MEETING BRIEFS

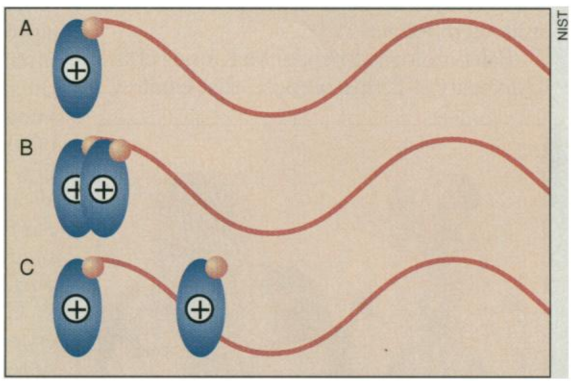
AAAS Gathering Explores Animals, Aliens, and Atoms

BALTIMORE—A cross section of the scientific community, 4200 strong, came out for the 162nd Annual Meeting and Science Innovation Exposition of the American Association for the Advancement of Science (AAAS, the publisher of *Science*), held 8 to 13 February. We covered early sessions last week (*Science*, 16 February, p. 903); here we cover talks on "giant" molecules, precocious lemurs, and other topics.

Timing Atomic Relationships

Like quarreling lovers, pairs of atoms in molecules push each other apart when they get too close and beckon each other when they drift apart. This atomic pas de deux is brought about as electromagnetic fields generated by the atoms exert a force on their partners. Because these fields travel between partners at a finite speed—the speed of light—there should always be a tiny delay between when the field is sent by one atom and when its force is felt by the partner. But signs of this delay between two atoms have eluded researchers for decades: Atoms in a molecule are normally bound just a few angstroms apart, too close to detect any effects. In Baltimore, observation was finally at hand, with the help of two-atom "giant" molecules.

A team of researchers led by Bill Phillips and Paul Lett at the National Institute of Standards and Technology (NIST) in Gaithersburg, Maryland, reported witnessing a so-called "retardation" effect in molecules whose atomic partners have drawn apart by an average of 3.5 nanometers, 10 times the spacing in a normal molecule. It took an electromagnetic field several billionths of a billionth of a second longer to cross the gap. The lag was reflected in the amounts of energy needed to construct this molecular state.



Distance difference. Electrons orbiting an atom create an oscillating electromagnetic field (A), which radiates out as a wave. Neighboring atoms (B) experience the wave identically, while atoms in a "giant" molecule (C) get the peaks at different times.

"There has been a lot of theory about retardation," says John Weiner, a chemist at the University of Maryland who chaired the conference session. "These results really show in an unambiguous way how retardation occurs." While there was little doubt of the effect's existence, its confirmation validated theorists' quantum mechanical calculations.

In theory, retardation occurs because greater distance changes the communication between atomic pairs. The oscillating electromagnetic field that carries interatomic messages rises and falls like a wave as it radiates away from one atom at the speed of light. When two atoms are close by, both the sending and receiving atom experience the same phase of the field—essentially, both see a peak or a trough at the same time. If the atoms draw farther apart, however, one atom experiences the peak of a wave a tiny bit earlier than the other (see diagram).

Giant molecules, then, were a perfect test of this delay. To create them, the researchers first used lasers to "cool" a small sample of sodium atoms by hitting them with photons, which slows them and lowers their temperature to less than a thousandth of a degree above absolute zero. The ultracold temperature was an essential precondition for binding atoms an average of 3.5 nanometers apart, explains Phillips, as the electromagnetic force is so weak at that distance that even the slightest bit of heat would prevent binding. Once the atoms were cooled, the researchers could fire photons at highly specific energies at them, which would shift the balance of attractive and repulsive forces ever so slightly, forcing the atoms to bind unusually far apart.

But the amount of energy it takes to do this depends on the retardation effect. If there were no lag, then quantum mechanical calculations suggest that it would take the energy of a photon with a wavelength of about 589.1 nanometers to stitch the two atoms together in a giant molecule, says Phillips. "But this time lag changes the force between the atoms and lowers the energy you need to put in to make a molecule," he adds.

