SCIENCE NEWS of the week

Promising Addition to Autism Treatment

For most of his life, the 12-year-old autistic boy had uttered only single words or short phrases. A constant anxiety flared into panic if he noticed that the table was not set in just the right way for a meal. He flapped his arms for hours at a time, shunning toys or other children. A scar on his neck testified to the repeated scratching he inflicted on himself.

Then the boy entered a drug experiment in which he received clomipramine, an antidepressant previously found to reduce the vexing rituals of obsessive-compulsive disorder (SN: 5/21/88, p.324), as well as compulsive hair pulling (SN: 9/9/89, p.175) and nail biting. Not only did the boy's arm flapping subside markedly within a few weeks of clomipramine treatment, but his anxiety, self-injury and social withdrawal lessened. Toys he had not touched for years now drew his interest. Although still saddled with language difficulties and other autism-related problems, his progress remains steady after 18 months on the drug.

This case illustrates the encouraging, but preliminary, results of the first controlled trials of clomipramine in autistic children. "We're not talking night-and-day improvement for autistic children on clomipramine," cautions psychiatrist Charles T. Gordon of the National Institute of Mental Health in Bethesda, Md., who has directed two clomipramine studies with a total of 25 autistic youngsters. "But this drug produces clinically significant behavior improvement for many of the kids we've studied."

Clomipramine treatment also allowed some autistic children to benefit more from behavior therapy, in which adults offer immediate rewards for appropriate actions, Gordon says.

In 1990, his team studied seven youngsters, ages 6 to 18, with mild to severe autistic symptoms (the boy described above displayed moderate symptoms). Participants had taken no psychoactive drugs for at least three months prior to the trial. For two weeks, each child received placebo pills. The children were then assigned at random to five weeks of treatment with either clomipramine or desipramine, an antidepressant with different biochemical effects. Five weeks of treatment with one drug was followed by five weeks of therapy with the other.

Neither experimenters nor parents knew when a child got clomipramine or desipramine, and parents did not know the initial phase involved placebos.

Youngsters received increasing doses for two to three weeks until a positive response or side effects appeared; they then remained at that dosage.

Clomipramine proved much superior to desipramine and placebo, Gordon's group reports in the March AMERICAN JOURNAL OF PSYCHIATRY. Ratings of compulsive behavior, social withdrawal, anxiety, angry outbursts and self-injurious actions improved significantly with clomipramine. Both active drugs caused minor side effects, such as mild sleep problems and dry mouth.

At their parents' behest, four youngsters still take clomipramine and have maintained their improvement with minimal or no side effects, Gordon says.

In an unpublished 10-week study of 18 more autistic children, his group found similar improvement with clomipramine, but not with desipramine or placebo.

Moderate or "remarkable" improvement occurred among 15 of the 25 participants in the two trials, Gordon says. A long-term study of clomipramine use by autistics must follow, he adds.

Clomipramine increases the availability of the chemical messenger serotonin, but its specific effects on serotonin receptors in the brain remain unclear, Gordon notes. Fenfluramine, another drug that alters serotonin supplies, has yielded mixed results with autistics. Clinicians often prescribe the antipsychotic drug haloperidol for autism, but its purported effectiveness and sometimes severe side effects have proved controversial.

Based on clomipramine's effects, Gordon's team theorizes that all ritualistic, impulsive behaviors – whether they occur with autism or any other disorder – may stem from a "core" disturbance of serotonin function in the brain.

– B. Bower

New polymers shine in rainbow patterns

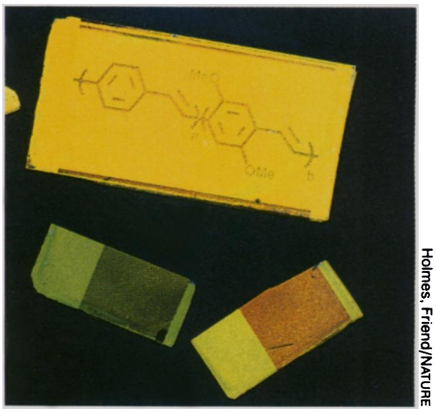
Scientists manipulating the chemical makeup of polymers have expanded the potential of plastics for making light-emitting diodes in a rainbow of colors. These materials could lead to billboard-size, multicolor electronic displays, higher resolution in portable computer screens and new devices for guiding light.

