

# CURRENT SCIENCE

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EDITORIAL

## Science and Social Science: The Spreading Tentacles of Biology

Biology is a discipline that bridges the 'soft' social sciences and the 'hard' sciences on a very broad front. Some practitioners of biology resemble physicists and chemists in their methods and approaches. Others favour methodologies, which resemble those of social scientists. Among the social sciences, economics is a subject where both rigorous mathematics and the somewhat fuzzier ideas of evolutionary biology have made an impact. If Malthusian thought influenced Darwin, he in turn influenced the economists of his time. More recently, geneticists and economists appear to be embroiled in a controversy, where the results of genetic analysis may have been overinterpreted, while examining the factors that drive national economies. A news report entitled 'Economics and genetics meet in uneasy union' draws attention to a debate that has been sparked by the circulation of a study which appears to suggest a link between the genetic diversity of a country's citizenry and the success of a national economy. Such an attempted correlation is bound to raise hackles, inviting the inevitable charge of 'genetic determinism and racism' (Callaway, E., *Nature*, 2012, **490**, 154). The *Nature* report reminds readers of Stephen Jay Gould's famous admonition to those who are prone to correlate the uncorrelated: 'The invalid assumption that correlation implies cause is probably among the two or three most serious and common errors of human reasoning.' The key conclusions of the 107 page paper (economists appear to write significantly longer papers than scientists) are succinctly summarized in the *Nature* report: 'High genetic diversity in a country's population is linked with greater innovation ... because diverse populations have a greater range of cognitive abilities and styles. By contrast, low genetic diversity tends to produce societies with greater interpersonal trust, because there are fewer differences between populations.' The report appears to extrapolate these findings to further suggest that, 'countries with intermediate levels of diversity, such as the United States, balance these factors and have the most productive economies'.

Many casual readers, and I am one, would instinctively recoil from a conclusion that genetic factors dictate economic fitness; a reminder of darker times when genetics seemed to be a weapon more often misused than used. The critics of the paper in the *American Economic Review* were quick to mount an offensive, charging that

'the suggestion that an ideal level of genetic variation could foster economic growth and could even be engineered has the potential to be misused with frightening consequences'. The critics, geneticists and biologists amongst them, appear to be overreacting. While flawed statistical methodologies may be involved, many more factors presumably contribute to the interpretation of the data. The authors defend themselves by responding that critics have only a 'superficial understanding of the empirical techniques involved', adding that the study is unrelated to the perennial 'nature or nurture' debate. In an editorial comment *Nature* notes that for economists and geneticists to collaborate fruitfully 'both sides must take seriously the standards, methodology and history of the other'. Economists attempting to carve out a new niche, sometimes called 'genoeconomics', may underestimate the complexity of genetic data. They may also forget that 'human geneticists bear the historical scars of eugenics, and more recent accusations of insensitivity to indigenous populations'. Can geneticists learn from the economists? Undoubtedly, the social scientists have developed their own quantitative tools and are, as *Nature* notes, 'experts in measuring human behaviour both individual and collective' (*Nature*, 2012, **490**, 144).

If biology can influence economics, can politics be far behind? Indeed, two weeks after highlighting the fracas between economists and biologists, *Nature* carried a news feature on 'The Anatomy of Politics'. The article draws attention to the fact that 'an increasing number of studies suggest that biology can exert a significant influence on political beliefs and behaviours'. An interesting suggestion follows: 'And shrewd politicians might be able to take advantage of those biological levers through clever advertisements aimed at voters' primal emotions' (Buchen, L., *Nature*, 2012, **490**, 466). What are these 'biological levers' that politicians must learn to operate? Buchen highlights a number of reports in the literature of biology and social sciences that appear to link political positions and social attitudes to genes and hormones. Once again, studies in this area are calculated to remind observers of the dark days when genetic determinism seemed to be a malignant force in human affairs. While US studies focus on views that are 'right' or 'left', conservative or liberal, similar studies may be harder in larger democracies like India, where religion, language and caste become additional terms in a complex equation.

The first suggestions that genes may be linked to the positions people take on social issues appeared in the mid 1980s and were largely ignored. More recently, in 2005, studies on data from twins appear to have stirred interest in a field where biology intrudes into politics. If our political and social beliefs are written into our genomes, the hunt for candidate genes must inevitably follow. The *Nature* report cites studies on 'genes involved with the olfactory system and the neurotransmitters glutamate, dopamine and serotonin' which 'have all been linked to behaviours such as voter turnout and ideology'. Curiously, these reports have appeared in journals which must be as far removed from biology as can be; *Journal of Politics* and *Journal of Political Psychology*. Are such studies reproducible? Apparently not, as a comment in the *Nature* report indicates: 'The reviewers have not been familiar with the replication problems that exist'. Biologists who have struggled to identify the genetic markers for disease must undoubtedly view the entry of political scientists into genomics with a considerable degree of skepticism.

