Armenia. Next he lobbied the formidable Armenian Caucus in Congress. The result: $15 million of the State Department's 2001 budget was earmarked for SESAME or "a comparable project" in Armenia.

Even as Jordan was struggling to make its case for SESAME, Hovnanian made a surprise announcement in November 2000: Armenia would instead build a synchrotron from scratch. Physicists in Yerevan, he says, had convinced him that "they could build a bigger and better machine for less money." CANDLE got extra clout the following spring when prominent high-energy physicist Alexander Abashian, recently retired from Virginia Polytechnic Institute and State University in Blacksburg, was appointed project director.

If CANDLE secures its U.S. grant, Abashian hopes to begin construction in 2004. For the rest of the funding, "we'll target everyone we can," he says, including U.S. government sources and nonprofits that support FSU science. Provided the fundraising succeeds, CANDLE might still have trouble luring users to Yerevan. One reason that Armenia wasn't chosen to host SESAME is its "difficult accessibility," says Herwig Schopper, who heads SESAME's interim council. "Jordan is much more centrally located," he says. (BESSY I arrived in Jordan earlier this month and is expected to be operating by 2006.)

Still, CANDLE technical director Vasili Tsakanov expects "broad participation" from the Middle East, Russia, and other FSU countries. And scores of Armenian scientists could be called on to do contract research. "If somebody doesn't want to come to Armenia, we will do the research for you," Hovnanian says. "This is an investment that would benefit the world, not just Armenia."

–RICHARD STONE

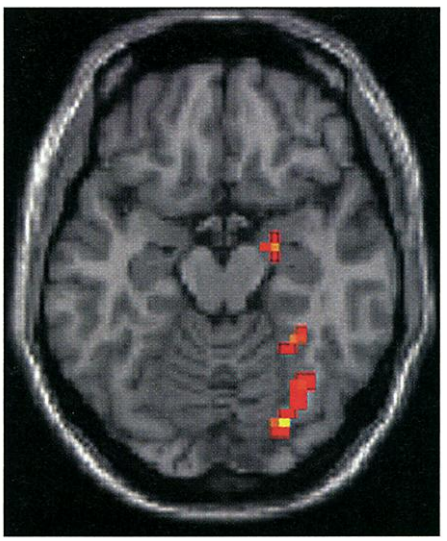
NEUROSCIENCE

Gene's Effect Seen in Brain's Fear Response

The saying "like father like son" reflects the common assumption that temperament, like eye color and pattern baldness, can be passed on in the genes from one generation to the next. But demonstrating how genes influence behavioral traits has been much more difficult than tracing the lineage of physical characteristics.

A study on page 400 might provide a tantalizing glimpse of things to come. A team led by psychiatrist and neurologist Daniel Weinberger of the National Institute of Mental Health in Bethesda, Maryland, has shown that people with different versions of a single gene have different patterns of brain activity in response to emotion-laden stimuli.

The findings demonstrate that individual genes can contribute to how the brain interprets its environment, Weinberger says: "How that translates into a person's perception of the world is a much more complex question, but I think we'll be able to understand how genes contribute to emotionality, temperament, and psychiatric illness by understanding how they contribute to information processing in the brain."



CREDIT: A. HARIRI *ET AL.*

Yikes! A single gene appears to modulate the amygdala's reaction to emotional faces.

"It's a fascinating study," says Joseph LeDoux, a neuroscientist at New York University. "It will surely stimulate lots of additional work on the neural basis of normal and pathological fear and anxiety."

The gene in question encodes a transporter protein that shuttles the neurotransmitter serotonin back into neurons after it has been released, thus limiting serotonin's effect on neighboring cells. The gene comes in two common versions, or alleles. One contains a short promoter region, the stretch of DNA that controls the gene's expression; the other has a longer promoter. In cell culture experiments, the short allele produces only about half as much of the transporter as the long allele, but the jury is still out on whether this difference exists in vivo. One hint that the transporter gene influences behavior comes from the finding that people who have a copy of the short allele—about 70% of the population in North America and Europe—are slightly more likely (3% or 4%) to show signs of anxiety or fearfulness on clinical personality tests than those with two copies of the long allele.

Weinberger's team reasoned that the gene's effect might show up more clearly in patterns of brain activity—particularly in an almond-shaped region of the brain called the amygdala, the brain's emotional command center. The researchers used functional magnetic resonance imaging to monitor activity in the amygdalas of 28 volunteers, half of whom had two copies of the long allele and half of whom had at least one copy of the short allele. While being scanned, subjects saw a picture of a face with either an angry or frightened expression and then had to choose which of two other faces showed the same emotion.

Both groups matched expressions correctly about 90% of the time. But people in the short-allele group showed considerably more activity in their right amygdalas while engaged in the task. There was no difference in brain activity when subjects had to match shapes. Many studies have shown that the amygdala revs up in frightening situations, Weinberger says, and the heightened activity in the short-allele group might help explain why, at the population level, people with the short allele are more prone to anxiety. "The amygdala puts a label on information that says 'This is dangerous,' " he explains, and a hyperactive amygdala—perhaps resulting from less serotonin transporter—might make people feel threatened even in nonthreatening situations.

Researchers say the study is one of only a handful to link a genetic variation to differences in brain activity. "It is a true milestone in psychobiological research and behavioral genetics," says psychiatrist and neuroscientist Klaus-Peter Lesch of the University of Würzburg in Germany, whose group discovered the two alleles of the serotonin transporter.

Still, some caution that the study doesn't prove that the difference in amygdala activity is caused by a difference in serotonin function. "To make the demonstration complete, it would have been so nice to measure aspects of serotonin transmission," says Chawki Benkelfat, a research psychiatrist at McGill University in Montreal, Canada. Even so, the new study puts researchers one step closer to understanding how small genetic differences might shape the way people respond to the world.