So the researchers started by firing two lasers: The first sent 589.1-nanometer photons into their sample of sodium atoms; the second sent other photons designed to rip an electron off any newly formed giant molecules, creating easily detectable ions. They found no ions, showing that giant molecules weren't formed. When the researchers then slightly lowered the frequency of the first laser, their detection beam produced ions, bearing witness to the creation of giant molecules—and indirectly to the time lag in atomic communication.

–Robert F. Service

E.T. Search Finds Noise, No Signal

After yet another year during which E.T. did not phone home, the scientists and engineers in the search for extraterrestrial intelligence (SETI) remain upbeat. At the meeting, speakers reported that even though a derisive Congress cut off SETI funding in October of 1993, researchers have fared pretty well, thanks to the generosity of private donors who have enabled three searches to go on scanning the sky for radio signals from intelligent life. And one group has dramatically improved its ability to distinguish human signals from the real things.

So far, of course, there haven't been any. "All we know for sure is that the sky is not littered with powerful microwave transmitters," says SETI patriarch Frank Drake of the SETI Institute in Mountain View, California.

When Congress cut the leading SETI search, begun by the National Aeronautics and Space Administration (NASA) in 1992, some participants created Project Phoenix in its stead under the aegis of the nonprofit SETI Institute. They located four principal benefactors in high-tech industry: David Packard and William Hewlett of Hewlett-Packard; Gordon Moore, founder of Intel; and Paul Allen, co-founder of Microsoft.

The first $7.5 million of private funding let Phoenix researchers make 23,000 observations of 209 sunlike stars last year and find a way to eliminate terrestrial false alarms. Two other, less powerful searches, sponsored by the public membership Planetary Society—the SERENDIP SETI Sky Survey and the META II search—have come up with many signals defying identification. In NASA's 1992 observing run, researchers traced many such signals to unexpectedly heavy human-made radio interference, but only after laboriously checking out each one.

The Phoenix team weeded out unwanted terrestrial signals automatically with the help of a second, smaller antenna 250 kilometers from the main antenna in New South

Wales, Australia. By comparing the Doppler shifts of the same signal received at the two sites, the computer processing the data could determine whether a signal could be extraterrestrial or just a TV transmitter, passing satellite, or radar. Says Jill Tarter of the Phoenix team: "We did a search that left no mysteries; all signals were identified." And they were all terrestrial.

Hopes for finding an exception ride on the continued generosity of donors. Packard, Hewlett, and Moore have each promised Phoenix $1 million per year for the next 5 years. That should allow it to search 1000 stars—the original NASA star-by-star search goal.

Will that be enough to bag an alien signal? If there is an antenna like the world's largest—the 300-meter antenna at Arecibo, Puerto—beaming a signal our way from one out of every 1000 sunlike stars, estimates the SETI Institute's Kent Cullers, "then we will succeed soon." In case the galaxy is not so thickly populated by garrulous aliens, the SETI Institute plans to raise a $100 million endowment to extend the search even further, a chore that could tax the optimism of even a SETI searcher.

–Richard A. Kerr

Chewing Up the Fossil Record

Development keeps evolving: New species often improvise on their ancestors' route to adulthood, finding slightly different ways of growing up. But those improvisations can confuse paleontologists struggling to identify new species from an imperfect and hard-to-read fossil record. Witness this tale of a researcher who found a "new" species of lemur—only to have it turn out to be an old species with a previously unrecognized pattern of development.

While rummaging through a museum collection in Madagascar, the world's only natural lemur habitat, paleontologist Laurie Godfrey of the University of Massachusetts, Amherst, discovered a tiny lower jaw with big teeth. And the jaw stood out. "It certainly seemed at first glance that I had found another species," Godfrey recalls.

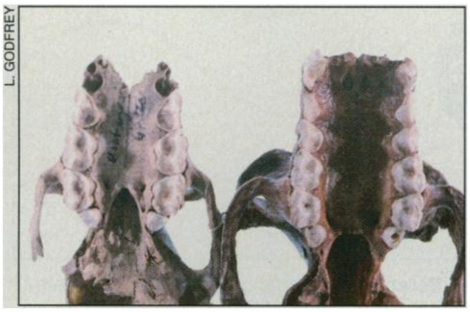
Bearing a full complement of adult teeth, the mandible closely resembled the lower jaw of a lemur genus known as *Mesopropithecus*, which became extinct approximately 2000 years ago. But adult *Mesopropithecus* mandibles are typically longer and deeper than the one that was in Godfrey's hand. She thought she had gotten hold of a new species, one that was "juvenilized," retaining the light-boned jaw of a youngster into adulthood.