Genes only provide a blueprint for complex physiological mechanisms. Biochemistry translates the genetic message into action. Can the body's chemistry control reactions to specific situations and influence attitudes? After all, a surge of adrenalin often comes to our aid in difficult circumstances. Recent research suggests that glucocorticoids, steroid hormones released by the adrenal gland, may act as mediators of social stress and influence behaviour. The finding of 'surprising neuro-anatomical specificity' promises 'therapeutic approaches that could intervene and restore normal behaviours' (McEwen, B. S., *Science*, 2013, **339**, 279). While studies in mice may take a long time to translate into effective therapeutic intervention in humans, the unmasking of the mechanisms that determine behavioural responses to stress is clearly a first step along a long road. The connection between hormones and the environment has long been recognized. Indeed, the word 'chemistry' is widely used to describe social interactions. For sociologists interested in human behaviour an old hormone, oxytocin, has made a dramatic reappearance. Oxytocin, a peptide hormone synthesized by the hypothalamus and secreted by the pituitary gland has been widely used in clinical practice to induce uterine contraction. The molecule's synthesis in the laboratory was a landmark, recognized by the 1955 Nobel Prize to Vincent du Vigneaud. Half a century later, oxytocin is being touted as a potential behaviour modifier and possibly a potential therapeutic for treatment of psychiatric disorders. A news report in *Science* begins by alluding to a string of 'breathless' media reports which 'have credited this hormone with promoting the kind of teamwork that wins World Cup soccer championships and suggested that supplements of the peptide could have prevented the dalliances and subsequent downfall of a certain high ranking US intelligence official' (Miller, G., *Science*, 2013, **339**, 267). The *Science*

report draws attention to 'a genuine and infectious excitement among many scientists about the hormone's role in social behaviour', an area far removed from its primary function 'in childbirth and lactation'. The interest in oxytocin appears to stem from studies that suggest a role for oxytocin in promoting 'trust and cooperation' and in making 'people more attuned to social cues'. While many psychiatric disorders have become targets for oxytocin, autism appears to be a condition where administration of the hormone may be worth investigating. Unfortunately, several ongoing studies may be throwing up results that argue for a more cautious approach in clinical trials. The effects of oxytocin in humans may vary with a 'person's genetic makeup and psychological status'. Large scale studies are underway where the potential benefits of oxytocin in autistic children are being explored; the results of which will be eagerly awaited. Animal studies using prairie voles as subjects are throwing up results that the short term beneficial effects of oxytocin in promoting bonding with a mate may be offset by a reversal of behaviour in the long term.

Social scientists may be drawn to a report that appeared a couple of years ago that declared, 'oxytocin promotes human ethnocentrism' (De Dreu, C. K. W. *et al.*, *Proc. Natl. Acad. Sci. USA*, 2011, **108**, 1262). Using clever experimental design, De Dreu *et al.* assessed the effects of oxytocin in modulating social attitudes in studies involving a large number of participants. Their results point to the role of oxytocin in enhancing ethnocentrism – 'the tendency to view one's group as centrally important and superior to other groups'. This is a quality which 'creates intergroup bias that fuels prejudice, xenophobia and intergroup violence'. Clearly, De Dreu *et al.* draw a diametrically opposite conclusion to those who have called oxytocin a 'love drug' or 'cuddle chemical'. While oxytocin promotes cooperation within groups ('in group favouritism') it is clearly capable of enhancing intergroup prejudices. These authors 'suggest that oxytocin has a role in the emergence of intergroup conflict and violence'. While the role of hormones in influencing the 'social brain' is being increasingly recognized, cognition and physiology may also be linked. A recent report which must attract political scientists is engagingly titled: 'The political left rolls with the good and the political right confronts the bad: connecting physiology and cognition to preferences' (Dodd, M. R., *Philos. Trans. R. Soc.*, 2012, **367**, 640). Such studies attempt to provide a biological basis for 'at least a part of our political differences', suggesting that physiology and cognition conspire to 'lead people to experience the world in fundamentally different ways'. In a country where political and social conflicts dominate everyday discourse, we might be comforted by the thought that as the tentacles of biology spread into the social sciences, greater understanding of human behaviour may help in promoting tolerance.

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