WHEN IT COMES TO BEHAVIOR, WE HAVE MOVED BEYOND GENETIC DETERMINISM. Our genes do not lock us into certain ways of acting; rather, genetic influences are complicated and mutable and are only one of many factors affecting behavior. In their editorial, Landis and Insel (p. 821) elaborate on this idea, explaining that proteins encoded by genes direct the formation of multicomponent neural circuits, which are the true substrates of behavior, as these circuits respond to internal and outside stimuli.

Why do we study the genetic underpinnings of behavior? One reason is to understand how certain behaviors evolve. Conserved neural pathways can be tied to the evolution of social behaviors (Robinson et al., p. 896), and the conserved peptides oxytocin and vasopressin regulate social cognition and reproductive behaviors in many species (Donaldson and Young, p. 900). In a News story, Pennisi focuses on a region of chromosome 17 that has a complicated pattern of evolution in humans and other primates and is linked in unexpected ways to various disorders, including mental retardation, learning disabilities, and dementias.

Genetics can help us understand why identical circumstances can elicit different behavioral responses among individuals. Genetic differences are reflected in variations in behavior; activation of distinct versions of a hormone receptor gene, for example Donaldson and Young present, results in monogamous behavior in one species of vole but not in another. Conversely, as Robinson et al. describe, insights from recent work show that perceiving social information—such as bird songs or dominance behavior from cichlid fish—from another individual of the same species can itself alter gene expression in the brain, with downstream effects on physiology and behavior.

The potent genetic tools available for Drosophila have uncovered many genes that, when deleted, disrupt behaviors. This, in turn, has allowed dissection of the neural circuits that control essential behaviors. One of the best understood is a social activity necessary for reproduction—stereotypical mating behavior—as outlined by Dickson (p. 904). Genetic methods have also led to the understanding of another class of behaviors: those driven by the circadian clock. The genetic basis of the clock was elegantly worked out in Drosophila, followed by a similar achievement in mice. The reasons for these successes are outlined by Takahashi in his Perspective (p. 909), in which he also explains what tools will be needed to attain similar advances for other behaviors in mice.

Humans are not as genetically tractable as mice or flies, and human behavior is not as stereotypical. Holden’s News story on the strengths and shortcomings of genetic studies of personality illustrates this point (p. 892). So do Cotton and some members of the Human Variome Project community in a Policy Forum (p. 861) that describes how the genes and loci associated with disorders of the nervous system are a particular challenge to geneticists and clinical neurologists in need of reliable diagnostic tests. And in a Perspective on a critical human social activity—politics—Fowler and Schreiber (p. 912) argue that genetics and neurobiology have much to teach us about how our leaders are chosen.

Some believe that psychology is the last frontier of genetic analysis. This special section provides a sampling of our early explorations.

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Editor's Summary

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