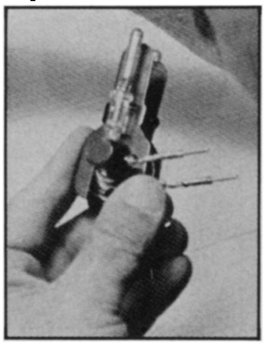
CHEMISTRY

Studying life with synthetic leaves

It was hard enough getting used to "biometrics," "bionics" and "bioengineering." The interfaces between life and math, electricity and engineering at first seemed so *implausible.* (These connections, however, have turned out to be both plausible and important.) Now there's another such field—"biomimetics"—



mimicking biological systems with mechanical analogs in order to study biochemical processes. One promising analog is the mechanical leaf.

Chemist Joseph J. Katz and colleagues at Argonne National Laboratory have constructed a synthetic leaf to study the exact biochemical workings of chlorophyll molecules during photosynthesis. Each "leaf" is small enough to fit in one's hand and contains two compartments separated by a plastic, semipermeable membrane. One compartment is filled with an oxidizing agent, one is filled with a reducing agent and the membrane is impregnated with chlorophyll molecules linked to water. (These chlorophyll-water "adducts" are considered to be the normal form of much naturally occuring chlorophyll.)

So far, according to the Feb. 16 CHEMICAL AND ENGINEERING NEWS, the team has learned new details about "antennae chlorophyll." These are molecules that capture light energy and transfer it to specialized chlorophyll molecules that, in turn, convert electrical energy to chemical energy. The mechanical chlorophyll system, the team also learned, makes chemical species that are similar, if not identical, to those made by living systems. Although there is interest in such devices as potential solar energy converters, the report states, the main value of the Katz biomimetic leaf right now is basic understanding.

Cyclamates: A tentative OK

It is a logical impossibility to prove that cyclamates can never cause cancer. But indications are that the artificial sweetener is not a human cancer agent. So states a subcommittee of the National Cancer Institute in a recent report. Seven well-respected scientists, led by Mayo Clinic pathologist Arnold L. Brown, finished reviewing evidence on the carcinogenicity of cyclamates early this year. Cyclamates were banned by the Food and Drug Administration in 1969 due to evidence of tumor formation in laboratory rats. But contradictory evidence has appeared regularly since then, much of it generated by Michael Sveda, the chemical's creator. The National Cancer Institute therefore directed the subcommittee to review all the data and report to the FDA.

Present evidence, the committee concludes, does not establish the carcinogenicity of cyclamate or its principal breakdown product, cyclohexylamine, in animals. There was evidence of bladder tumor formation in some test animals, but not a statistically significant amount, they state. This, combined with a paucity of epidemiological data on human cancers and cyclamates, makes a definitive statement impossible. But the chemicals "at worst *may* be weakly carcinogenic in animals." Animal tests designed to ferret out even the smallest (statistically significant) detectable incidence of tumor formation would require a whopping 51,968 animals and cost $8 million to $10 million, they estimate. And even then, a *negative* result still could be questioned.

Sveda and cyclamate producer Abbott Laboratories would like to see the ban lifted. Officials of the FDA are now reviewing the report before deciding on possible regulatory action.

PHYSICAL SCIENCES

Heavy ions: Damped collisions

Experimenters who concern themselves with the reactions that occur when accelerated heavy ions (essentially atomic nuclei) strike other atomic nuclei, have recorded a number of surprises. What they seem to have expected was that projectile and target would fuse into a new nucleus and this nucleus would then break up (fission) according to its own internal dynamics. What they seem to be finding is that mostly less intimate unions take place. Lately, for projectiles ranging from oxygen to krypton, as mostly fusionless coming together called "strongly damped collision" has been reported.

The heavier the ions, the less interpenetration there seems to be. The results of the first studies in which the accelerated ion was xenon 136 appear in the March 8 PHYSICAL REVIEW LETTERS (W. U. Schröder, J. R. Birkelund and J. R. Huizenga of the University of Rochester; K. L. Wolf and J. P. Unik of Argonne National Laboratory and V. E. Viola Jr. of the University of Maryland). The target was bismuth 209. The data are dominated by strongly damped collisions in which the two nuclei cling together, but do not actually fuse. When this intermediate stage comes apart, the products "remember" more or less their initial charges and masses, as well as their direction of motion. Although there is no real fusion, while the two nuclei cling together some of the energy of motion is translated into internal energy of the system, and some nucleons are exchanged between the two nuclei.

A supernova waiting to happen?

The celestial object called Eta Carinae has a complicated structure. It falls into three parts: a very bright central object that doesn't quite look like a star; the "homunculus," a bright reddish-orange nebulosity; and the outer shell, composed of fainter matter outside the homunculus extending as far as 25 seconds of arc from the central object.

Nolan R. Walborn of the Cerro Tololo Inter-American Observatory in Chile has done a study of the outer shell of Eta Carinae with the observatory's 4-meter telescope. He reports in the ASTROPHYSICAL JOURNAL (204:L17) that some of the features of the outer shell have increased their distance from the central object since 1949. These bear resemblance to certain flocculi seen in the supernova remnant Cassiopeia A, which some astronomers believe is matter ejected by the presupernova, the star that existed before the explosion. It has been suggested that Eta Carinae is a presupernova, and Walborn proposes that the changes he finds may be the same sort of presupernova ejections.

The particles in Saturn's rings

The size, shape and exact nature of the particles in Saturn's rings remain open questions despite centuries of observations. A recent study of brightness variations of two of the rings by Kari Lumme and William M. Irvine of the University of Massachusetts (ASTROPHYSICAL JOURNAL 204:L55) may throw some light on part of the mystery.

They studied 70 plates of the planet belonging to New Mexico State University taken between 1969 and 1975. They found that the reflectivity of the A, or outermost, ring varies according to where the particles are in their orbit, but that of the B ring does not. The simplest explanation, according to Lumme and Irvine, is that the A-ring particles rotate with a period locked to that of their orbital revolution around the planet. This would place constraints on their size and structure. It seems also that the particles in the A ring differ in average properties from those of the B ring.