

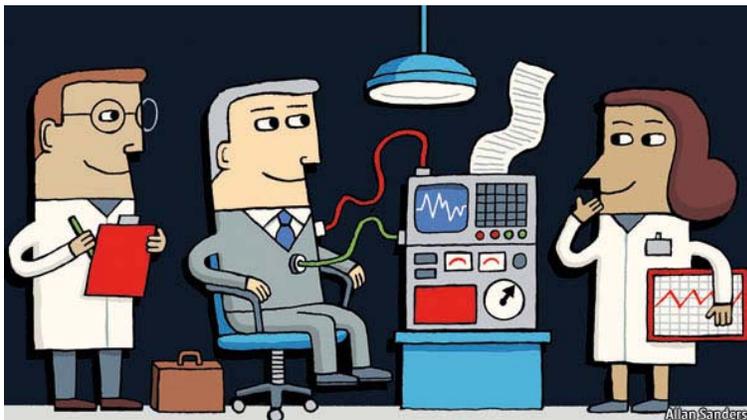
The
Economist

The biology of business

Homo administrans

Biologists have brought rigour to psychology, sociology and even economics. Now they are turning their attention to the softest science of all: management

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SCURRYING around the corridors of the business school at the National University of Singapore (NUS) in his white lab coat last year, Michael Zyphur must have made an incongruous sight. Visitors to management schools usually expect the staff to sport suits and ties. Dr Zyphur's garb was, however, no provocative fashion statement. It is *de rigueur* for anyone dealing with biological samples, and he routinely collects such samples as part of his research on, of all things, organisational hierarchies. He uses them to look for biological markers, in the form of hormones, that might either cause or reflect patterns of behaviour that are relevant to business.

Since its inception in the early 20th century, management science has been dominated by what Leda Cosmides and John Tooby, two evolutionary psychologists, refer to disparagingly as the **standard social science model (SSSM)**. This assumes that most behavioural differences between individuals are explicable by culture and socialisation, with biology playing at best the softest of second fiddles. Dr Zyphur is part of an insurgency against this idea. What Dr Cosmides and Dr Tooby have done to psychology and sociology, and others have done to economics, he wants to do to management. Consultants often talk of the idea of "scientific" management. He, and others like him, want to make that term meaningful, by applying the rigour of biology.

To do so, they will need to weave together several disparate strands of the subject—genetics, endocrinology, molecular biology and even psychology. If that works, the resulting mixture may provide a new set of tools for the hard-pressed business manager.

To the management born

Say "biology" and "behaviour" in the same sentence, and most minds think of genetics and the vexed question of nature and nurture. In a business context such questions of heredity and environment are the realm of Scott Shane, a professor of management at Case Western Reserve University in Ohio. In a recent book*, Dr Shane proffers a review of the field. Many of his data come from studies of twins—a traditional tool of human geneticists, who are denied the possibility of experimental breeding enjoyed by their confrères who study other species, such as flies and mice.

Identical twins share all of their DNA. Non-identical twins share only half (like all other siblings). Despite a murky past involving

Family business

% difference between individuals' job preferences that is explained by genes

the probable fabrication of data by one of the field's pioneers, Sir Cyril Burt, the science of comparing identical with non-identical twins is still seen as a good way of distinguishing the effects of genes from those of upbringing.

The consensus from twin studies is that genes really do account for a substantial proportion of the differences between individuals—and that applies to business as much as it does to the rest of life. Dr Shane observes genetic influence over which jobs people choose (see chart), how satisfied they are with those jobs, how frequently they change jobs, how important work is to them and how well they perform (or strictly speaking, how poorly: genes

account for over a third of variation between individuals in “censured job performance”, a measure that incorporates reprimands, probation and performance-related firings). Salary also depends on DNA. Around 40% of the variation between people's incomes is attributable to genetics. Genes do not, however, operate in isolation. Environment is important, too. Part of the mistake made by supporters of the SSSM was to treat the two as independent variables when, in reality, they interact in subtle ways.

Richard Arvey, the head of the NUS business school's department of management and organisation, has been looking into precisely how genes interact with different types of environment to create such things as entrepreneurial zeal and the ability to lead others. Previous research had shown that people exhibiting personality traits like sensation-seeking are more likely to become entrepreneurs than their less outgoing and more level-headed peers. Dr Arvey and his colleagues found the same effect for extroversion (of which sensation-seeking is but one facet). There was, however, an interesting twist. Their study—of 1,285 pairs of identical twins and 849 pairs of same-sex fraternal ones—suggests that genes help explain extroversion only in women. In men, this trait is instilled environmentally. Businesswomen, it seems, are born. But businessmen are made.

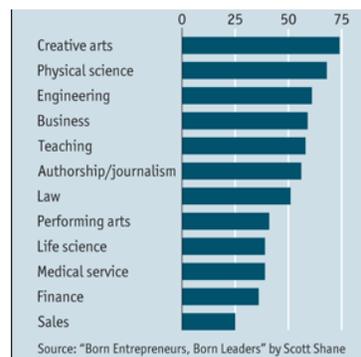
In a second twin study, this time just on men, Dr Arvey asked to what extent leaders are born, and to what extent they are made.

