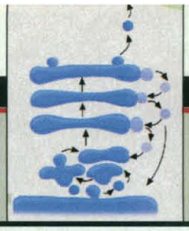


Claude Cohen-Tannoudji compared the centralized but research-weak French university system unfavorably with that of the United States. "To do university research the way it is done in the United States is illusory," he said. "French universities don't have real autonomy and the teaching load is too heavy." And Henri-Edouard Audier, a chemist at the Ecole Polytechnique near Paris, argued that there could be no real partnership between the CNRS and the universities until university professors and instructors were able to contribute equally to the research effort. "The day [their] teaching load is cut in half, there will be no more problems of mobility between [the CNRS] and the universities," Audier said.

Brézin says that researchers' fears that the CNRS will be absorbed into the universities are misplaced. "This idea that a closer approach to the universities will weaken the CNRS is false," he told *Science*. Brézin also criticizes the rebellious attitude many scientists have taken toward Allègre's attempts at reform. "This wish of researchers to be independent of all control is not legitimate."

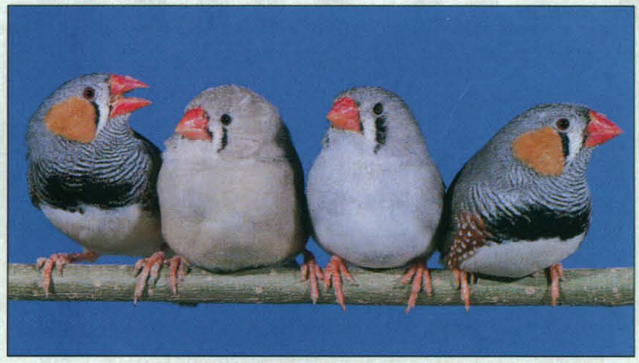
But the simmering resentment at what many researchers see as Allègre's attempts to cram reform down the throats of French scientists burst into open anger during a speech to the meeting by geophysicist Vincent Courtillot, who was formerly Allègre's chief adviser and last week was promoted to be the ministry's director-general for research. Courtillot's speech was interrupted a number of times by boos and catcalls, particularly when he told the delegates that they represented only the CNRS and not French researchers in general. And his critique of the failure of research to pay off in economic terms, capped by the assertion that "the unemployed have created more businesses than have researchers," was met with loud cries of "False! False!"

Indeed, most researchers were very surprised at Courtillot's confrontational tone, and his talk was openly condemned throughout the day as a deliberate "provocation" that came directly from Allègre. But whether or not Allègre's intention was to make French scientists angry, he seems to have succeeded in uniting them as never before. Chemist Pierre Potier, director of a CNRS institute in the Paris suburb of Gif-sur-Yvette—site of one of the largest remaining CNRS installations not linked to a university—summed up the feelings of many researchers. "We agree with the minister that things must move, but not just in any old direction." —MICHAEL BALTER

NEUROBIOLOGY

Birds May Refine Their Songs While Sleeping

Like novice tenors learning an aria, young male songbirds first learn their species' courtship songs by copying the melodies sung by other males; later, each bird adds flourishes that make his rendition unique. Some researchers think that happens "on line," with the birds correcting errors and improving their technique as they sing. But on page 2250, Daniel Margoliash and his colleagues at the University of Chicago argue that at least some song learning and refinement may occur while the birds sleep.



Wide awake and throttled down. Information travels less freely between song-dedicated brain areas in awake zebra finch males (birds with orange cheek patches) than it does in sleeping birds.

Margoliash's team based that conclusion on measurements comparing the activity of song-specific neurons in the brains of waking and sleeping zebra finches. The researchers found that in sleeping birds, auditory signals triggered by a recording of each bird's own song flowed freely between the brain areas that govern singing. But when the birds woke up, it was as if a gate came down to block that flow. Margoliash suggests that during sleep the wide-open gate allows the birds' brains to refine the neural firing patterns that produce the song, an "off-line" learning similar to the memory strengthening that some neuroscientists think may occur during sleep when rats learn mazes and humans learn motor tasks (see *Science*, 29 July 1994, p. 603).

Other birdsong researchers praise the new work, noting that it's the first time anyone has done such a study on naturally sleeping birds. Birdsong pioneer Fernando Nottebohm of Rockefeller University's Field Research Center in Millbrook, New York, calls it "novel and intriguing," and Richard Mooney, who studies bird song learning at Duke University Medical Center, adds that it may provide new clues to human language learning. But both Mooney and Nottebohm say it fails to prove that song refinement takes place during sleep. At this point, Nottebohm says, "there are really no grounds to suggest that anything like 'off-line learning' is taking place" while the birds sleep.

Just as the human brain contains special areas that control speech, birds have brain areas devoted to producing song. Neurons in an area called HVc send signals to a second region, RA, which connects to motor neurons that directly control the singing muscles. Because researchers have found activity in HVc and RA not only when birds sing, but also when they hear their own song played back, some suggested that the neurons self-correct while the bird is singing, modifying their activity to improve the song.

But those results came from anesthetized birds, and Margoliash's team saw a different picture when they recorded from individual HVc and RA neurons while the birds were awake. When those birds heard recordings of their own songs, team member Albert Yu found that HVc neurons responded, but those in RA did not, instead firing in a monotonous pattern. But when the birds naturally drifted off to sleep, the firing patterns in response to the recorded songs shifted to resemble those in the anesthetized animals. At that point, team member Amish Dave found, the RA neurons came alive and began to fire in response to signals from HVc. When the birds awoke, RA returned to its monotonous firing pattern.

