says avian ecologist Trevor Price of the University of California, San Diego. Females may pay the highest price, amplifying the redstarts' skewed sex ratio (like many migratory songbirds, redstarts have a higher proportion of males than females) and spelling trouble for the species. For redstarts and other migratory songbirds, the decline of wet winter forests could turn already difficult winters into one-way tickets south.

–BERNICE WUETHRICH

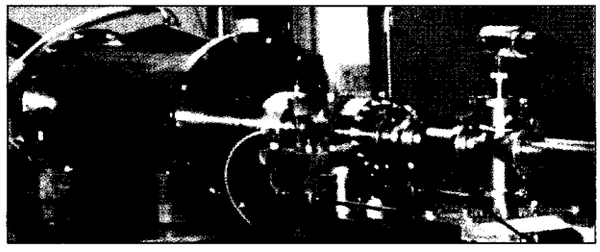
Bernice Wuethrich is an exhibit writer at the National Museum of Natural History in Washington, D.C.

X-RAYS

Tabletop Laser Packs a Punch

When materials scientists and x-ray crystallographers talk about "light sources," they are normally referring to facilities as big and pricey as electric power plants: synchrotron radiation sources, particle accelerators built to produce intense x-ray beams for probing the structure of matter. But now a team of scientists at Colorado State University in Fort Collins has made a light source you could take home: a tabletop x-ray laser that can deliver rapid-fire pulses of x-rays comparable to those of some synchrotron sources.

"We have right now the same coherent power ... as a third-generation synchrotron beamline," says team leader Jorge Rocca. Described in an upcoming paper in *Physical Review Letters*, the tabletop device, powered by electric discharges, could relieve some of the seemingly insatiable appetite for new x-ray sources to study the structure of materials and biomolecules. Although the source emits very low-energy, or "soft," x-rays, verging on the ultraviolet, at a single frequency, all wavelengths are of interest to researchers. "There are biologists who use wavelengths from visible ultraviolet to x-rays on the same machine to determine structures," says Marie-Emmanuelle Couprie of LURE, which houses France's synchrotron in Orsay.



Rapid fire. Tabletop laser generates several x-ray pulses per second.

In 1994 Rocca and his colleagues reported that they had demonstrated the world's first tabletop x-ray laser (*Science*, 4 November 1994, p. 732). While existing x-ray lasers use powerful pulses from a separate, usually huge, optical laser to ionize a gas into a plasma and then excite the ions so that they produce x-rays, Rocca's team used a different approach. They filled spaghetti-thin capillary tubes 18 centimeters long with argon gas and then used electric discharges both to create the plasma and excite the ions. Their laser was not very powerful, however, and it only produced one nanosecond-long pulse per minute. By 1996, the team had upped the power output per shot, but because of problems cooling the capillaries it could not improve on the rate of one shot a minute, well short of the millions of pulses achievable with a synchrotron source.

Since then, the team has made several improvements. Instead of capillaries made of polyacetal, a very tough plastic, they use water-cooled ceramic ones made from alumina, which are stronger and conduct heat better, allowing the team to apply more rapid-fire electric discharges. "We have also made electrical changes to supply the power at the right rate," says Rocca. In their upcoming paper, the team announces that it has achieved its goal. The device generates x-ray pulses with a wavelength of 46.9 nanometers at a repetition rate of 7 per second, producing an average output power of about 1 milliwatt—two to three orders of magnitude larger than produced by some older synchrotron sources.

Such a laser is no competition to the top rank of high-energy, or "hard," x-ray sources such as the European Synchrotron Radiation Facility in Grenoble, France, which structural biologists rely on to study the three-dimensional structure of proteins. "The study of proteins requires much harder x-rays" than the laser can produce, says Michel Bessiere of LURE. But the laser could conceivably fill the needs of some users of "soft" x-ray beams at sources like Berkeley's Advanced Light Source or Italy's Elettra for applications such as x-ray holography and spectroscopy. This could prove to be a boon for researchers queuing to run their experiment at today's facilities, which are seriously overcrowded. "You could fill every synchrotron-hour in Europe four times," says Bob Cernik of Britain's SRS synchrotron at Daresbury Laboratory.

