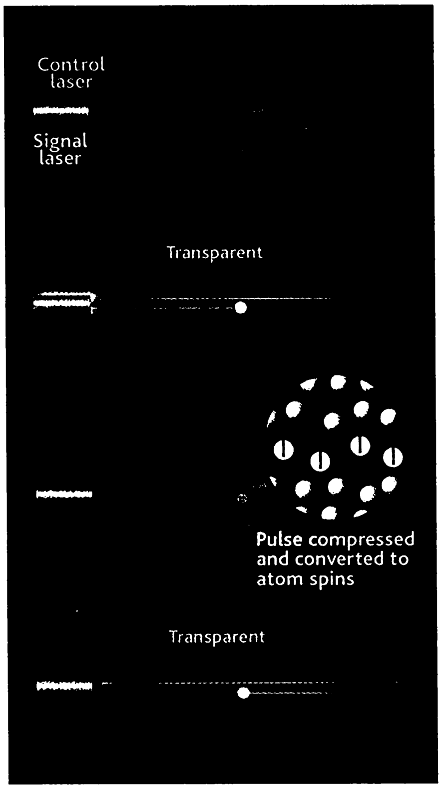
one day be useful in the still theoretical field of quantum information processing.

"This is very brilliant stuff," says Steve Harris of Stanford University, a physicist who first measured the optical slowing effect 5 years ago. "You can compress this kilometers-long pulse down and store it completely, and all of the information is preserved."

Light travels at about 300 million meters per second, a fact hammered into the heads of beginning science students. But that's in a vacuum, and it is only half the story. In fact, light has two different velocities—the phase velocity and the group velocity—and they can be very different. Phase velocity is the speed of a theoretical, pure light wave of a single frequency. Group velocity, by contrast, measures how fast a real signal moves through real matter.

Last year, researchers led by Lene Hau of Harvard University slowed light to a crawl by exploiting the way special kinds of atomic matter can play around with the group velocity of a laser pulse. They started with a gas of sodium atoms, chilled down to nanokelvin temperatures, of the sort used to study Bose-Einstein condensates (*Science*, 22 December 1995, p. 1902). Normally the sodium vapor is opaque to laser pulses, but the researchers canceled out the absorption by tweaking the atomic energy levels with another laser. Such "electromagnetically induced transparency" (EIT), which Harris and colleagues discovered nearly a decade ago, suddenly makes the gas transparent to the laser light. It also causes the light pulses to slow down by factors of millions and shrinks them by seven orders of magnitude, like a stretched-out Slinky toy dropped into a tank of molasses. Last year, Mikhail Lukin, Susan Yelin, and Michael Fleischhauer of the Harvard-Smithsonian Center for Astrophysics (CfA) in Cambridge, Massachusetts, worked out a theory for how this EIT effect could be used to trap, store, and release light.




**Light trap.** Beam from a "control laser" first clears the way for a second pulse to enter atomic vapor, then releases it from confinement. Real beams are collinear.

In their new experiments, Hau's group prepped the sodium for EIT by hitting the atoms with a "coupling laser." Then they fired in another laser pulse, which slowed and scrunched down inside the vapor. When the pulse had fully entered the atomic soup, they turned off the coupling beam. "The light pulse comes to a grinding halt," Hau says. "All the information in the pulse gets stored in the atoms, and we can park it there for a while." When they switched the coupling laser on again, the vapor became transparent again, and the atomic spins regenerated a perfect copy of the original laser pulse. With this atomic Silly Putty, Hau's team could store light pulses for up to 1 millisecond and spit them out again.

Meanwhile, another group at CfA has stored and reemitted light by very different methods. Rather than supercold sodium atoms, Ron Walsworth, Mikhail Lukin, and their colleagues used a warm rubidium vapor to catch a laser pulse and then read it out again. In contrast to Hau's tailor-made equipment, the CfA group cobbled theirs together from components they were using in other experiments. "We basically did this with atomic-clock technology," Lukin says. Their simpler apparatus stored light for up to half a millisecond before releasing it.