Polymer processing can be fine-tuned to alter the ability of semiconducting polymers to emit light when subjected to an electrical current, Paul L. Burn and his colleagues from the University of Cambridge in England report in the March 5 NATURE.

These physicists and chemists first discovered electroluminescent polymers in late 1990. Now they've created several new materials that work up to 30 times better than their original one and as well as the inorganic materials currently used in light-emitting diodes, they add.

The British team uses a conjugated polymer—every other carbon atom in the polymer's extensive backbone chain connects via a double bond, thereby creating a route along which electrons can travel. They make the polymer from building blocks, called monomers, that are poorly conjugated; their second bonds instead usually connect to side groups of atoms. By knocking off these side groups, chemists cause more double connections to form.

Burn and his colleagues put different side groups on the building blocks. By kicking off some or all of these side groups while joining the building blocks and by varying the ratio of the monomers, they adjust the degree and spacing of conjugation, and consequently the color of light emitted. "The secret is in the conversion," says Andrew B. Holmes, a synthetic organic chemist who works with Burn. Polymers with longer conjugated sections emit redder light, while those with lots of side groups tend to glow yellow.



Holmes, Friend/NATURE

These samples, shown fluorescing under ultraviolet light, demonstrate the patterning potential (indicated by the chemical structure) and range of colors now possible in light-emitting polymers.

Physicist Richard H. Friend and his colleagues at the Cavendish Laboratory in Cambridge have fashioned this new material into prototype light-emitting diodes with patterns of colors.

"They've made a combination of [chemical] structures and used them in a creative way. It saves steps in patterning," comments physicist-chemist Alan J. Heeger, who develops electroluminescent polymers at the University of California, Santa Barbara.

To achieve electroluminescence, researchers place a thin film of these poly-

mers between two electrodes. One electrode sends electrons into the film, creating negative charges that traverse the polymer. The other electrode pulls electrons out of the film, leaving positive charges ("holes") that drift toward the negative side, Holmes explains. If an electron encounters a hole, the polymer gets excited briefly and then emits light as it relaxes again.

The British researchers' newfound chemical finesse allows them to be more effective in getting opposite charges together. They use building blocks that slow down positive charges, says Holmes. Also, interruptions in conjugation along the polymer's chain can block migration. Thus, more electrons meet holes, and the polymer becomes more efficient at emitting light—in theory, up to 25 percent efficient, compared with less than 1 percent now.

So far, the British group has created polymers that emit yellow-green, orange-red or blue-green light, and Austrian scientists recently made a different polymer glow blue, says Holmes.

"Things are looking most promising," he says. "We think our polymer can be made up in as large an area as you need, and I think there's lots of opportunity for higher resolution." — *E. Pennisi*

Earth's mantle holds moister minerals

Compared with pork chops or pieces of wood, stones don't hold much moisture. But two geoscientists report that certain minerals from deep inside the Earth contain more water than previously assumed — a finding that alters theories about the internal workings of the planet.

Geologists know that so-called hydrous minerals, such as mica and talc, actually have H_2O or OH locked within their crystalline structures. The most abundant minerals within the mantle, however, are labeled anhydrous because their chemical formulas do not include hydrogen.

In recent decades, experiments have shown that even anhydrous minerals can contain small amounts of water, but researchers were unable to determine the amount of water present. Now, David R. Bell and George R. Rossman of the California Institute of Technology in Pasadena have succeeded in measuring the water content in a broad group of important mantle minerals.

Bell and Rossman passed infrared light through thin mineral samples from the mantle. Bonds between oxygen and hydrogen absorb a specific wavelength of light, allowing the researchers to quantify the hydrogen content of a given sample. In the March 13 SCIENCE, they report that certain anhydrous minerals, called pyroxenes, contain small but significant amounts of water — between 200 and 500 parts per million.