Instead, the jaw actually belonged to a juvenile. Combing through the museum's collection drawers, Godfrey examined the skull of a closely related extinct genus called *Palaeopropithecus*. The skull's sutures had not yet fused, and it lacked the pronounced orbital rims of adults. Instead of a juvenilized adult of a new species, Godfrey inferred that she had the precocious juvenile of *Mesopropithecus*.

This was a largely overlooked pattern of lemur development—one that persists today, as Godfrey learned when she examined museum specimens of the animal's closest living relatives, the genus *Propithecus* (commonly called the sifaka). These animals all breed at the same time, and so their babies are born during the same 6-week span during the dry season in the southern hemisphere's winter. As a result, the date a juvenile museum specimen was captured gives a good estimate of age. When Godfrey compared the tooth development of sifakas from infancy through their first birthday, she found that these animals, like *Mesopropithecus*, indeed pack in almost all of their permanent teeth within their first year. All other observed groups of lemurs develop their adult teeth later, as their jaw grows.

Dental precocity occurs among an entire family of lemurs. Paleontologists have unearthed five extinct species from various sites in Madagascar. And Godfrey and her colleagues discovered two new species in the previously unsurveyed northern region known as Ankarana. She and her colleagues also think they've unearthed an explanation for this pattern. All of the early toothed lemurs appear to be leaf-eaters, and youngsters need their adult teeth to survive on tough, dry seeds and leaves. Fruit-eating lemurs, because of their softer diet, manage with their milk teeth longer.

Paleontologist Michael McKinney of the University of Tennessee notes that Godfrey's work "emphasizes the importance of the timing of development" in understanding evolutionary processes. He points out that paleontologists must find ways to establish developmental time courses for other animals, or risk confusing new animals with existing ones that have found new ways of growing old.



L. GODFREY

Young jaw, old teeth. This extinct lemur gets its adult teeth at a very early age.

–Lisa Seachrist

Lisa Seachrist is a free-lance writer in Bethesda, Maryland.

CELL BIOLOGY

Regulating G Protein Signaling

As anyone who has ever slept with a snorer, studied in a college dormitory, or lived next door to a pianist knows, tuning out one's surroundings can be a sanity-preserving skill. This ability isn't just limited to humans. Even the simplest cells can mute their own internal communication lines to tune out the racket of chemical noise made by hormones, neurotransmitters, growth factors, and other cell regulators, allowing them to damp down their responses to such stimuli after prolonged exposure.

Exactly how cells achieve this "desensitization" is unclear, but in a spate of recent studies, researchers in several laboratories have closed in on one volume control for a key intracellular communication line: the "G proteins" that serve as intermediaries carrying signals from numerous hormones and neurotransmitters to the cell interior. Over the past year, the work has uncovered a large and growing family of proteins that seem to regulate the sensitivity of G protein signaling pathways in organisms ranging from yeast and nematodes to rats and even humans.

Heidi Hamm, a biochemist at the University of Illinois, Chicago, who recently helped unravel the molecular structure of G proteins themselves, describes the new proteins—known as the RGS proteins (for Regulators of G protein Signaling)—as "very intriguing." Eva Neer, a biochemist at Brigham and Women's Hospital in Boston, agrees and says the findings may help solve a question that signal-transduction researchers have been puzzling over for years.

G proteins take part in an enormous variety of biological sensing and communication systems, helping control everything from mating in yeast to egg-laying in the nematode *Caenorhabditis elegans* to immune responses and vision and olfaction in mammals. But cell biologists have had trouble figuring how cells manage to make the right responses at the right times. "It's hard to explain the specificity of cellular responses solely on the basis of what's known about G protein action in vitro. The cell has to be contributing something else that modulates responses," says Neer. And she adds, "This is exactly the kind of family one would hope that someone would find."

Although the complete mode of action of the family members hasn't yet been worked out, researchers think they work by binding to one of the three protein subunits that