The team fingered a molecule that may help cause the blockade: norepinephrine, a neurohormone whose levels fall during

CREDIT: ROBERT MAIER/ANIMALS ANIMALS

sleep and rise with waking. When the team boosted the norepinephrine level in anesthetized birds, the RA responses dropped. Margoliash notes that other as yet untested signaling molecules, such as dopamine, may contribute to the effect as well.

To Margoliash, the wide-open communication between HVc and RA during sleep suggests that that's when the birds learn to refine their songs. He speculates that even though a sleeping bird doesn't normally hear its own song, as the birds did in the experiment, its HVc neurons might spontaneously fire in the same pattern that is induced by the song while the bird is awake. That information would pass freely to RA neurons, which could use it to fine-tune the commands they give to the singing muscles the next time the bird sings. His team, he says, is now studying HVc firing patterns during sleep to see whether they do mimic the song response in awake birds.

Without such evidence, Mooney argues, the wide-open circuitry during sleep may be a "red herring," the result of the fact that the brain has little else to attend to. What makes the new work "profoundly important" in his view are the results obtained with birds that are awake, in which, he points out, RA's response to the HVc activity elicited by the song recordings is "throttled down," but "not shut down entirely." That "in-between state," he says, makes the circuits sensitive to modulating influences such as attention, which could regulate the information channels to control when song learning can occur.

Mooney finds the results tantalizing for another reason as well. They may provide a clue to a well-known human phenomenon: the loss of ability to learn new languages fluently at puberty. At puberty, bird songs become less responsive to auditory feedback. Mooney notes that sex hormones affect the turnover rates of norepinephrine in ways that could locally increase its levels, and he speculates that increases of sex hormones at puberty could reduce the bird's ability to self-correct its song. If so, he adds, it would "not be a big leap" to consider that a similar mechanism may be responsible for the problems humans have learning to speak a language like a native after puberty.

Those ideas remain to be tested, but to Nottebohm, that's another benefit of the new results. "What opportunities for future work," he enthuses. Indeed, just as the tenor and the zebra finch use feedback to fine-tune their songs, song researchers will likely be tweaking their hypotheses in response to these results and the new experiments they are bound to inspire.

—MARCIA BARINAGA

CREDITS: (TOP) KEN HEINEN; (BOTTOM) ARMED FORCES INSTITUTE OF PATHOLOGY

BIOETHICS

Panel Proposes Tighter Rules for Tissue Studies

Clinical researchers have received a bioethics package for Christmas, and some may be afraid to open it. It appeared on 3 December in the form of a draft report from the president's National Bioethics Advisory Commission (NBAC) (posted on the Web at www.bioethics.gov) arguing for tighter controls over research on stored samples of human blood and tissue to protect the donors' privacy.

The "tissue issue," as Yale bioethicist Robert Levine calls it, has become a hot topic. Stored tissue can contain a gold mine of information for researchers tracking the spread of disease, hunting disease genes, and studying human genetic variation. And it's a huge resource: NBAC calculates that U.S. institutions hold more than 282 million samples of archived human tissue today. Although those who donated the material

Potential gold mine. Tissue bank at the Armed Forces Institute of Pathology.

probably gave broad consent for its use in research, ethicists believe that more specific consent may be needed for certain studies that could identify and stigmatize donors.

NBAC—a 17-member group of lawyers, ethicists, and medical professionals chaired by Princeton University President Harold Shapiro—began picking its way through this dense thicket 2 years ago. A draft report in late 1997 was withdrawn after it drew flak from clinicians and NBAC members. The new version, completely rewritten, is still likely to be controversial. Even before he had seen the details, pathologist John Trojanowski, an Alzheimer's disease specialist at the University of Pennsylvania, objected that its proposed new reviews and consent requirements would be so burdensome that they "would bring research to a standstill." But others were more accepting.

Judith Greenberg, who oversees the operation of a large human tissue collection for the National Institute of General Medical Sci-

ScienceScope

NIH TO REVIEW CONFLICT POLICIES

The National Institutes of Health (NIH) will take a closer look at the outside consulting fees earned by its scientists. This week, in response to a congressional query about an NIH scientist who received thousands of dollars in drug company fees, NIH director Harold Varmus requested a review of his agency's conflict-of-interest policies.

On 7 December, the *Los Angeles Times* reported that Richard Eastman, chief of the diabetes division at the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK), had received speaking fees for several years from the Warner-Lambert Co. of Morris Plains, New Jersey. Eastman told the *Times* that he did not take part in decisions affecting company products while he was a consultant, but he was in charge of a clinical trial that included a Warner-Lambert diabetes prevention drug called troglitazone. Last summer, after a patient taking the drug died, the NIDDK dropped the drug from the trial.

The story prompted Representative Henry Waxman (D–CA, above) to send Varmus a two-page list of questions about the case on 7 December. A "concerned" Varmus responded by asking the inspector-general of the Department of Health and Human Services to examine whether NIH staff involved in the case complied with federal conflict-of-interest guidelines. His staff is also reviewing how NIH's two dozen institutes and centers apply the rules, with an eye toward clarifying them.

ACADEMIC INBREEDING ATTACKED

South Korea wants to imbue its universities with a little fresh blood. The National Assembly is expected to pass a bill this session that would prohibit universities from filling more than half of new faculty openings with their own alumni.

Inbreeding has been a hallmark of top Korean schools. At the prestigious Seoul National University (SNU), for instance, 95.6% of the faculty are alums. Now, government officials want to reduce the in-house promotions in an effort to spread around the scholarly talent.

But some SNU administrators oppose any quota, arguing that SNU's star students are also the most-qualified professors. "The best candidates happen to be our alumni," says Lee Jung Jae, an SNU education professor. Electrical engineer Park Young Joon, however, favors the change. The current system, he says, makes it too hard to bring in new talent.