Abstractions

BOOK REVIEW AUTHOR

Efforts to understand how ecology and evolution shape human behaviour rely, at least in part, on studying the social dynamics of non-human primates. On page 1160, Sarah Brosnan, an assistant professor of psychology at Georgia State University in Atlanta, reviews three books that detail the intimate social interactions between gorillas, chimpanzees and rhesus macaques. It is hardly monkey business: the politics, plotting and power struggles would make Machiavelli proud, Brosnan tells *Nature*.

Two of the books reference Renaissance philosopher Niccolo Machiavelli. Why?

All three books focus on the evolution of social behaviour, specifically on how individuals live in groups. Machiavelli suggested that, as a monarch, it is better to be feared than loved, which is reminiscent of the interplay of power, sex and politics seen in primates. Frans de Waal's book *Chimpanzee Politics*, for example, chronicles the ever-shifting alliances among three high-ranking males trying to lead a group. The coalitions and power strategies seem to be similar to office politics of contemporary humans.

On the basis of your experience, which primate group is most manipulative?

Quite possibly humans. Among non-human primates, I think apes are the most intentionally manipulative. They are best able to conduct behaviours that will gain them something in the long run, even if there is a short-term cost.

Did any of the books shed light on primate social behaviour?

Gorilla Society by Alexander Harcourt and Kelly Stewart made an explicit effort to calculate the most advantageous behaviour for a gorilla in any situation by measuring the costs and the benefits of alternatives. For example, you rarely see a hostile takeover of gorilla harem societies. Even though there would be a short-term benefit to the new male, it doesn't make long-term sense, because female gorillas have a lot of control over their own decisions. They could leave the new male after he had gone to considerable effort to acquire them.

Which book relates most to your work?

I study cooperation, economic behaviour and prosocial behaviour — that is, behaviour that is beneficial to others — in chimpanzees and capuchin monkeys. All three books investigate the occurrence of various prosocial behaviours, documenting the situations in which they are likely to occur. It is interesting to speculate about what conditions led some species to evolve more prosocial behaviours. ■

MAKING THE PAPER

David Pines

More than half a century's work on superconductivity theories.

A pessimist might posit that David Pines' 1955 career move cost him a share of the 1972 Nobel Prize in Physics. But, looking back on a career that spans almost 60 years studying the theory of superconductivity, Pines has no regrets.

Superconductivity is the mysterious quantum state through which certain materials exhibit zero electrical resistance at very low temperatures. Such materials were first discovered in 1911, but the theory describing the phenomenon was not devised until 1957. In the meantime, all the giants of theoretical physics, from Albert Einstein to Werner Heisenberg, tried to come up with a theory. "Everyone wanted to understand this fascinating phenomenon that signalled the emergence of a new quantum state," says Pines, now a theoretical physicist at Los Alamos National Laboratory in New Mexico and the University of California, Davis.

By 1952, when Pines became a postdoc with John Bardeen at the University of Illinois at Urbana-Champaign, there were hints that superconductivity might result from phonons — discrete quanta, or packets, of vibrational energy in a crystal lattice — generating an attractive force between electrons. Leading physicists scoffed at the idea, believing that such a force would be overwhelmed by Coulomb repulsion — which occurs between two like charges — between electrons. But in 1954, Pines and Bardeen showed that, despite strong Coulomb repulsion, it is possible for phonons to generate an attractive force for some electrons.

This laid the groundwork for Leon Cooper, who replaced Pines as Bardeen's postdoc in 1955, when Pines moved to Princeton University in New Jersey. Cooper, Bardeen and Bardeen's graduate student Bob Schrieffer went on to find a bound state for electrons of opposite spin that attract one another, and discovered the wave function for the superconducting state that results from this attraction. They published the Bardeen-Cooper-Schreiffer (BCS) theory of superconductivity in 1957, which earned them the 1972 Nobel prize.

Although his contribution did not net him a share of the Nobel, Pines relishes the part he played in establishing the theory's foundations. "The BCS paper had a major role in the development of nuclear physics, astrophysics and particle physics," he says. "It had the same role in the physical sciences that Watson and Crick's DNA paper had in the biological sciences."

In the mid-1980s, many theorists turned to considering whether superconductivity could occur in the absence of phonons. Superconductivity had been discovered in heavy electron materials such as uranium–platinum 3 (UPt3), and high-temperature superconductivity identified in copper-oxide-based materials. Following these discoveries, Pines, along with other theorists, proposed that the mechanism in these almost antiferromagnetic materials was a magnetic interaction between electrons of opposite spins that could be highly attractive. Pines and his colleagues subsequently explored this mechanism in detail (see page 1177).

A consensus on a theory of high-temperature superconductivity is proving difficult to reach, says Pines, because the explosion in experimental work means that "some theorists view high-temperature superconductivity as a kind of Chinese menu from which you pick favourite experiments to support your theory". But, he points out, "Science is not like that — you have to explain all the key facts." ■

FROM THE BLOGOSPHERE

On his Nature Network blog, John Wilbanks entertains the idea of e-commerce for biological research materials (http://tinyurl.com/2p6gj9). Whether plasmids, cell lines, mice or fish, such materials — a "treasure trove of implicit knowledge and encoded experience" — are hoarded by the owning lab for more publications, or simply decay from neglect after a graduate student or postdoc moves on. Imagine the benefits to scientists' ability to build on published research, Wilbanks says, if an Amazon-style system existed where one could "search the web, drop in a credit card number, and get a cell line via fedex in four days".

The unloved plasmid or the one-time cell line of the classic paper are currently: not findable online, not available by digital contract, not fulfilled by anyone other than the creator, and credited only by a citation. These four elements, Wilbanks argues, are needed to achieve "one-click" and could be fulfilled by existing search engines, standard contracts and repositories. The idea would be part of a research web to haul scientific tool-making out of the sixteenth century and into the network. ■

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