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FRANCE

Top Scientists Lock Horns in Research Reform Debate

PARIS—A nationwide debate on the future of French research heated up last week, as some of the country's leading scientists presented often conflicting reform proposals at a day-long hearing held here at France's National Assembly. The 9 June hearing, attended by about 200 researchers and conducted by parliamentary deputies Pierre Cohen and Jean-Yves Le Déaut, was the penultimate event in a parliamentary inquiry launched last February by Prime Minister Lionel Jospin at the request of research minister Claude Allègre (*Science*, 5 March, p. 1442). The inquiry will conclude on 26 June with a mass colloquium in Paris, after which the deputies will make their recommendations to Jospin.

Reformer. Pierre Chambon wants to end "researchers for life."

Allègre had resisted the notion of holding a national debate before moving ahead with what he considered essential reforms. But his attempts to forge closer relations between the universities and public research agencies—such as the basic research agency CNRS and the biomedical agency INSERM—provoked such fierce resistance from many researchers, who feared the measures would dilute the quality of French science (*Science*, 18 December 1998, p. 2162), that the government was obliged to consult with France's scientific community, via a Web-based forum and numerous small hearings and consultations held throughout the country.

The latest hearing, which featured two invited panels—one made up of established researchers and the other of younger scientists—was largely dominated by the divergent views of two well-known figures in the debate: molecular biologist Pierre Chambon, director of the Institute of Genetics and Molecular and Cellular Biology near Strasbourg, and chemist Henri-Edouard Audier of the Ecole Polytechnique near Paris. Chambon briefly presented his "wish list" of reforms—originally drawn up by a committee commissioned by Allègre and headed by Chambon but never published—which include ending the "researcher for life" status of French public service scientists. Chambon argues that the universities should be given the major role in recruiting young researchers and that once researchers have obtained university or research agency positions, they should undergo evaluations by international scientific committees every 5 years to continue receiving research funds. Those who fail to pass muster, he says, should be assigned to teaching or administrative duties.

As for the public research organizations, Chambon argued that the research funds of agencies such as the CNRS should be given only to the best scientists—whether they are university teachers or full-time public researchers—rather than being spread around only among their own staff, as is currently done. "We must transform the research organizations into powerful granting agencies," he said. Chambon also advocated eliminating the current rung of permanent entry-level positions in the universities and research organizations and replacing them with temporary postdoctoral positions, which are rarely available in France at present.

But the Chambon plan drew criticism from Audier and some other members of the panel. "I am absolutely opposed to replacing [the entry-level positions] with postdocs," Audier said. "How can we hang on to the best scientists if we offer them a mediocre salary over 4 or 5 years when industry can offer them a good salary right away?" And panel member Alain Deshayes, a former researcher with the National Institute for Agronomic Research who now serves as a research director for the Swiss corporation Nestlé, expressed concern about the consequences of "sending researchers in decline into teaching." Audier agreed: "Pierre Chambon thinks creativity is a function of age. I don't believe that."

Chambon countered that it is "competence, not age" that matters most, adding that if a scientist is brilliant enough to pass an evaluation every 5 years he or she could still be a researcher for life. As for the lack of funding for postdoctoral positions in France, Chambon argued that its major effect is to force French researchers to do their postdocs abroad. "It doesn't seem to bother anyone if [they] take on insecure positions in the United States," he said. But although the panel members disagreed on many issues, all were in accord that no serious rapprochement between the universities and the research agencies would be possible until the current heavy teaching loads of young university teachers were reduced. "It leaves us little time for research," said panel member Isabelle Kraus, an assistant professor of physics at the Louis Pasteur University in Strasbourg. "We have to do research in the evenings and at the weekend."

Given these differing visions for French research, and the high stakes for France's future scientists, the final colloquium of the inquiry on 26 June is sure to be heavily attended: Cohen and Le Déaut have reserved the 1000-seat auditorium at the Sorbonne for the event. —MICHAEL BALTER

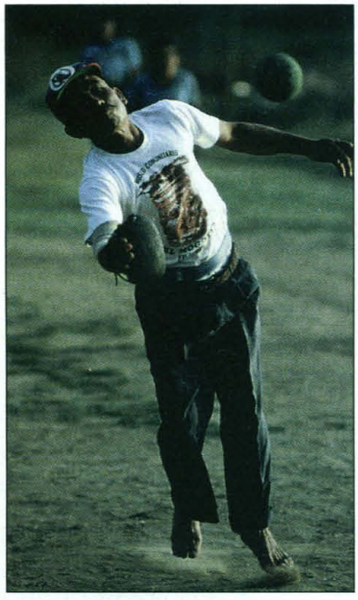
ARCHAEOLOGY

How Aztecs Played Their Rubber Matches

When 16th century Spanish clerics came to the New World, they were enthralled by a fast-paced and sometimes bloody sport. Teams of up to six athletes would whack heavy, solid balls through hoops several meters above the stone courts using anything but their hands or feet. Apart from the occasional postgame human sacrifice, what most astonished the Spanish were the ricocheting balls. "I do not understand," wrote Pedro Martyr, the official historian of the Spanish court in 1530, "how when they hit the ground they are sent into the air with incredible bounce." For Europeans used to playing with pigskins, the rubber balls were practically miraculous.

