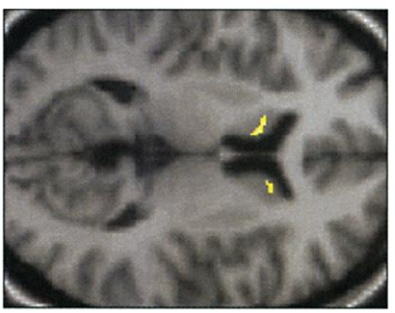
GENETICS

First Gene Linked to Speech Identified

Plenty of animals can caw or roar or buzz, but only human beings can string a complex series of sounds together into speech. Now a team of researchers has identified the first gene directly involved in this uniquely human trait. The discovery may provide insights into how language is processed in the brain, and it opens the door to figuring out how and when language arose—a central question in the study of human evolution.

The new gene, called *FOXP2*, was identified by studying members of a British family who suffer from a severe inherited speech and language disorder, as well as an unrelated child with similar symptoms. "This is the first clear identification" of a gene "with direct relevance for language ability," says geneticist Svante Pääbo of the Max Planck Institute for Evolutionary Anthropology in Leipzig, Germany. Philip Lieberman, a language-origins researcher at Brown University in Providence, Rhode Island, calls the discovery "a milestone event." But Lieberman and other researchers caution that the function of the gene is not yet clear, and that it is probably only one of a number of genes involved in speech and language.



Speechless. People with a mutation in the newfound gene have less gray matter (yellow) in the basal ganglia's caudate nucleus.

The identification of *FOXP2* caps a decade of controversy over how to define the disabilities found in three generations of a family known to researchers as "KE." Nearly half the members of the KE family suffer from the syndrome. Researchers initially identified it as an inability to learn proper grammar, and the claim led to news accounts in the early 1990s that humans have an innate "grammar gene." But that notion was largely discounted after others reported that affected family members suffer from a wide range of speech and language problems, from garbled pronunciation to putting words in the wrong order. They also have trouble understanding speech.

Now many researchers suspect that the inability to order things correctly accounts for the family members' symptoms. "The core deficit is an inability to sequence and appropriately select the small sounds that result in words and sentences," says cognitive neuroscientist Faraneh Vargha-Khadem of the Institute of Child Health in London. This handicap extends to nonverbal sequences as well; people with the syndrome have trouble following directions to close their lips, open their mouths, and then stick out their tongues. Brain imaging studies may back up this diagnosis: Vargha-Khadem and colleagues linked the disability to defects in the basal ganglia, which connect to centers for language and movement and are thought to be involved in sequencing behaviors.

To identify the genetic basis of the disorder, Vargha-Khadem's group teamed up with geneticist Anthony Monaco and his colleagues at Oxford University in the late 1990s. They localized the defect to a segment of chromosome 7, which they called SPCH1, and began to search for the critical gene. Then came a lucky break: Jane Hurst of Oxford's Radcliffe Hospital, who had originally described the KE family, found a 5-year-old boy with a similar disorder. Analysis of the boy's genome showed that a large segment of his chromosome 7 had switched places with a segment of chromosome 5, a genetic error known as a translocation.

Now the Vargha-Khadem and Monaco teams report that the "breakpoint" of the boy's translocation is in the middle of a gene similar to the previously discovered *FOX* family of regulatory genes, which have been implicated in embryonic development. The researchers screened the KE family and found that affected members had a mutation in the gene in which one adenine nucleotide was substituted for a guanine, apparently rendering the gene inactive, the research group reports in the 4 October issue of *Nature*.

Although mutations in the gene appear to account for this language disorder, researchers caution against calling it a "speech" or "language" gene. "It is still unclear what the gene does and what role it really plays in language development," says Michael Corballis, a psychologist at the University of Auckland in New Zealand. For instance, Elizabeth Bates of the University of California, San Diego, contends that the core disability is a motor dysfunction rather than something specific to speech or language.

The motor aspect of the syndrome has caught the attention of researchers who study chimps and other primates. Michael Tomasello of the Max Planck Institute in Leipzig points out that apes are "incapable" of controlling their mouths with sufficient precision to make consonants. "Language never would have evolved in human beings if there wasn't the ability to make a variety of sounds," Tomasello says.

The evolutionary implications of the new work have not escaped language-origins researchers. Pääbo's group is now studying *FOXP2*'s sequence in nonhuman primates to see how it differs from the human version. This kind of comparative genetic study, says Lieberman, "may help solve the mystery of how we came to be." **–MICHAEL BALTER**

SCIENCE POLICY

New Regulatory Czar Takes Charge

In his first public move as head of regulations at the White House Office of Management and Budget (OMB), John Graham came out of his corner swinging. In actions last month—a memo to agencies and two "prompt" letters—Graham, a risk-analysis expert on leave from Harvard, signaled that he intends to take firm control of regulatory policy across the government. His office won't "play a simply reactive role," says Graham, who faults his predecessors in the past 8 years for letting agencies have free rein.

Specifically, Graham clarified procedures that the Office of Information and Regulatory Affairs (OIRA) will use to evaluate economically significant regulations proposed by agencies such as the Environmental Protection Agency (EPA) and the Occupational Safety and Health Administration (OSHA). His 20 September memo reiterated that regulations not based on science will be sent back for more work. And in a shift, agencies will have to submit their cost-benefit analyses, not just their scientific assessments, to peer review.

Graham's presidential appointment was controversial partly because of his emphasis on cost-benefit analysis. And some see these steps as an effort to stall regulations, harking back to the OMB of the Reagan years. Johns Hopkins University epidemiologist Lynn Goldman, who headed EPA's pesticides office during the Clinton Administration, doesn't see "the value added" by routinely reviewing economic impact analyses, which are usually done by standard methods.

Graham insists, however, that the analyses behind regulations need improvement. "I think it's well recognized that the quality of [cost-benefit] documents across agencies is very uneven," he says. And he points out that new requirements will generally apply only to regulations that will cost at least $100 million a year to implement.

In an unexpected move, Graham urged agencies to expedite two regulations that clearly pass the cost-benefit test. In a "prompt" letter to the Food and Drug Administration, Graham pushed the agency to complete a proposed rule requiring labeling of trans fatty acids—which have been linked to

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