Inborn leadership traits certainly do exist, but upbringing, he found, matters too. The influence of genes on leadership potential is weakest in boys brought up in rich, supportive families and strongest in those raised in harsher circumstances. The quip that the battle of Waterloo was won on the playing fields of Eton thus seems to have some truth.

Pathways to success

Twin studies such as these point the way, but they provide only superficial explanations of what is going on. To get at the nitty gritty it is necessary to dive into molecular biology. And that is the province of people like Song Zhaoli, who is also at the NUS.

One way genes affect behaviour is through the agency of neurotransmitters, the chemicals that carry messages between nerve cells. Among these chemicals, two of the most important are dopamine and serotonin. Dopamine controls feelings of pleasure and reward. Serotonin regulates mood. Some personality traits have been shown to depend on the amounts of these neurotransmitters that slosh around the junctions between nerve cells. Novelty-seeking, for example, is associated with lots of dopamine. A tendency to depression may mean too little serotonin. And the levels of both are regulated by genes, with different variants of the same underlying gene having different effects.





Recent years have seen a surge of research into the links between particular versions of neurotransmitter-related genes and behavioural outcomes, such as voter turnout, risk-aversion, personal popularity and sexual promiscuity. However, studies of work-related traits have hitherto been conspicuous by their absence.

Dr Song has tried to fill this gap. His team have gathered and analysed DNA from 123 Singaporean couples to see if it can be matched with a host of work-related variables, starting with job satisfaction.

In this case Dr Song first checked how prone each participant in the study was to the doldrums, in order to establish a baseline. He also asked whether they had experienced any particularly stressful events, like sustaining serious injury, getting the sack or losing a lot of money, within the previous year. Then he told participants to report moments of negative mood (anger, guilt, sadness or worry) and job satisfaction (measured on a seven-point scale) four times a day for a week, using a survey app installed on their mobile phones.

He knew from previous research that some forms of melancholia, such as seasonal affective disorder (or winter blues), have been linked to particular versions of a serotonin-receptor gene called *HTR2A*. When he collated the DNA and survey data from his volunteers, he found those with a particular variant of *HTR2A* were less likely than those carrying one of its two other possible variants to experience momentary negative mood, even if they had had a more stress-ridden year. Dr Song also found that when carriers of that same variant reported lower negative mood, they also tended to report higher job satisfaction—an effect which was absent among people who had inherited the remaining two versions of the gene.

This suggests that for people fortunate enough to come equipped with the pertinent version of *HTR2A*, stressful events are less likely to have a negative effect on transient mood. What is more, for these optimists, better mood turns out to be directly related to contentment with their job. In other words, it may be a particular genetic mutation of a serotonin-receptor gene, and not the employer's incentives, say, that is making people happier with their work.

The hormonal balance-sheet

Neurotransmitters are not the only way an individual's genetic make-up is translated into action. Hormones also play a part. For example, oxytocin, which is secreted by part of the brain called the hypothalamus, has been shown to promote trust—a crucial factor in all manner of business dealings. The stress hormone cortisol, meanwhile, affects the assessment of the time value of money.

That, at least, was the conclusion of a study by Taiki Takahashi of Hokkaido University in Japan. After taking saliva samples from 18 volunteers, Dr Takahashi asked them what minimum amount of money they would accept in a year's time in order to forgo an immediate payout of ¥10,000 (around \$90 at the time). He found those with a lower base level of the hormone tended to prefer immediate payment, even when the sum in question was piffling compared with the promised future compensation.

Then there is testosterone, the principal male sex hormone (though women make it too). The literature on this hormone's behavioural effects is vast. High levels of the stuff have been correlated with risk tolerance, creativity and the creation of new ventures. But testosterone is

principally about **dominance and hierarchy**. This is where Dr Zyphur's mouth swabs come in.

When Dr Zyphur (who is now at the University of Melbourne) was at the NUS, he led a study of how testosterone is related to status and collective effectiveness in groups. He and his colleagues examined levels of the hormone in 92 mixed-sex groups of about half a dozen individuals. Surprisingly, a group member's testosterone level did not predict his or her status within the group. What the researchers did discover, though, is that **the greater the mismatch between testosterone and status, the less effectively a group's members co-operate**. In a corporate setting that lower productivity translates into lower income.

Testosterone crops up in another part of the business equation, too: sales. It appears, for instance, to be a **by-product of conspicuous consumption**. In an oft-cited study Gad Saad and John Vongas of Concordia University in Montreal found that men's testosterone levels responded precisely to changes in how they perceived their status. Testosterone shot up, for example, when they got behind the wheel of a sexy sports car and fell when they were made to drive a clunky family saloon car. The researchers also reported that when a man's status was threatened in the presence of a female by a display of wealth by a male acquaintance, his testosterone levels surged.

