Memory cell: Charge of the light, delayed

It's hard to store a pulse of light. The clumsy techniques available today include sending a light signal along a coiled kilometer of optical fiber. A compact optical memory chip would make telecommunications networks more efficient and optical computers more feasible, information technology experts say.

German researchers report this week creating an optical-memory prototype that combines small size, speedy operation, and controllable release of signals. This sandwich of semiconductors stores light by transforming it into pairs of positive and negative charges and then stepping in like a referee at a fight to hold the opposite charges apart.

The charges accumulate as light signals to be stored dislodge electrons from atoms in a thin intermediate semiconductor layer, known as a quantum well (SN: 4/20/96, p. 247). The layer's properties enable it to confine charges.

Each photon freeing an electron from the well's crystal structure also creates an electron vacancy, known as a hole, which can behave as a mobile positive charge. Voltages applied to electrodes steer the electrons and holes into separate spots in the well and hold them for potentially useful periods of up to tens of microseconds. An earlier version used sound waves to separate the charges (SN: 5/24/97, p. 318). When the voltage is shut off, the electrons and holes combine, releasing a flash of light.

Stefan Zimmermann of the University of Munich and his colleagues there and at the Munich Technical University in Garching describe their prototype device, which stores a single pixel of light, in the Feb. 26 SCIENCE.

To improve the device's characteristics, the researchers say they are changing the materials from which it is made so that it can work at room temperature instead of the frigid 100 kelvins necessary now. They also anticipate being able to shrink it dramatically.

"We never thought it would work," says Jörg P. Kotthaus of the University of Munich. "We made it rather large to get a lot of signal out." Rather than its present 200 micrometers on a side, the circuitry to store one pixel could shrink to less than 2 μm on a side, he predicts.

Storage times of many microseconds represent a valuable step, says Claude Weisbuch of the École Polytechnique in Palaiseau, France. However, he suspects that "it will be tricky to make it work at room temperature" because more energetic electrons and holes will tend to leak past the voltage barriers. —*P. Weiss*

Milky Way's tug robs stellar cluster

There are hundreds of tails in the Milky Way. This is just one of them.

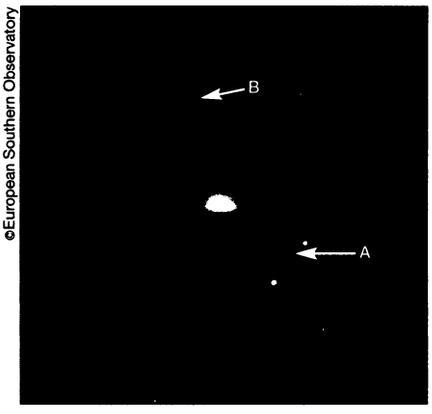
In this drawing, the globular cluster NGC 6712 is seen at two different times—before (A) and after (B) the swarm of stars passes through the plane of our massive, pinwheel-shaped galaxy. The cluster's repeated passage may have stretched NGC 6712 like a comet's tail.

That scenario could explain a new observation: None of the several-hundred-thousand stars in NGC 6712 are less massive than the sun. That's a surprise, because clusters usually contain many more lightweight stars than heavyweights. The tug of the Milky Way's dense center has robbed NGC 6712 of its lightest members, says Francesco Paresce of the European Southern Observatory in Garching, Germany.

"NGC 6712 is the first real example of 'evaporation' of stars, allowing us to watch the process unfold in front of our eyes," he notes. Other clusters don't show the same pattern because they don't come as close to the Milky Way's center. NGC 6712 may have ventured within 1,000 light-years of the core just a few million years ago. The lightest stars are more easily detached because they tend to lie at the periphery of a cluster, says Lars Hernquist of Harvard University.

Like the rest of the universe, as much as 99 percent of the Milky Way's mass is thought to be made of invisible material, or dark matter. By studying the extent to which clusters, as well as tiny satellite galaxies, are distorted or torn apart by our galaxy's gravity, astronomers hope to shed light on the distribution and the amount of dark matter in the Milky Way.