The laser's potential for low cost and size could allow every university to have one of its own, but some synchrotron experts doubt that it is a serious contender yet. Couprie points out that it does not match the pulse rate or the reliability of synchrotrons, and its limited operating time—currently 30 minutes at five pulses per second—could also form an obstacle. Still, the intensity of the laser's pulses may make it useful for studying how the optical properties of plasmas change at very high radiation intensities, says Couprie.

Rocca is well aware of the laser's shortcomings, and he and his team are already testing the laser with different gases in the plasma and hotter temperatures. Although his tiny laser is unlikely to topple the mighty synchrotrons, Rocca is sure it will find a niche. Agrees Cernik: "You need lasers and synchrotrons as well."

–ALEXANDER HELLEMANS

Alexander Hellemans is a writer in Naples, Italy.

NEUROBIOLOGY

Steadying Influence For Neurons Identified

Like people, neurons sometimes need to be steadied a bit so that they don't overreact to stimuli. That role is one of several that fall to potassium channels, tiny protein pores that allow potassium ions to flow out of neurons. So far, researchers have identified the proteins that make up most of the 20 or so known types of potassium channels. But one channel with a major influence on neuronal excitability, the M-channel, has remained mysterious—until now.

On page 1890, David McKinnon and Jane Dixon of the State University of New York, Stony Brook, and their colleagues report that they have identified the two proteins that together make up the M-channel. Their success is being heralded partly because it will help researchers understand how neural excitation is controlled. "This channel represents the most important regulator of excitability in many neurons," says University of California, Berkeley, neuroscientist Ehud Isacoff.

The M-channel may also be a key target for drug development. Even before the Stony Brook work, others had discovered that defects in the genes encoding the proteins cause a form of epilepsy. And M-channels are found in many brain areas including the hippocampus, where neural responsiveness can affect learning and memory. Knowing the identity of the channel's components will help researchers learn what turns it on and off and could lead to new drugs for epilepsy or Alzheimer's disease.

McKinnon and Dixon study sympathetic neurons, which control things like heart rate and blood pressure. Like all neurons, sympathetic neurons fire in response to signals arriving from other neurons, which open channels that let positively charged ions flow into the cell. But some sympathetic

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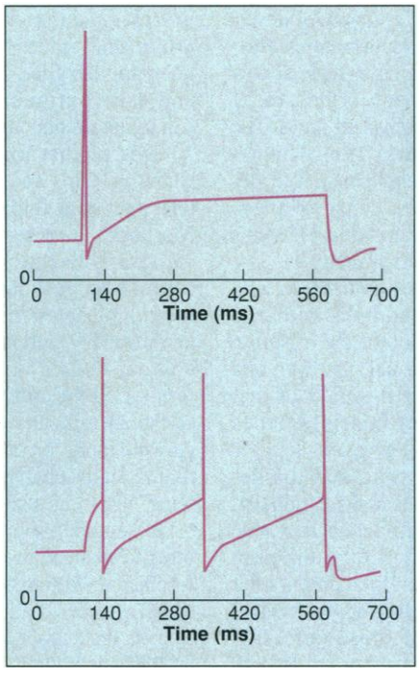
neurons are more excitable than others, firing many more action potentials in response to a given stimulus.

In earlier studies, McKinnon and Dixon's team specifically tested neurons for the M-current, the flow of potassium ions across the membrane under conditions in which M-channels would be the only potassium channels open. They found that the less active neurons have M-channels while the more active neurons lack them. That made sense, because M-channels let positively charged potassium ions flow out of the neuron during the period leading up to an action potential. That reduces the neuron's excitability by countering the inward flow of ions triggered by neural signals.

The Stony Brook team used their knowledge of which neurons lack M-channels to help them search for the channel's protein components. In both types of neurons they screened through the RNA messages that indicate which proteins the neuron is making, to see whether any of the known potassium channel proteins were made only in the M-channel–containing neurons. KCNQ2, a potassium channel subunit that had not been linked to any known channel, fit the bill. In further experiments the researchers injected RNA encoding the different KCNQ subunits into frog egg cells and showed that KCNQ2 combines with another subunit, KCNQ3, to make a channel that behaves exactly like the M-channel.