As Dr Saad and Dr Vongas point out, a **better understanding of this mechanism could help explain many aspects both of marketing and of who makes a successful salesman**. Car salesmen, for example, are stereotypically male and aggressive, which tends to indicate high levels of testosterone. Whether that is really the right approach with male customers is, in light of this research, a moot point.

Natural selection

Results such as these are preliminary. But they do offer the possibility of turning aspects of management science into a real science—and an applied science, to boot. Decisions based on an accurate picture of human nature have a better chance of succeeding than those that are not. For instance, if job satisfaction and leadership turn out to have large genetic components, **greater emphasis might be placed on selection than on training**.

Not everyone is convinced. One quibble is that many investigations of genetics and behaviour have relied on participants' retrospective reports of their earlier psychological states, which are often inaccurate. This concern, however, is being allayed with the advent of techniques such as Dr Song's mobile-sampling method.

Another worry is that, despite the fact that most twin studies have been extensively replicated, they may be subject to systematic flaws. If parents exhibit a tendency to treat identical twins more similarly than fraternal ones, for instance, then what researchers see as genetic factors could turn out to be environmental ones.

That particular problem can be examined by looking at twins who have been fostered or adopted apart, and thus raised in separate households. A more serious one, though, has emerged recently. This is that identical twins may not be as identical as appears at first sight. A process called **epigenesis**, which shuts down genes in response to environmental prompts, may make their effective genomes different from their actual ones.

Statistically, that would not matter too much if the amount of epigenesis were the same in identical and fraternal twins, but research published last year by Art Petronis of the Centre for Addiction and Mental Health in Toronto and his colleagues, suggests it is not. Instead, identical twins are epigenetically closer to each other than the fraternal sort. That means environmentally induced effects that are translated into action by this sort of epigenesis might be being confused by researchers with inherited ones.

Still, this and other concerns about the effectiveness of the new science should pass as more data are gathered. But a separate set of concerns may be increased by better data. These are those of an ethical nature, which pop up whenever scientists broach the nature-nurture nexus. Broadly, such concerns divide into three sorts.

The first involves the **fear that genetic determinism cheapens human volition**. But as Dr Shane is at pains to stress, researchers like him are by no means genetic fatalists. He draws an analogy with sports wagers. Knowing that you have the favourable version of a gene may shift the odds somewhat, but it no more guarantees that you will be satisfied with your job than knowing of a player's injury ensures that you will cash in on his team's loss. Indeed, it might be argued that a **better understanding of humanity can help direct efforts to counteract those propensities viewed as detrimental or undesirable**, thus ensuring people are less, rather than more, in thrall to their biology.

The second set of ethical worriers are those who fret that **biological knowledge may be used to serve nefarious ends**. Whenever biology meets behaviour the spectre of social Darwinism and eugenics looms menacingly in the background. Yet, just because genetic information can serve evil ends need not mean that it has to. Dr Shane observes that **pretending DNA has no bearing on working life does not make those influences go away, it just makes everyone ignorant** of what they are, "Everyone, that is, except those who want to misuse the information."

The third ethical qualm involves the **thorny issue of fairness**. Ought employers to use genetic testing to select their workers? Will this not lead down a slippery slope to genetic segregation of the sort depicted in the genetic dystopias beloved of science-fiction?

This pass, however, has already been sold. Workers are already sometimes hired on the basis of **personality tests** that try to tease out the very genetic predispositions that biologists are looking for. The difference is that the hiring methods do this indirectly, and probably clumsily. Moreover, in a rare example of legislative foresight, politicians in many countries have anticipated the problem. In 2008, for example, America's Congress passed the Genetic Information Nondiscrimination Act, banning the use of genetic information in job recruitment. Similar measures had previously been adopted in several European countries, including Denmark, Finland, France and Sweden.

Biohazard?

There is one other group of critics. These are those who worry that applying biology to business is dangerous not because it is powerful, but because it isn't. To the extent they are genetic at all, behavioural outcomes are probably the result of the interaction of myriad genes in ways that are decades from being fully understood. That applies as much to business-related behaviour as to behaviour in any other facet of life.

Still, as Dr Zyphur is keen to note, not all academic work has to be about hard-nosed application in the here and now. Often, the practical applications of science are serendipitous—and may take a long time to arrive. And even if they never arrive, understanding human behaviour is just plain interesting for its own sake. "We in business schools often act like technicians in the way we conceptualise and teach our topics of study," he laments. "This owes much to the fact that a business school is more like a trade school than it is a part of classic academia." Now, largely as a result of efforts by Dr Zyphur and others like him, management science looks set for a thorough, biology-inspired overhaul. Expect plenty more lab coats in business-school corridors.

*"Born Entrepreneurs, Born Leaders. How Your Genes Affect Your Work Life". Oxford University Press. \$29.95

Science and Technology