Beaming with a double-decker microlaser

It's easy to overhear words whispered by someone standing near the interior wall of a circular, domed chamber. The whispers echo throughout the gallery, making the words audible to any eavesdropper elsewhere along the wall.

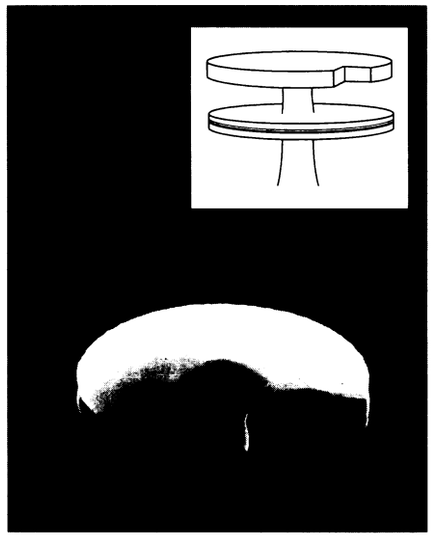
Infrared light injected into a microscopic semiconductor disk follows a similar course, circulating along the disk's edge for long periods with little diminution in intensity. Such a device can act as a laser, spraying coherent light that fans out from the disk's rim (SN: 11/23/91, p.327).

Now, a team of researchers at Northwestern University in Evanston, Ill., and the University of California, San Diego, has found a way to channel the emitted laser light into a beam without greatly degrading the quality of the disk in which the light initially circulates.

Northwestern's Seng-Tiong Ho and his collaborators accomplish this feat by placing a second disk atop the first, joined by a narrow neck. Photons slowly leak from the bottom to the top disk. These photons then leave via a notch cut into the upper disk (see illustration).

"This seems to be an effective way to get the light out in a directed manner," Ho says. "Eventually, we want to make the light come out vertically."

Constructed from disks only 5 micrometers in diameter and mounted in air on a pedestal, this double-decker microlaser is considerably smaller than the tiny semiconductor lasers that scan discs in compact-disc players. "We can make them as small as 2 or 3 [micrometers] in diameter," Ho says.



Electron micrograph of a double-disk microcavity laser. The upper disk guides photons generated in the lower disk to an aperture from which the photons emerge as a beam (inset).

Ho described the group's experiments at an Optical Society of America meeting, held this week in Dallas. Further details will appear in a forthcoming issue of APPLIED PHYSICS LETTERS. — *I. Peterson*

Better leukemia survival

Once invariably fatal, acute myeloid leukemia (AML) still kills most of its victims. But a study involving 1,088 patients treated at medical centers across the country now indicates that more aggressive chemotherapy may help this cancer's younger sufferers.

At the most effective dose studied, the new regimen is often so toxic that many patients, especially those over age 60, cannot tolerate it. But for those who can, rates of long-term remission appear comparable to those seen in patients receiving bone-marrow transplants from a marrow-matched sibling. That's currently the most promising treatment option, but it's not available to many.

In AML, which hits 6,400 people in the United States each year, blast cells — produced in the bone marrow — don't mature as they should into granulocytes, a type of infection-fighting white blood cell. Oncologists usually use chemotherapy to kill those blast cells, starting with some combination of cytarabine and at least one other drug. The 65 percent of treated patients who then go into remission, or show no signs of disease, typically begin a period of maintenance therapy. At this stage, researchers tried increasing the dosage.

In the new study, they gave about one-third of 596 patients who entered remission daily doses of 100 milligrams of cytarabine per square meter of body surface area for 5 days. The researchers gave the other volunteers either 4 or 36 times as much drug. Patients received four courses of their regimen, each at least a month apart.

The older the individual and the higher the dose, the more likely a patient was to suffer seizures and other forms of cytarabine's potentially irreversible neurotoxicity, report Robert J. Mayer of Harvard Medical School in Boston and his coworkers in the Oct. 6 NEW ENGLAND JOURNAL OF MEDICINE. But among those age 60 and under who tolerated the drug, the probability that an individual would survive diseasefree for at least 4 years climbed from 24 percent among those on the 100-mg dose to 29 percent in the 400-mg group and to 44 percent in the megadose group.