Paresce and his collaborators made their observations with the first component of what will be a quartet of 8.2-meter telescopes, known as the Very Large Telescope, on Cerro Paranal in Chile. The team describes its findings in the March 1 ASTRONOMY AND ASTROPHYSICS. —*R. Cowen*



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Disability law may cover gene flaws

A recent Supreme Court ruling has fostered a fledgling legal strategy that could protect people from discrimination based on their genes. The ruling suggests that the power of the Americans with Disabilities Act (ADA) might extend to people who are genetically predisposed to disease—before they fall ill.

As researchers identify genes associated with diseases such as breast cancer, colon cancer, or Huntington's disease, the danger arises that employers or insurance companies could discriminate against people who carry genetic defects. No federal law specifically protects people from genetic discrimination. "It's about all of us, folks," said Francis S. Collins, director of the National Human Genome Research Institute in Bethesda, Md. "We're all at risk for something."

Lawyers, scientists, genetic counselors, advocates for the disabled, and congressional staffers met Feb. 19 in Washington, D.C., to brainstorm about legal protections for people who carry identified genetic risk factors. The conference, sponsored by Collins' institute and the National Action Plan on Breast Cancer of the Public Health Service, focused on last year's Supreme Court case *Bragdon v. Abbott*.

In that ruling, an HIV-positive plaintiff was found to be protected under the ADA even though she had not developed any symptoms of AIDS. The woman sued her dentist after he refused to fill her cavity. The ADA defines as disabled, and therefore protected under the act, any person who is limited in a "major life activity." The plaintiff argued that she met this criterion because, after learning that she carried the AIDS virus, she decided not to have children. The court agreed, in a 5-4 decision.

Bragdon v. Abbott demonstrated that the ADA can extend to people who may, sometime in the future, develop a disease. Because it rested on the plaintiff's decision not to have children, however, a strict interpretation of that ruling would not protect people whose reproductive choices are unaffected by their genetic risk factors, said Paul Miller, commissioner of the Equal Employment Opportunity Commission in Washington, D.C. "The broader question is whether the ADA protects against discrimination on the basis of diagnosed but asymptomatic genetic conditions—those that have the potential to limit major life activities," said Miller. The ADA should apply in such cases, he said.

Whether it will is an open question. The commission would vigorously support a test case, Miller said, and might use a legal strategy that does not rely on

major life activities. The ADA also protects people who are "regarded as" disabled, he pointed out. Arguably, someone denied a promotion because of a genetic risk factor would be regarded as disabled by the employer and therefore covered under the ADA.

Ideally, identifying genetic risks for disease should help tailor health care to individuals, said genetic counselor Jill Stopfer of the University of Pennsylvania Cancer Center in Philadelphia. For example, women with mutations in the genes *BRCA1* or *BRCA2* have a heightened risk of developing breast and/or ovarian cancer. Such women may choose to have frequent mammograms, take anticancer drugs such as tamoxifen, or undergo prophylactic removal of cancer-prone tissue, says Stopfer.

Fear of discrimination, however, deters some women from being tested, said attorney Kathy Zeitz of the Nebraska Methodist Health System in Omaha. Her daughter, who has a family history of breast cancer, refuses to undergo genetic screening for fear that she may someday be denied health insurance.

Future congressional action could render ADA-dependent legal strategies obsolete. Last year, lawmakers introduced seven bills that would protect people with genetic risk factors from discrimination in employment or insurance coverage or both. Although none passed, one (H.R. 306) has been reintroduced and several more are expected in the upcoming months. Legislation is urgently needed, as Collins summed up at the end of the conference, because no one is confident that adequate legal safeguards exist. *—L. Helmuth*

A prostate cancer link to papilloma virus?

Scientists in Germany have found a curious connection between prostate cancer and human papillomavirus (HPV), a common sexually transmitted pathogen.

While HPV has been associated with cervical cancer in women and may even cause it, any connection between HPV and prostate cancer remains controversial and unproved. Some studies have detected HPV in prostate tumors, but other work—including a U.S. study published in 1998—has not.

There are dozens of known HPV strains. Researchers report in the Feb. 15 CANCER RESEARCH that HPV-16, a strain linked to cervical cancer, turned up in considerable amounts in 10 of 47 samples of prostate-tumor tissue. In contrast, HPV-16 was present in such quantities in only 1 of 37 tissue samples from men without cancer. All of the samples in the study showed at least some HPV-16.