Both sets of researchers stress that they haven't actually trapped photons like butterflies in a jar. The information contained in the laser pulse, they point out, is converted into atomic states that sit around until the control beam tells the light to emerge. Then energy from the control beam is converted into an outgoing pulse identical to the input pulse.

Many researchers are excited by the prospect of using the technique as a kind of coherent optical storage device—a sort of quantum hologram. Or it might lead to a quantum Internet, with light beams coherently ferrying information from atom cloud to atom cloud. But there is a long way to go before anyone will be saving e-mail in frozen light.

–DAVID VOSS

NOBEL PRIZE

## Researcher Overlooked For 2000 Nobel

When the Nobel Foundation announces its list of prize winners, there are often grumbles that somebody's seminal work was overlooked. Last year's award of the medicine prize has provoked something more: an open letter to the award committee signed by more than 250 neuroscientists.

The award went to three researchers for their work on how nerve cells exchange signals, and the Nobel Foundation's announcement pointed out the relevance of such work for treating Parkinson's disease and other neurological disorders. The problem, say those who signed the letter, is that the person who discovered the underlying neurotransmitter deficit in Parkinson's disease—and designed the treatment still in use today—wasn't included in the award or even mentioned in the accompanying announcement.

"Everyone was surprised" that neurologist Oleh Hornykiewicz didn't receive the Nobel Prize last year when the committee recognized contributions to the study of neurotransmitters, says neuroscientist John Hardy of the Mayo Clinic in Jacksonville, Florida. Hornykiewicz's work "fundamentally changed how neuropharmacology is practiced," he asserts. His colleagues who

**Nobel slight?** Neuroscientists say Oleh Hornykiewicz deserved a Nobel.

CREDIT: (BOTTOM) BRAIN RESEARCH INSTITUTE/VIENNA UNIVERSITY MEDICAL SCHOOL signed the letter—which will appear in an upcoming issue of *Parkinsonism & Related Disorders*—apparently agree: The letter congratulates the year 2000 award winners but states "that one prominent scientist ... should have been included in this Award."

"We want to set the record straight," says neurologist Donald Calne of the University of British Columbia in Vancouver. Calne and others emphasize that the open letter is "not intended to slight" any of this year's winners, and they acknowledge that the committee that picked the awardees could only honor three people. (A spokesperson for the foundation said that they receive complaints every few years but are barred from discussing the selection committees' deliberations until 50 years have passed.)

Hornykiewicz, a still-active professor emeritus at the Brain Research Institute of Vienna University Medical School, reported in 1960 that the neurotransmitter dopamine is depleted in the brains of people with Parkinson's disease. He analyzed postmortem brains of people with a variety of neurological disorders and discovered that only Parkinson's correlated with low dopamine levels. "More or less immediately" after that finding, Hornykiewicz says, he proposed that replenishing dopamine could benefit Parkinson's patients. He convinced a neurosurgeon colleague to administer a dopamine precursor to Parkinson's patients "and saw spectacular results," he says—results they reported in a 1961 article.

Giving Parkinson's patients dopamine precursors is "still the best medication we have," says one drafter of the open letter, neurologist Ali Rajput of the University of Saskatchewan in Saskatoon. What's more, says Hardy, Hornykiewicz's approach to Parkinson's inspired similar neurotransmitter-based therapies for depression, schizophrenia, epilepsy, and other disorders.

Many of the letter writers and signatories are concerned that the Nobel announcement seems to attribute Hornykiewicz's insights to Arvid Carlsson of Göteborg University in Sweden. Carlsson's work, starting in the late 1950s, set the stage. He discovered that dopamine is a neurotransmitter and found that animals with movement disorders improved when treated with dopamine. But in describing Carlsson's accomplishments, the Nobel Foundation also states: "His research has led to the realization that Parkinson's disease is caused by a lack of dopamine in certain parts of the brain and that an efficient remedy (L-dopa) for this disease could be developed."

While expressing the "utmost respect and admiration" for Carlsson, Calne and others contend that the statement is "not absolutely wrong, but easy to misunderstand." Although the open letter doesn't make it explicit, some signatories suggest that the 2000 Nobel Prize should have focused more narrowly on the impact of neurotransmission research on treatments for neurological disease, and Carlsson and Hornykiewicz should have shared the prize.