— *J. Raloff*

The seasonal ozone decline continues

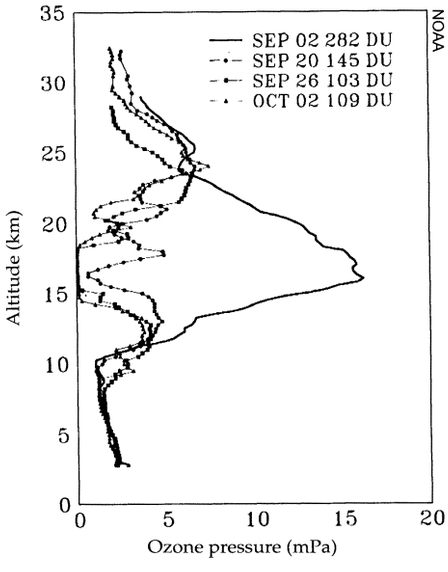
It's that time of year again, when the ozone over Antarctica grows almost as sparse as the hair on a balding man's head and provides little more protection against the sun's cancer-causing rays.

So far, however, this year's ozone measurements are producing a confused picture. Data taken from a U.S. spectrometer flown aboard a Russian satellite suggest that the protective layer has thinned almost as much as it did last October, researchers told SCIENCE NEWS. But data from instruments on balloons sent into the stratosphere hint that things aren't that bad.

The ozone layer helps guard Earth from the sun's damaging ultraviolet radiation. In the spring, when sunlight finally reaches Antarctica, the protective blanket of gas thins as light activates chlorine and bromine particles, which help break apart ozone molecules. By November, as the polar stratosphere warms, the hole begins to mend. Concentrations of ozone should bottom out around Oct. 10, says Samuel J. Oltmans of the National Oceanic and Atmospheric Administration in Boulder, Colo.

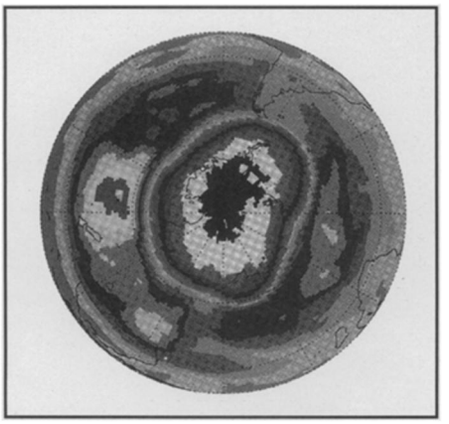
Last October's record-breaking 70 percent drop in ozone probably resulted in part from the dose of sulfur dioxide that Mt. Pinatubo shot into the stratosphere when it erupted in 1991 (SN: 10/16/93, p.247).

In the last 2 weeks, the low recorded by researchers using the balloon instruments was 103 Dobson units of ozone — about 10 percent more than last year at the same time, Oltmans says. This slight increase doesn't suggest a permanent comeback for ozone, he warns. The data



The graph shows ozone measurements taken at different altitudes between Sept. 2, when the depletion began, and Oct. 2.

NASA



Satellite image of Antarctica's ozone hole, which includes center black area and the white, gray, and black areas around it. Ozone there ranged from 100 to 175 Dobson units on Sept. 30.

have a margin of error of plus or minus 4 Dobson units.

Satellite records suggest that the rate of ozone decline has almost matched last year's, says Arlin J. Krueger of NASA's Goddard Space Flight Center in Greenbelt, Md. He and his colleagues recorded a low of 100 Dobson units of ozone on Sept. 30 and expect it will drop to last year's low of 90, he says. The margin of error is 10 Dobson units.

The ozone hole has become more extensive in the past few years. It now covers about 23 million square kilometers, roughly the size of North America.

— T. Adler

A keen view of vision: Seeing cone cells

At the back of an eye lies the retina, a tissue-paper-like membrane studded with rod and cone cells. Those cells facilitate sight by transforming light energy into electrical signals, which are then sent to the brain. Yet seeing those cells in action is difficult. While scientists study retinal cells removed from eyes donated for research, they have been unable to watch single vision cells at work in living subjects.