Even such a minuscule amount could have important effects because pyroxenes make up between 30 and 40 percent of the mantle, says Bell. Using their findings, the researchers calculated how much water the mantle might hold. "We have something like 80 percent of the volume of the oceans of the world contained down there in these rocks," says Rossman.

The realization that such large amounts of water can reside in anhydrous minerals may help scientists understand the origin of the oceans, he says. Some theorists have suggested that Earth's water originally resided inside the planet and gradually escaped onto the surface through volcanic eruptions. Bell and Rossman's work shows which minerals could have stored the water and in what quantities.

Water in the mantle also plays an important role in determining where volcanoes form and how violently they erupt. "Water is probably the most important single constituent that affects the explosive behavior of volcanic eruptions," says John R. Holloway of Arizona State University in Tempe. The new studies of water in anhydrous minerals will help geoscientists understand the process that creates volcanoes, he says. — *R. Monastersky*

Nipple fluid flags breast cancer risk

One in nine American women will develop breast cancer at some time during her life. The most common malignancy affecting women, breast cancer killed almost 45,000 women in the United States last year alone. Unfortunately, physicians have no routine procedure for determining which symptomless women are at increased risk of this disease. But a team of San Francisco-area researchers has just reported results of a promising prognostic approach: painless extraction of sloughed-off breast cells.

"Someday this kind of approach is going to be enormously important," says Mary-Claire King, an epidemiologist at the University of California, Berkeley.

Beginning in 1973, epidemiologist Nicholas L. Petrakis of the University of California, San Francisco, and his coworkers began recruiting volunteers for a breast cancer screening survey. Over the next seven years, they attempted to siphon off small amounts of breast fluid from 2,701 white women, using a nipple aspirator similar to the breast pumps used by many nursing mothers.

In the breasts of adult women, even those who have never given birth, "there is some [fluid] secretion and reabsorption going on all the time," Petrakis notes. These secretions, which resemble the colostrum produced by new mothers, also harbor some cells from the tissue in which breast cancers form. Petrakis' team extracted a drop or two of these secretions from the nipples of most volunteers, none of whom was pregnant, lactating or suffering from breast cancer.

Between June 1988 and April 1991, the researchers tracked down and then surveyed 87 percent of the former volunteers, 104 of whom had developed breast cancer. Nearly all women age 55 or older during testing fit into the same cancer-incidence group, regardless of whether the researchers had been able to obtain breast secretions; only those whose secretions contained highly abnormal breast cells at the time of testing faced a higher risk of cancer.

However, a significant elevation in breast cancer appeared among volunteers under 55 who possessed extractable fluid, especially those whose secretions contained abnormal cells. Compared with younger volunteers whose breasts emitted no fluid, women whose sampled secretions contained even healthy cells faced a 6.4-fold increase in cancer risk. Younger women whose secretions showed hyperplasia (mild or moderately proliferating normal cells) faced 9.5 times the cancer risk of women not expressing fluid, and those whose cells appeared more precancerous (described as atypical hyperplasia) faced 16.3 times the risk.

These findings appear in the Jan. 15 AMERICAN JOURNAL OF EPIDEMIOLOGY, released last week.

Why should breasts with no extractable fluid be less prone to cancer? Higher levels of secretions may increase the exposure of breast tissue to cancer-fostering chemicals in the body, the researchers suggest. Biochemical tests they performed on extracted fluids showed that the secretions contain hormones, cholesterol and cholesterol-oxidation products. What's more, Petrakis says, secretions from "8 percent or so of the women came up positive in the Ames test," a bacterial assay to identify possible carcinogens.

But "having been a subject giving breast fluid from time to time, I know that sometimes you can get fluid and sometimes you can't," says King; so an inability to express fluid may not be "a lifelong feature." She also believes the current technique's sensitivity "is way too low" for clinical reliability: By not drawing from all breast-secretion ducts, it may miss many precancerous lesions.

The technique nonetheless offers "a very useful research tool," says David Thomas of the Fred Hutchinson Cancer Research Center in Seattle. — *J. Raloff*