

nature neuroscience

The sexual brain

Sex is good for the genes. By continuously recombining the genetic material in each new generation, sexual reproduction keeps DNA from filling up over time with harmful mutations that would eventually send a species into extinction. Evolution has devised a dizzying array of complex behaviors to ensure that organisms get together at the right place and time to pass along their genetic blueprints. Becoming sexually competent, though, requires the development of not only the correct reproductive machinery but also the appropriate brain circuitry to motivate the search for a sexual partner—and to know what to do when you have found one. In the following special focus, we highlight some of the major areas where researchers are seeking to understand the neurobiology behind sexual behavior.

To understand what makes us tick sexually, we must first look to development, where the basic neural pathways are formed that will direct males and females to act the way they do. In their review, John Morris, Cynthia Jordan and Marc Breedlove discuss the development and differentiation of a number of sexually dimorphic structures in the brain and nervous system of rodents and birds, specifically focusing on how the masculinizing hormone testosterone promotes male behavior and brain structural development by altering cell survival and synaptogenesis. The authors close with a discussion of how more complex human behaviors, including sexual orientation, might develop through the actions of prenatal hormones.

Although much of what makes males and females sexually different occurs in the womb and during early life, puberty and adolescence are when we become reproductively capable and aware. Cheryl Sisk and Douglas Foster provide a fascinating review of this topic, describing how the brain helps to initiate puberty through increased hormone

release, ultimately leading to the maturation of the gonads and the production and release of sex steroids. These act on the body and brain to induce secondary sex characteristics and to stimulate the brain circuits formed during development that drive and control sexual behavior. But as the authors explain, puberty is not just the activation by hormones of these preset brain circuits; a number of behaviors do not fully mature until puberty, suggesting that the brain continues to develop sexually during this period.

Sex contributes to more than just reproduction; its effects are felt in other behaviors as well. Larry Young and Zuoxin Wang provide an intriguing view of how sex is involved in the formation of strong social bonds between mates (pair bonding). Prairie voles, which establish life-long monogamous pair bonds, provide a model system for revealing the underlying neural basis for pair bond formation. As the authors explain, sex enhances pair bonding through a pathway that involves reward centers in the brain, leading to the idea that the formation of a strong social bond is not unlike an addiction.

Attempts to understand complex human behaviors can be fraught with controversy, and studies of sexual behavior in particular are often at conflict with public morality. In an accompanying commentary, Paul Wolpe outlines some of the ethical issues that scientists must face when researching such a controversial topic. The discussion is perhaps timely, given that as this issue is being readied for the printers, conservative members of the US Congress are continuing their battle to limit federal funding of research into human sexual behavior. We hope that this focus will provide an enlightening glimpse into the serious and worthy scientific strides being made in our understanding of the sexual brain.

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