GENES AND BEHAVIOR: OVERNIGHT SOCIAL ISOLATION AFFECTS GENE EXPRESSION IN THE SONGBIRD'S FOREBRAIN

In the September 22 issue of the PNAS (USA), Julia George and co-workers from London, St. Andrews (UK), Urbana (Illinois, USA) and Seewiesen (Germany) show that social isolation of zebra finches leads to rapid alterations of gene expression in the auditory forebrain.
Similar to humans, songbirds also communicate using learned vocalizations. The *FOXP2* gene was the first gene in humans shown to be essential for speech and language development. Also in birds this gene has a function in the learning of vocal communication, and the highly social zebra finch (*Taeniopygia guttata*), which had its genome sequenced in 2010, has emerged as a model organism to study the neurobiology of vocal learning, including its genetic basis (see Cold Spring Harbor Protocols). Some 55 genes, including *FOXP2*, have similar patterns of gene expression during vocal learning in humans and in zebra finches. Using high-throughput RNA sequencing techniques, genome-wide methylation assays by bisulfite sequencing and in situ hybridization, one can study how the exposure to auditory signals influences gene expression in the bird's forebrain. George et al. applied these methods to show that genes annotated for axonal guidance and neutrophin pathways are repressed when the bird is isolated overnight in a sound attenuating chamber, and that this is accompanied by changes in DNA methylation.
Previous studies have shown that prolonged isolation has negative effects on brain and behavior in social organisms such as humans and birds. Now, George et al provide a dramatic example of environmental effects on brain gene expression by showing that overnight isolation is sufficient to trigger epigenetic changes affecting gene activity in a higher integrative center of the songbird's brain.