Chemistry

Corinna Wu reports from Orlando, Fla., at a meeting of the American Chemical Society

Gels can give drugs a timely release

No one likes to get shots, but some drugs can't be swallowed. Stomach acid and enzymes break down proteins, including insulin and other hormones, which would also be poorly absorbed in the stomach because of their high molecular weight. Both doctors and patients would like to have ways to administer these drugs orally.

Emmanuel O. Akala, Pavla Kopeckov, and Jindrich Kopecek of the University of Utah in Salt Lake City have synthesized a biodegradable polymer that can work as a protective coating on pills, preventing the release of the drugs until they reach the large intestine.

The hydrogel takes advantage of the difference in acidity between the stomach and large intestine. The gel is unaffected in the stomach, but once it enters the less acidic large intestine, it takes up water and swells. "There will be an increase in the pore size of the hydrogel," Akala says, "so the drug diffuses out." The swelling is gradual, so the gel can pass through the small intestine to the large intestine before releasing large amounts of the drug.

Scientists are targeting the large intestine because "it's a less hostile environment" than the stomach, Akala says. Also, retention times there are long—between 15 and 64 hours—allowing plenty of time for drug absorption.

Contacts for aging baby boomers' eyes?

Some people say your eyesight is the first to go. You have to hold books and newspapers at arm's length to read them. When your arms get too short for that to work, there's no denying it: You've got presbyopia, more commonly known as far-sightedness. Contact lens makers recognize this fact of life and see a huge potential market in the aging baby boomer population. For most far-sighted people, however, lenses made according to current technology would be impractically thick.

Now, researchers in France are developing a way to address this limitation. Instead of shaping the lens to aid eyesight, Isabelle Calderara, a chemist at the contact lens maker Essilor in Créteil, and her colleagues have made a lens that focuses light with a graded refractive index. In other words, the lens' power to bend light rays changes from the center to the edge, a technique that can potentially be used to make more practical corrective lenses for far-sightedness.

The French researchers shine light on the building blocks of a polymer, causing them to link together. The more light, the greater the number of links and the denser the polymer. Density determines the polymer's refractive power, so shining different amounts of light on adjacent parts of the lens creates a gradation.

But one polymer isn't enough, Calderara says. To get the degree of light-bending needed, it's necessary to intertwine two different polymers in the same lens. After the first polymer is linked appropriately, Calderara and her colleagues add the building blocks of a second polymer, shine light on it, and create another network that penetrates the first. The second polymerization doesn't affect the first linked structure, but it must be carefully controlled or the lens will lose its flexibility.

"It's very exciting," says polymer scientist L.H. Sperling of Lehigh University in Bethlehem, Pa., who studies interpenetrating networks. "I'm always interested in new materials and new applications, and this is very different," he adds. Russian scientists did the same thing with solid polymers, he notes, but no one has done it in soft, hydrophilic polymers—materials used for contact lenses.

It's too early to say whether this technique will be used commercially, Calderara says. The next challenge, she says, is to see what range of lens powers they can make.

Science & Society

New laws rewrite rules on pesticides. . .

On Aug. 3, President Clinton signed into law environmental legislation designed to get around some inflexible language in the nation's primary food safety law. The controversial measure had prohibited residues of cancer-causing pesticides in processed foods if the residues were more concentrated in the final product than in the raw ingredients—even if the amounts in question posed no demonstrable health risk.

This portion of the Food, Drug, and Cosmetic Act, known as the Delaney clause, dates back to 1958, when technologies for detecting carcinogens picked up only gross contamination. As analytical methods improved, traces of pesticides began showing up more routinely—though often at levels below those considered to pose risks. This was especially true in many processed foods, such as oils extracted from seeds, which by their very nature require a concentrating of raw ingredients.

In the late 1980s, the Environmental Protection Agency decided to cope with the problem by allowing elevated pesticide residues in processed foods when the amounts posed a "negligible" cancer risk. This policy lasted only a few years, however—until a federal court ruled that EPA had no authority to interpret the law this way (SN: 5/15/93, p. 311).

Congress has now offered a permanent solution, instructing EPA to set identical pesticide residue limits for raw and processed foods. Moreover, the new Food Quality Protection Act says this strategy must be applied to setting pesticide limits to cope with all health risks, not just cancer.

The new law also directs EPA to consider the increased susceptibility of infants and children to certain health risks when it sets these pesticide residue limits—thereby addressing what the National Academy of Sciences had argued was a major flaw in the old law (SN: 7/3/93, p. 4).

Finally, the new act requires that within 2 years, EPA must develop a program to test pesticides for hormone-mimicking properties, to implement this program by 1999, and to report on its progress to Congress a year later. An agency briefing paper on the new law notes that this research program is "a high priority for EPA." It also acknowledges that Congress has assigned it "a very ambitious schedule," considering how little is known about the way pesticides emulate hormones (SN: 7/15/95, p. 44) or about the potential for synergy between environmental hormones (SN: 6/8/96, p. 356).

. . . and safeguarding drinking water

On Aug. 6, President Clinton signed the second major environmental bill to emerge from Congress—a reauthorization of the Safe Drinking Water Act. This new law increases consumer information by requiring municipal water suppliers to tell their customers what contaminants have been detected in their city's water and whether they pose a health risk. These facts are to be mailed in each household's bill.

Under the law, EPA must also promulgate new drinking water standards for radon, the nation's most dangerous drinking water pollutant (SN: 8/15/87, p. 105)—but not until the National Academy of Sciences reviews new research findings and reports back to Congress on the risks posed by waterborne radon. The law further instructs EPA and the Atlanta-based Centers for Disease Control and Prevention to study the risks posed by sulfates in water, with an eye toward imposing regulations by 2001 for this component of acid rain.

Also within 5 years, EPA must review new data on the health risks posed by arsenic in water (SN: 2/24/96, p. 119), then revise its drinking water standard for this bladder carcinogen. Finally, the law contains language similar to that in the new Food Quality Protection Act about developing a screening program within 2 years for hormone-mimicking contaminants in drinking water.