. Gibson argues that the human genome is not yet suited for the environment humans live in - as opposed to, for instance, the crocodile genome and the crocodile habitat. The key is in the 'yet': Gibson ends his book by suggesting that "if we come back in a few million years, perhaps we will find that our adolescent genome has evolved to a more mature equilibrium" (p.149). The analogy is confusing, especially since the path from adolescent to adult is, biologically, fixed, while the evolutionary trajectory the human genome will take is unpredictable at best. While the notion of the adolescent genome and the proposition that equilibrium can be attained make for very interesting discussions in theoretical evolutionary biology, they are confusing in a book that attempts to "explain how our genes make us sick".

The body of the book is devoted to discussion of a number of classes of diseases. Gibson visits, in order, cancer, diabetes and obesity, asthma, infectious diseases, mental illness and Alzheimer's. Many of these diseases act as exemplars for others. For instance, asthma invites the author to venture into autoimmune diseases. Given

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the variety of these classes of diseases, unsurprisingly, the role of genes and genomes in each of these is very different. Gibson provides scores of examples of genes and discusses the basics of how epidemiological research generated knowledge about the gene, what it does, which alleles exist in which ratios and much more. We hear, for example, about TCF7L2, a gene that emerged from whole genome scans. It codes for a transcription factor and a particular variant of the gene may account for "20 per cent of the incidence of diabetes in Africans and Europeans" (p.59).

The chapters are by no means symmetrical discussions. In fact, they are hardly comparable, since the genetic or genomic element is radically different. In his discussions of AIDS, Gibson fails to "explain how our genes make us sick". He shows how susceptibility varies according to genomic variation – a strategy he also uses in his discussion of mental illness.

From time to time, sticking to his main argument appears to be hard going. Gibson makes some creative interpretations and resorts to statements such as, "Depression is one of the most genetic illnesses there is, yet paradoxically no one has been able to find a gene for depression." (p.109)

It Takes a Genome presents us with an interesting yet quite chaotic collection of genetic epidemiological facts. Each of these facts is an interesting snippet of information, and combined they may lead us to reflect upon how our genomes and ourselves relate to one another. One would expect this to leave room for multiple positions. Gibson, however, has set up his book as a college textbook. Each chapter starts with half a dozen claims that will be discussed and, apparently, ought to be remembered (do we get a test?). For instance: "Type 1 diabetes. The rare form of diabetes arises because a child's own body destroys the pancreatic cells that make insulin" (p. 41). Additionally, throughout the text, Gibson highlights key phrases. He decides what the important facts are and what is worth remembering. The book suggests that there is only one way to read and remember it properly.

This leads us to an important observation. The design resembles a text book, yet college students will not be impressed. They presumably know all the facts, or at least where to find them. The analogies, the context of information and the method of presentation vary enormously. Gibson talks down to the more informed reader by referring to genes as petty criminals, and making fun of their boring names. He spends significant parts of each chapter listing which celebrity suffers or suffered from which disease. (To those interested in celebrity genomes, a warning to the European reader: many of the American sports celebrities I had never heard of.) In the chapter on "Genetic AIDS", Gibson deviates from listing celebrities at the start of the chapter. He sticks to a single fictional patient: Tom Hanks' character in the movie Philadelphia.

In other instances, he estranges those who might be less informed. He suggests that people go and look for themselves at publications on PubMed. While GSP readers, for instance, may find that worthwhile and perhaps even exciting, it will simply be out of reach of most of Gibson's readers since most of the academic texts require expensive subscriptions – not to mention the amount and complexity of information PubMed hosts. More striking is his explanation of what DNA is. In a book on the human genome one would expect a proper introduction, especially considering the numerous

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references in the book to mutations, deletions, codes, codons and SNPs. Yet Gibson refers to DNA as "consisting of four letters, A, T, G and C, strung together in long molecules" (p.15). That seems a bit brief.

Aside from all sorts of genetic epidemiological facts, Gibson focuses mostly on a single take-home message: the human genome is in disequilibrium with itself and its environment. But what does this mean? He argues that our genome is young, yet our lifestyles are a lot younger. The young genome 'explains' the internal imbalance, while our even younger lifestyles ought to 'account for' the imbalance between genome and life. By 'internal imbalance' Gibson seems to mean that a number of characteristics of the human genome are not optimal, including, but not restricted to, that genes work and collaborate improperly, or that certain alleles exist in unexpected ratios, thereby allowing unwanted characteristics to proliferate.

The posited imbalance between genome and lifestyle is more complex. Our environments can make us ill: pathogens and toxins surround every one of us. Depending on your lifestyle, you may or may not have frequent exposures to them. Gibson's point seems to be that it is our genome's responsibility to deal with these threats in such a way that no disease arises. This leads me to wonder whether this is the balance he refers to? It hardly seems reasonable to wait another 10,000 generations for our genome to evolve to such a state, especially considering that by then our lifestyles are likely to have changed exponentially. The equilibrium Gibson craves is utopian. I would have preferred Gibson to invest in a sensible and reflexive evaluation of our lifestyles against the backdrop of our genome. Gibson's equilibrium may make (some) sense from an evolutionary point of view, but it completely disregards the social realities of our lives.

Gibson succeeds in showing that the genetic component of disease is always only a component. Without explicitly mentioning it as his goal, he debunks notions of genetic exceptionalism and genetic determinism. Especially in his discussion of cancer, he spends a significant amount of time explaining the difference between heritability and genetics – well worth the effort. However, these strengths are outweighed by the book's weakness: *It Takes a Genome* offers something to many audiences, but not enough to any one of them. It meanders between a text book on genetic epidemiology, a lay guide to the genome, a theoretical evolutionary genetic argument and a gossip guide to celebrity genomes. It combines an ambitious claim with a chaotic execution and I would have to test my imagination to determine to whom to recommend it.

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