Hornykiewicz says he's "very grateful" for the support. "That is one of the things that really count in the life of a researcher—the recognition of colleagues," he says.

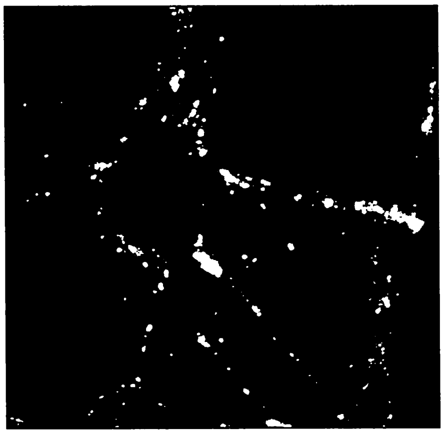
—LAURA HELMUTH

NEUROSCIENCE

## Glia Tell Neurons to Build Synapses

After decades of neglect by researchers more interested in know-it-all neurons, brain cells classified as "glia" are getting some respect. Although glia account for 90% of the cells in the adult human brain, they've been written off as simple scaffolding that supports neurons, as sources of nutrition, or as a waste-disposal mechanism for sopping up extra ions and neurotransmitter molecules. But a new study on page 657 shows that glia play a more important role in neuron-to-neuron communication: They tell neurons to start talking to one another.

Before neurons can send and receive messages, they have to establish connections called synapses, points of near-contact where neurons swap chemical signals. How these synapses form is "a major question in neurobiology," says Robert Malenka, a neuroscientist at Stanford University who was not involved in the research. In the new work, Stanford's Ben Barres and his colleagues report that neurons can't build synapses very efficiently on their own. Young neurons contain all the raw materials necessary to do the job, but the neurons don't start construction until getting the go-ahead from nearby glial cells known as astrocytes.



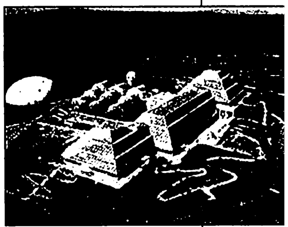
**Talk to me.** Neurons grown near glia build more synapses (aglow).

The first indication that glia boost synaptic communication came in 1997, when

## ScienceScope

**Bioscheme** The U.S. government is jumping into Biosphere 2, the giant greenhouse in the Arizona desert. On 18 January —2 days before leaving—Secretary of Energy Bill Richardson signed an agreement with Columbia University to examine the feasibility of making Biosphere 2 a Department of Energy (DOE) "national user facility." DOE will pitch in $700,000 over the next 2 years to help Columbia work up plans for a structure that failed its original test in the early 1990s as a self-sufficient home for Earth-bound econauts.

Scientists at Columbia, who took over the facility in 1996, have struggled to control gas levels and temperature in Biosphere's "biomes," including a minirainforest, ocean, and desert. The DOE agreement is evidence that Biosphere 2 "has proven itself" as a facility to study ecosystems' responses to climate change, says Columbia's Executive Vice Provost Michael Crow.



A DOE official says the department "is not prepared to start sending scientists to Biosphere 2 to do research." But the pact will allow it to explore whether the facility can complement ongoing studies of climate change, carbon sequestration, and atmospheric chemistry.

**Headhunting** A looming labor shortage has led some Canadian universities to spice up their hiring efforts. The province of Ontario is seeking $350 million for a recruiting drive, while Quebec is offering a 5-year income tax holiday to scholars who relocate to institutions within la belle province.

The Ontario Confederation of University Faculty Associations (OCUFA) recently estimated that 15,000 new professors—more than the number now employed—will be needed over the next decade by provincial universities to cope with retirements and a projected 40% jump in enrollment. Government budget cutbacks have already led to skyrocketing student-to-faculty ratios, says McMaster University political scientist and OCUFA president Henry Jacek. "The situation is bad and every day it gets worse."

But Jacek opposes tax holidays as a recruiting lure, saying they engender "animosity" within faculties and encourage professors to move away temporarily to be eligible for the break. He believes the long-term solution "is increased operating grants" from the government.

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