–GREG MILLER

FOOT-AND-MOUTH DISEASE

Report Urges U.K. to Vaccinate Herds

LONDON—Britain's top scientific body has urged the government to abandon its longstanding practice of relying solely on slaughtering animals to combat future outbreaks of foot-and-mouth disease (FMD). Instead, in a report released 16 July, a Royal Society panel has concluded that vaccination and improved data collection should result in better control and fewer dead animals.

The use of vaccination to control FMD

epidemics has long been controversial, but the panel argues that new tests and changes in rules governing sale of meat from countries that use "emergency" vaccination remove many of the objections. The panel's recommendation "is a great step forward," says Martin Hugh-Jones, a veterinary epidemiologist at Louisiana State University in Baton Rouge. Other recommendations receiving praise include accelerated research on a vaccine conferring sustained immunity to FMD and an upgrade in the U.K.'s antiquated veterinary data-collection system.

New approach. Sophisticated antibody tests have tipped the equation in favor of emergency vaccination, says inquiry chair Brian Follett (right).

Last year's outbreak of FMD led to the slaughter of 6 million cows, pigs, and sheep. Images of livestock pyres haunted the nightly news, and tourism in the affected regions plummeted. The British agriculture industry alone lost an estimated $4.8 billion.

Britain has been under attack for having relied on culling to contain the epidemic. Vaccines against FMD exist, but they confer immunity for only several months. Moreover, vaccinated animals can become infected with the foot-and-mouth virus, and until recently it was virtually impossible to distinguish infected from noninfected vaccinated animals. Agricultural officials were also faced with the prospect of a 1-year delay after an FMD outbreak before the country could export meat with the coveted "disease-free without vaccination" status. With culling, the delay is only 3 months.

The panel notes, however, that more sophisticated antibody tests can now distinguish vaccinated from vaccinated-infected animals. "These have really changed the situation on the ground," says panel chair Brian Follett, vice chancellor at the University of Warwick, who presented the report here at a press conference. In addition, in May the Office International des Épizooties—which writes regulations aiming to stem the global spread of animal diseases—agreed to cut to 6 months the minimum wait before a country could apply for disease-free status after vaccinating its herds. Those steps led the panel to conclude that although there would still be a role for culling, "emergency vaccination should now be considered as part of the control strategy from the start of any outbreak of FMD."

Several issues must be resolved before emergency vaccination becomes an avowed strategy, the panel notes, starting with assurances from the U.K. government that meat from vaccinated animals could be sold on the domestic market. In addition, the report notes, scientists need to validate the new tests that discriminate between infected and vaccinated animals. These issues "are not insuperable," Follett says, and could be worked out by the end of 2003.

The report also highlights the woeful state of U.K. data collection on animal diseases, including the use of handwritten notes and poor dissemination. The panel calls for the creation of a virtual center to bolster animal health R&D. "We need to get this in place as quickly as possible and make data available at the earliest possible opportunity," says Neil Ferguson of Imperial College in London, who led one of the teams that modeled last year's outbreak (*Science*, 20 April 2001, p. 410). "What is really needed is a change in culture," he says, in which "detailed data on animal populations are provided to scientists as a matter of course."

Hugh-Jones would like to see the government take even stronger steps to tackle the data problem. He says a special forensic team might be necessary in the next outbreak to make an independent assessment. "When all the dust has settled," he says, "one must be able to sit down and work out, without blame, what went right and what could have been done better." Although the Royal Society panel lacked such a resource, Hugh-Jones and others believe that it has come up with sound advice.

–RICHARD STONE

Burning issue. Mass culls like this one last year in southern Scotland will be history if the Royal Society panel holds sway.

CREDITS: (TOP TO BOTTOM) R. STONE; ADAM BUTLER/AP

RESEARCH INTEGRITY

U.S. Universities Urged To Do a Better Job

Over the past decade, the U.S. research community has agonized over a definition of scientific misconduct, while the federal government has struggled with how to police it. This week, an Institute of Medicine (IOM) panel suggested ways to prevent it, calling on universities to make ethical conduct a bigger part of the academic culture.

The report's recommendations, which are aimed at all university research, will cost money to implement, its authors say, and are likely to be controversial. "I imagine we'll get quite a lot of flak," says panel chair Arthur Rubenstein, dean of the University of Pennsylvania School of Medicine in Philadelphia. But panelists say the report's emphasis on self-review is better than forced compliance through new regulations. Institutions prefer voluntary programs to federal mandates, such as a misconduct education requirement that was proposed earlier and then suspended for further review (*Science*, 2 March 2001, p. 1679).

The report, *Integrity in Scientific Research*, was requested by the Department of Health and Human Services' Office of Research Integrity (ORI), which wanted advice on how to evaluate academic integrity programs. Under "integrity," the panel includes the treatment of human subjects and animals as well as explicit research misconduct such as plagiarism and faking data. Yardsticks for what works don't exist, it concluded, recommending that ORI finance research on surveys and other tools.

The lack of data doesn't mean that universities shouldn't forge ahead, however. Integrity should be "embedded" in research, Rubenstein says, and go far beyond a 1-hour course for grad students. That could include workshops and counting ethics activities in tenure decisions. Institutions should also conduct "self-assessments" with outside reviewers, and integrity programs should be part of the standard for accreditation. "They're asking for something quite ambitious," says ORI director Chris Pascal.

To pay for the improvements, the report suggests that federal agencies might need to provide funding for integrity programs. IOM plans a public meeting in October to discuss the report.

–JOCELYN KAISER