CHEMISTRY

Ceramic bones and glass 'glue'

Ceramics and glass are being used to replace damaged bones and may, in the future, prevent some limb amputations. University of Florida chemist Larry L. Hench described one such novel material, "bioglass," to a recent American Chemical Society symposium on ceramics.

Bioglass is much like regular window glass, but contains calcium and phosphorus. Those mineral additives are also the principal elements in hydroxyapatite, one structural component of bones. Bioglass has been used successfully to fuse living bone to artificial hip joints in sheep, leg bones in dogs, teeth and jawbones in baboons and middle ears in cats. Human trials are underway in Europe, and U.S. trials will start soon.

The artificial implants are often made of a microporous ceramic called alumina, and, in Hench's tests, are coated with bioglass. Remaining healthy bone tissue reacts with the coating as it grows and invades the alumina pores. The reaction stops eventually, and leaves in its place a strong, mineralized bond between the implant and the living bone.

The invasive bone and mineral layer make so strong a bond that long bones such as tibias and femurs might be replaced and perform well. Such artificial replacements, if they prove safe and reliable, could save limbs normally amputated due to a damaged or diseased segment.

Old Bell invention, new Bell studies

A technique invented 100 years ago by Alexander Graham Bell is being plugged in, so to speak, to some modern investigations. The technique—photoacoustic spectroscopy—is fairly simple: Tiny microphones inserted into cells convert internal pressure changes caused by flashes of light into sound waves and thence, into electrical signals. The pressure changes reflect the amount of light absorbed and are thus a good measure of internal composition.

Bell Laboratories chemist Allan Rosencwaig, using the technique, measured skin changes in newborn mice that may be related to the aging process. He described his results to the American Chemical Society meeting in Akron, Ohio. The technique has also been used to measure the composition of blood, leaves and human corneas.

Aflatoxin found in U.S. man's liver

Aflatoxin poisoning may not be just a Third World problem after all. Aflatoxins are chemicals produced by certain molds as they grow on stored foods. The most common and potent, Aflatoxin B_1, is often found in moldy peanuts and has been linked to cancers and other diseases. Such poisonings are thought limited to societies with primitive food storage methods or where moldy nuts are eaten. But now, it seems, aflatoxin has turned up in the liver tissue of a man from Missouri.

Three biochemists from Columbia, Mo., Dannie L. Phillips and David M. Yourtee of the Cancer Research Center and Scott Searles of the University of Missouri, examined liver biopsy tissue from a man with liver and rectal cancer. Their purpose, coincidentally, was to study aflatoxin breakdown in liver tissue, so they added a few micrograms of commercially prepared toxin to each of several experimental samples. To their surprise, aflatoxin turned up in control samples, too—an indication that the man's liver contained the toxin all along. He mainly had eaten homegrown and canned foods, plus some commercial foods. Perhaps, the team suggests in the May TOXICOLOGY AND APPLIED PHARMACOLOGY, aflatoxin contamination is more widely spread than previously believed, even in countries with modern food storage.

ASTRONOMY

Interstellar cyanodiacetylene

The organic chemistry of interstellar space gets heavier and heavier. The latest and heaviest compound found is cyanodiacetylene, which has a molecular weight of 75. It appears in the famous cloud Sagittarius B2, and was detected by L. W. Avery, N. W. Broten, J. M. MacLeod and T. Oka of the Herzberg Institute of Astrophysics in Ottawa and H. W. Kroto of the University of Sussex in Brighton, England. They used Canada's Algonquin Park Radio Observatory (ASTROPHYSICAL JOURNAL 205:1173).

Beside its heavy weight, cyanodiacetylene has yet another superlative. Its structure has a hydrogen atom at one end, a nitrogen at the other and a chain of five carbons between. "The chain of one nitrogen and five carbon atoms contains more heavy atoms than any other molecule previously observed . . .," the discoverers note.

The discoverers also point out that cyanodiacetylene is getting into the molecular weight range where organic chemistry starts to slip into biochemistry. Glycine, the simplest amino acid, has the same molecular weight. "Unfortunately its microwave spectrum is unknown," so radio astronomers can't search for it. Still, the presence and abundance of cyanodiacetylene tend to suggest that many types of heavy molecules may exist in Sagittarius B2.

The sun's forever blowing bubbles

Cosmic rays arrive at the earth in about the same amounts from all directions. This implies that they must undergo a lot of scattering and direction change along their way because otherwise their distribution would allow us to pinpoint their sources. The scattering is generally held to be done by magnetic fields in interstellar space.

For cosmic rays with energies above 100 billion electron-volts, R. F. Flewelling and F. V. Coroniti of the University of California at Los Angeles suggest magnetic bubbles blown by stars (ASTROPHYSICAL JOURNAL 205:L135). The sun ejects such bubbles, regions where the magnetic field lines curve around to form closed spheres rather than extending more or less radially away from the sun, during large flares. The bubbles are convected away by the solar wind and expand till their dimensions are millions of kilometers. Eventually they form a wake behind the sun. Other stars ought to blow similar bubbles, and if enough of them are floating around the galaxy, they make good scatterers for the high-energy cosmic rays.

Planetary radio sources

The earth, Jupiter and Saturn all emit bursts of radio waves which seem to be related to the planets' magnetospheres. In the May 27 NATURE, C. F. Kennel and J. E. Maggs of the University of California at Los Angeles argue that though each planet's bursts come in a different frequency range, the mechanism that produces these "magnetospheric radio bursts" is essentially the same in each case, depending on an interaction between the planet's magnetosphere and the solar wind.

On that basis, they derive an equation that should allow them to calculate the intensity of such bursts for any planet with a magnetosphere, provided they know the relevant characteristics of the planet's magnetosphere and the solar wind at the planet's distance from the sun. They then calculate whether such bursts from Uranus and Neptune might be observable radio-astronomically from the earth. The conclusion is that Uranus's and Neptune's bursts would be too weak to be detectable through the earth's own radio noise. But Kennel and Maggs suggest that a spaceprobe away from the earth might find them.