The cancer patients averaged 67 years of age, the control group 70. The controls had benign prostate hypertrophy, a common enlargement of the prostate not linked to cancer.

Previous studies of prostate cancer tissue have used a simpler measure of HPV that yields only a positive or negative reading. That method can result in some false-positive results, which contributed to the contradictory findings that have plagued this research for years, says study coauthor Jürgen Serth, a biochemist at the Medical School of Hannover. To gauge whether a tissue sample was positive for the virus, Serth and his colleagues used a threshold of 300 copies of the virus per 12,500 cells—finding that many more tumor samples exceeded this cut-off than did healthy-tissue samples.

"This is potentially a very important discovery," says Jonathan W. Simons, a molecular oncologist at Johns Hopkins Medical Institutions in Baltimore. "It's the first evidence of how the microbial environment—a virus itself—could promote prostate cancer."

Nonetheless, Simons cautions that the study doesn't show HPV-16 to be a "smoking gun" that causes prostate cancer. Serth and his colleagues agree. For example, it's not clear whether the virus inhabits cancerous cells themselves or simply is present in nearby cells. Roughly 60 percent of cells in prostate tumor tissue are not cancerous, Simons notes. Serth's team is now trying to ascertain whether the HPV-16 DNA they detected is in cancerous cells or not.

HPV shows up in more than 90 percent of cervical-cancer cells. It's unusual that the researchers found some HPV-16 even in benign tissues, says Howard D. Strickler, who coauthored the 1998 study finding no HPV in prostate tumors. "Their study would have been strengthened had they demonstrated that they were able to detect HPV at high prevalence in the cancers that we know to be HPV-associated, and not in related normal tissues," says Strickler, of the Albert Einstein College of Medicine of Yeshiva University in New York City. "Absent that sort of data, it's difficult to know about the sensitivity and specificity of this assay." *—N. Seppa*

Obsessions, compulsions span decades

Each day, a girl washes her hands for hours at a time to destroy the bacteria that, she tells herself, accumulate when she touches doorknobs. A man stops his car and retraces his path after any minor bump in the road, fearing that he has run over someone. People such as these often feel tormented by their obsessive thoughts and compulsive acts but cannot resist them.

While the symptoms of what psychiatrists call obsessive-compulsive disorder (OCD) disrupt daily life with dramatic bluntness, the long-term outlook for sufferers of this condition remains poorly understood. A 40-year investigation now offers a rare glimpse at the natural course of the disorder in a group of individuals who, for the most part, received no formal treatment.

A large majority of them exhibited substantial improvement, often within a decade of receiving an OCD diagnosis, hold Gunnar Skoog and Ingmar Skoog, psychiatrists at Sahlgrenska University Hospital in Göteborg, Sweden. However, only 1 in 5 individuals achieved full recovery; 1 in 3 continued to grapple with symptoms that interfered with their daily activities, and about 1 in 4 retained milder signs of the disorder.

A total of 144 people, all diagnosed with OCD at a psychiatric hospital between 1947 and 1953, participated in the study. Most were interviewed by Gunnar Skoog between 1954 and 1956 and again between 1989 and 1993; for 22, the second interview was with a close friend or family member and not the patient.

The study, published in the February ARCHIVES OF GENERAL PSYCHIATRY, contains several intriguing findings. People who developed obsessive-compulsive disorder before age 20, particularly males, had the worst prospects for improvement. Also, intermittent symptom flare-ups were the most commonly reported OCD pattern at the first interviews; at the second interview, participants most frequently cited symptoms that had lasted for at least 5 years.

Recovery within a few years of OCD's onset often heralded lasting gains but did not insulate patients against an eventual return of symptoms. Of 41 volunteers who had nearly or fully recovered from the disorder at the first interview, 20 maintained their improvement 3 decades later, while 8 had relapses after going largely without symptoms for more than 20 years.

Only 17 patients received a medication for OCD, clomipramine, that has become available in the past decade. Its use significantly helped 10 of them.

"This study will serve as a benchmark in our efforts to understand and treat OCD," conclude psychiatrist Lawrence H. Price of Butler Hospital in Providence, R.I., and his coworkers in an editorial comment in the same journal.

Despite limitations in their data and sample, the Skoogs' findings will aid efforts to evaluate the effects of new medications on the natural progression of OCD, Price's group says.

—B. Bower