Excitable. Sympathetic neurons missing the M-channel (lower panel) fire more than those that have the channel (upper panel).

This was not the first time the two proteins had attracted attention. Earlier this year, while the Stony Brook team was doing those experiments, a team at the University of Hamburg in Germany and another at the University of Utah reported that mutations in the genes that encode KCNQ2 or KCNQ3 cause a hereditary form of epilepsy. Finding out that the two proteins encode the M-channel "really makes sense," says Thomas Jentsch, a member of the Hamburg team, because "the M-channel has been shown to control neuronal excitability," and epileptic seizures occur when neurons become uncontrollably excited.

The prospect of controlling seizures via the M-channel already has drug company scientists intrigued. They "were all over the poster," McKinnon says, when he presented his team's work at the annual meeting of the Society for Neuroscience in Los Angeles last month. DuPont neuroscientist Barry Brown, a co-author on the paper, says drug companies can now use the subunits to screen drugs. "If you could find a drug that actually opened or enhanced the activity of M-currents, it may be a good antiepileptic drug," he says.

In addition, several compounds developed by DuPont as memory enhancers for Alzheimer's patients had already turned out to block the M-current. "That implies that the M-current is also involved in cognition," says Neil Marrion, a neuroscientist at the University of Bristol School of Medical Science in the U.K. "If you look at [animal models of] Alzheimer's, cell firing is actually dampened in the hippocampus," he notes. The cognition-enhancing drugs may work at least in part, he suggests, by "jazzing up" the excitability of neurons in this important memory area.

The DuPont drugs, along with the subunits and their genes, also provide a new set of tools for neuroscientists who study neural excitability. For example, the neurotransmitter acetylcholine enhances neurons' response to its excitatory signals by activating receptors that turn off the M-channel. But after years of research, no one has identified the intracellular messenger, triggered by acetylcholine, that turns the channel off. Having the subunits in hand "will help people to investigate what the messenger might be," says Marrion, who has studied the M-channel for a decade.

For instance, they can look for certain hallmark amino acid sequences in the channel proteins that provide clues to the kinds of regulatory molecules that act on the channel, mutate those amino acids to see the effects of losing that regulation, and even study the effects of altered forms of the M-channel in transgenic animals. "This work opens up whole new avenues," Marrion says.

–MARCIA BARINAGA

CREDIT: DAVID MCKINNON

FORECAST: FOG AHEAD ON JOB FRONT

A decade after lambasting the National Science Foundation (NSF) for botching a study of the science job market, Congress has asked the agency to once again take on the politically risky task of predicting how many high-tech workers the United States will need over the next decade.

The request is part of an ongoing debate over the impact of a new law designed to boost the number of foreign workers filling high-tech jobs. But social scientists warn that predicting labor markets is a tricky business. "It's extremely difficult, if not impossible, to project demand," says Jeanne Griffith, head of an NSF division that tracks demographic trends.

Nonetheless, such projections can spark a political firestorm, as NSF learned after a 1987 study, led by Peter House, warned of a coming "shortfall" of several hundred thousand scientists. After the forecast proved false, lawmakers questioned the agency's reputation for dispassionate analysis (*Science*, 14 February 1992, p. 788). NSF overcame that stain on its reputation, however, and "there is no truth to the rumor that [House] is being brought back to head the [new] study," says one NSF wag.

STEALTH PLAN TO DO AWAY WITH PEER REVIEW

Australian academics are upset about an internal government proposal to replace the Australian Research Council's peer-review system with block grants divvied up by individual universities.

The proposal, developed by the education ministry and first reported last month in *The Australian* newspaper, calls for moving away from peer review and recommends that graduate scholarships go directly to students rather than to universities. It also suggests using new performance measures to decide how to allocate research funds.

Alarmed academics, however, warn that abandoning peer review would undermine quality control and put smaller institutions at a disadvantage in the funding hunt. "These damaging and ill-considered ideas threaten the standard and standing of basic research in Australia," says Peter Cullen, president of the Federation of Australian Scientific and Technological Societies. The proposal is expected to be made public in the next few weeks.

Contributors: David Malakoff, Wayne Kondro, Jeffrey Mervis, Elizabeth Finkel