Chemistry

Richard Lipkin reports from Chicago at a meeting of the American Chemical Society

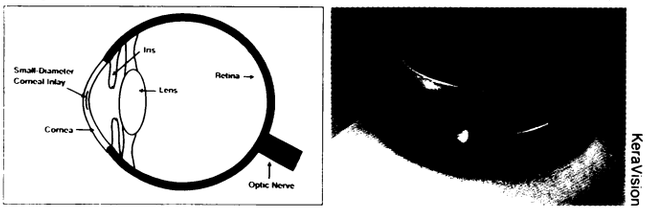
Focusing the soul's fuzzy window

Poets call the eyes the window of the soul. But when that window gets blurry, most souls prefer clarity without glasses.

Focusing on this problem are two advanced-materials companies, which are testing corneal implants for people who don't like glasses or contact lenses.

For those with presbyopia, which makes close-up focusing difficult, a tiny lens implanted in the cornea "acts like a bifocal," says Cary J. Reich, a chemist with Chiron IntraOptics, Inc., in Irvine, Calif. The cornea is the clear tissue covering the iris and lens of the eye. A surgeon inserts a wafer-thin lens, 2 millimeters in diameter, in front of the natural lens to help it focus on close objects. People with presbyopia, most of whom are over 45, struggle with reading because their natural lenses aren't as flexible as they once were. Thus, the implanted lenses act like a pair of reading glasses. The Small-Diameter Corneal Inlay, made of a soft, hydrogel polymer, will undergo clinical testing in the United States later this year, Reich says.

For myopia (nearsightedness), a small polymer ring reshapes the cornea and puts distant objects back into focus, says



Chiron IntraOptics

KeraVision

A corneal lens implant eases presbyopia (left), and a polymer ring flattens the cornea, correcting myopia (right).

Thomas A. Silvestrini, a chemist with KeraVision, Inc., in Santa Clara, Calif. The Intrastromal Corneal Ring, 7 millimeters in diameter, is inserted into the cornea's periphery, around the lens. By flattening the cornea, the ring sharpens distance vision without cutting into the central optical zone, he says. Testing of the ring in humans began overseas in 1991; a clinical study of 75 patients in three U.S. hospitals is now under way.

Both devices need further clinical evaluation and Food and Drug Administration approval before consumers can sign up for implants, the researchers note.

Sifting for junkyard treasure

That old junked Chevy may be an eyesore, but it's also a gold mine of recyclable materials.

The trick is in panning them out and cleaning them up, says Bassam J. Jody, a chemist at Argonne (Ill.) National Laboratory. Jody reports a new method for ferreting out seat cushion foam, recyclable plastic, and combustible chemicals from auto shredder residue and converting them into useful products.

Junked cars get ground up for their recyclable metals, leaving behind hundreds of pounds of waste – a nonmetallic stew of plastic, rubber, oil, glass, auto fluids, and fuels. The new recycling process first dries the residue, then sifts pieces for weight and size while extracting plastics with solvents. The result: clean foam, recyclable plastic, and fine particles. "The foam is perfect for products like carpet padding or cushion stuffing," says Jody. The plastics can be converted into oil or other plastics, such as polyvinyl chloride and polypropylene. And the fine particles mix well into cement. "Once we've extracted these solids, what's left is high-energy fuel, which can be mixed with coal or other solid fuels," he adds.

A 200-pound-per-day pilot plant to recycle old auto plastic will begin operating by year's end at Argonne, says Jody. For foam, another plant will go on-line in mid-1994. According to Argonne's own cost analysis, he adds, it will take about three years for these plants to pay for themselves.

Earth Science

Signs of success with CFCs

Monitoring stations around the globe have detected a substantial slowdown in the atmospheric buildup of the two prime ozone-destroying compounds. The measurements suggest that atmospheric concentrations of these chlorofluorocarbons (CFCs) will peak before the turn of the century and then start to decline, allowing the stratospheric ozone layer to begin the slow process of repairing itself.

The CFC measurements come from a network of sampling stations spread from Point Barrow, Alaska, to the South Pole. The data show that during the late 1980s the two most abundant CFCs, called 11 and 12, accumulated at a rate of 11 and 19.5 parts per trillion (ppt) per year, respectively. Since 1988, however, that rate has declined dramatically, says James W. Elkins of the National Oceanic and Atmospheric Administration in Boulder, Colo. In the Aug. 26 NATURE, Elkins and his colleagues report that the annual accumulation rate has dropped to 2.7 ppt for CFC-11 and 10.5 ppt for CFC-12.

The two compounds are used mostly in refrigeration, air conditioning, and foam insulation. Some manufacturers outside the United States use CFC-11 in aerosol spray cans, a practice banned in the United States in the late 1970s. Through a treaty called the Montreal Protocol, most nations have agreed to cease production and use of CFCs by 1996 and eliminate some other ozone-destroying chemicals at later dates.

Elkins says he was surprised to find a slowdown in CFC accumulation during the late 1980s, even before the limits under the Montreal Protocol took effect. However, companies that manufacture CFCs have reported that they did reduce production of such chemicals in the late 1980s, in response to decreased demand.

Past studies have indicated that it would take 50 to 100 years for reactions in the atmosphere to reduce the concentrations of ozone-destroying chlorine and bromine back to natural levels. Such chemicals will continue to erode the global ozone layer and open up an ozone hole over Antarctica for decades, says Elkins.

El Niño weakens in Pacific

The El Niño warming that wouldn't go away last year is finally showing signs of packing its bags, according to an advisory issued last month by the U.S. weather service's Climate Analysis Center. But having been fooled last year by similar developments, forecasters hesitate to say that the current El Niño has gone for good.

El Niños develop once or twice a decade when a huge pool of warm water spreads across the equatorial Pacific and the normal westward-blowing winds weaken. Such changes reroute typical air-circulation patterns and upset weather around much of the globe.

The recent El Niño started in 1991 and seemed to have run its course by mid-1992, prompting predictions of a return to normal or even cooler-than-normal conditions by year's end. However, the warming regained strength during the second half of 1992 and the first half of 1993. Because El Niños shift heat and moisture eastward from the western Pacific, the warming's resurgence last year dried out Indonesia and brought heavy rains to South America's Pacific coast this year. It also played a role in blocking the rains that normally wash northeast Brazil from February through May, says Vernon E. Kousky of the Climate Analysis Center.

Hints of the El Niño's imminent departure appeared in July when sea-surface temperatures started dropping in many parts of the tropical Pacific. As yet, however, the winds and atmospheric pressure in the Pacific have not returned to normal, making meteorologists leery about forecasting an end to the current El Niño.