The native Americans made their seem-

ingly magical material, Martyr wrote, by collecting sap from lowland trees and mixing in juice from a vine. Four centuries later, this crude recipe has finally given up some of its secrets. On page 1988, researchers describe how the Olmec, Maya, and other ancient Mexican and Central American cultures turned raw latex into rubber. This feat of chemistry, which converts the slippery polymers in raw latex to a resilient structure, was not duplicated until the mid-19th century. "It's a marvelous example of technology demonstrated at an incredibly early stage," says Frank Bates, a polymer chemist at the University of Minnesota, Minneapolis.



Lay techs. Re-creation of chaah, played with crude rubber ball.

The ball game, invented at least 3400 years ago, was an important ritual for many Mesoamerican societies. To the Maya, for instance, the game—called chaah—reenacted portions of their creation story. By the 5th century A.D., many towns had central stone courts, some of which could hold thousands of spectators. Leaders tested prophecies through tournaments, rival cities took out their aggressions on the court, and the rich placed huge wagers. According to a 16th century codex, the Aztec capital Tenochtitlan demanded 16,000 rubber balls each year as tribute from one province. The ballmakers "were the ancient equivalent of Rawlings," the sporting goods manufacturer, says Warren Hill, an archaeologist at the New World Archaeological Foundation of Brigham Young University in Provo, Utah. These societies also used rubber for a host of other products, including religious figurines, incense, and even lip balm.

Last summer, Massachusetts Institute of Technology (MIT) archaeologist Dorothy Hosler and undergrad Michael Tarkanian traveled to Chiapas, Mexico, to gather the raw materials for rubbermaking mentioned in ancient documents. To their surprise, they saw farmers collecting latex by slashing the bark of *Castilla elastica* trees, then mixing in juice from pulverized morning glory vines that wrap around the trees—just as the 400-year-old texts described. "It was amazing," recalls Tarkanian. "After about 10 minutes, a mass of rubber rose to the surface. We formed it into a ball that would easily bounce over your head."

The pair brought the ball, as well as raw latex and vine juice, back to their lab. A battery of tests showed that the homemade rubber was about twice as elastic as dried latex, which cracks when handled. With MIT materials scientist Sandra Burkett, the researchers probed the material with nuclear magnetic resonance spectroscopy, finding unidentified organic compounds in the latex that were absent from the rubber.

The team speculates that some of these mysterious compounds might be plasticizers, which would keep the latex runny by preventing its polymer molecules from linking to each other. (Modern rubber is made by cross-linking polymers.) If the vine juice dissolves the plasticizers, the researchers thought, polymer molecules would be more likely to entangle and form a rubbery mass. Although they failed to find direct evidence for cross-linking, they did discover vine juice components—traces of sulfonyl chlorides and sulfonic acids—that can react with polymers, stiffening segments and making them more likely to interact. The team says that only a few such entanglements would be enough to give the rubber its spring.

Understanding ancient rubbermaking "teaches us how conscious these people were of their environment and how they were able to manipulate it," Hosler says. She and her colleagues next plan to test rubber made with varying amounts of vine juice to see whether the Olmec, Maya, and Aztec could have engineered rubber with specific elasticities. No matter what they find, the Mesoamericans have earned the respect of modern chemists. "To discover [the process] and refine it to make those products is impressive," says Bates. "They probably had a pretty good R&D team."

–ERIK STOKSTAD

CREDITS: (LEFT) KENNETH GARRETT/*NATIONAL GEOGRAPHIC*; (RIGHT) ARCHIVE PHOTOS

NEUROBIOLOGY

Mutant Fruit Flies Respond to Lorenzo's Oil

The 1993 movie *Lorenzo's Oil* raised the profile of adrenoleukodystrophy (ALD), a fatal hereditary brain disease that strikes one in every 20,000 boys. The film told the true story of how one patient's parents set out to find a cure. Their brew of fatty acids, now known even among researchers as "Lorenzo's oil," didn't become the cure they had hoped for. But on page 1985, Kyung-Tai Min and Seymour Benzer of the California Institute of Technology in Pasadena report that a component of the oil prevents neural decay in fruit flies with a similar condition. The finding might spark new research on the oil, and it already has researchers enthused about the potential of the mutant flies for studying what causes ALD and how it might be treated.

Concerned parents. In the 1993 film *Lorenzo's Oil*, an afflicted boy's parents, portrayed by Susan Sarandon and Nick Nolte, looked for an ALD treatment.

"Using the fruit fly as a model … is ex-