Now, Donald Miller, David Williams, and G. Michael Morris, all researchers at the University of Rochester (N.Y.), have brought astronomical technology to bear on the retina. Using lasers and charged coupled devices (CCDs) originally designed for stargazing and military applications, they have observed individual, live cone cells with a resolution as small as 3 micrometers, they said this week at a meeting of the Optical Society of America in Dallas.

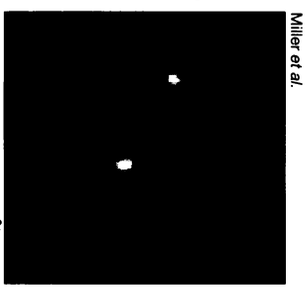
"This resolution is three times greater than the resolution that people have attained so far," says Williams. "It's the highest resolution of photoreceptors in living retinas for an image taken outside the eye. This offers a new benchmark for how fine a structure one can see in living retinal tissues. And we're hoping to see more detail in blood vessels, receptors, and other types of eye cells."

To obtain such images, the researchers use an argon laser to bounce a quick flash of light off the retina. They then capture the reflected beam with a CCD, which funnels the signal into a computer for processing and display. The patient remains awake the whole time.

To improve the instrument's acuity, Williams and his colleagues will incorporate an "adaptive optics" system used by astronomers to help compensate for atmospheric disturbances when viewing light from distant stars. This system has effectively compensated for the optical distortions that arise within an eyeball and obscure a high-resolution view of the retinal cells.

Williams sees two potential uses for this imaging method. One is to help physicians diagnose and chart the course of certain eye diseases — such as macular degeneration or retinitis pigmentosa — before disabling symptoms appear. The second possible use is scientific. "We don't yet understand very well how light is absorbed into the pigments of photoreceptors," Williams says. "Maybe by looking at these receptors we can gain some insight into how light passes through the retina's photoreceptive layer."

— R. Lipkin



Miller *et al.*

A cluster of live cone cells near the center of a human retina.

Food allergies linked to ear infections

Just the mention of otitis media makes many parents of young children cringe. Otitis media — middle ear infection — affects two-thirds of children in the United States by age 2 and is the most common cause of acquired hearing loss in children. Many get these earaches again and again, despite treatment with antibiotics.

This recurrent condition does not always cause pain, but just the buildup of fluid behind the eardrum can impair hearing and lead to permanent damage. Consequently, some 670,000 children a year wind up with tubes surgically implanted into the middle ear to keep it ventilated. Overall, otitis media represents a $3.5 billion-a-year U.S. health care cost.

Food allergies may underlie many of these multiple episodes, reports Talal M. Nsouli, an allergist at the Georgetown University School of Medicine in Washington, D.C. He and his colleagues tested 104 children with recurrent ear problems for food allergies. About a third proved allergic to milk, and another third reacted to wheat, with a total of 81 children having some allergy to a food they often ate. The scientists then had parents keep those children from eating the offending food for 4 months. Seventy children got better. "Those who avoided those foods had significant clearance of the ear," Nsouli says.

Then parents added those foods back to the diets of the 70 children. Within 4 months, the middle ears became clogged in 66 of the children, a result that reinforces the link between food allergies and persistent ear problems, Nsouli and his colleagues note in the September ANNALS OF ALLERGY.

During the testing period, the researchers periodically examined the ears, checking the eardrums in particular, and monitored the buildup of fluid inside the ear using an instrument called a typanometer. They tried to account for many of the factors that make the evaluation of treatments for this condition so difficult, Nsouli adds.

"Hopefully, most of the ear, nose, and throat doctors will start looking at these patients in light of allergies," says otolaryngologist Richard E. Linde of the George Washington University School of Medicine in Washington, D.C., and one of the study's coauthors.

Considering food allergies in children with these problems "might prevent surgery and might prevent permanent damage," Nsouli says.

— E. Pennisi

Cross-sectional view from the top of the head shows ways allergenic foods may affect the middle ear. (1) Stuffed-up noses cause fluid from the throat to move into the middle ear. (2) Nasal fluids drain into the Eustachian tube. Or (3) that tube swells shut because of an allergic reaction, causing a negative pressure in the middle ear.

Nsouli *et al.*