Science at the AAAS

From our reporters at the annual meeting of the American Association for the Advancement of Science in Houston

Shock treatment and diet

Joel S. Milner of Western Carolina University in Cullowhee, N.C., mentioned to a friend last year that his recent research showed that electroconvulsive shock decreases food intake in rats. The friend, who works in a psychiatric hospital with ECS-treated patients, was surprised: His patients seemed to eat all the candy and junk food they could get after shock treatment. Milner's most recent work, with Michael J. Prewett of East Carolina University School of Medicine in Greenville, N.C., may be the answer to his friend's puzzlement.

Milner found that a single ECS treatment can produce drastic and chronic changes in an animal's ability to select a proper diet — to the point of malnutrition.

Rats were allowed to select a diet from pure sources of carbohydrate, protein and fat. Twenty rats were chosen that could maintain a steady body weight and a constant intake of each of the three kinds of food. The day following ECS, however, protein intake dropped from 12.55 calories to 7.56 cal. and declined steadily during the 18-day test period to 4.23 cal. Carbohydrate intake, on the other hand, dropped slightly for two days after ECS, but rose and remained high. Fat intake increased slightly. The rats' weights fell steadily for 10 weeks after shock treatment and two animals died from malnutrition.

Little is known of the biochemical and physiological effects of ECS; Milner suggests only that "one or more internal mechanisms may have been altered."

Bacterial upheavals

A convent and school and 40 other buildings in Pittsburgh, Pa., were severely damaged when the bedrock on which they were built began to expand. Buildings in Cleveland, Ohio, and Ottawa, Canada, built on a similar type of shale, were damaged the same way. But at the White Pine Mine in Michigan, where the bedrock is nearly identical to that in Ohio and Pennsylvania and where such a problem could have disastrous effects, expansion does not occur.

The difference, says Emmy Booy of the Colorado School of Mines, is bacteria. *Thiobacillus ferrooxidans* munch the pyrite found in shale and excrete sulfuric acid. Sulfuric acid, in turn, reacts with lime in the rock to produce gypsum crystals. As the bacteria carry on, more gypsum crystals grow, exerting pressures as high as 10,000 pounds per square inch and causing the rock to heave and expand.

Michigan's bedrock, it seems, isn't quite right for the bacteria — the pH of the groundwater is a bit too basic and the ground temperature too cold. Unfortunately for eastern North America, however, the conditions are near perfect for *T. ferrooxidans* — pH 3 and 30°C. It's just something else to worry coal miners.

Sperm in the freezer

As sperm preserved by freezing are becoming more widely used in artificial insemination, clinicians are discovering advantages and peculiarities of the procedure. Freezing is desirable to allow time to test donated semen for disease-causing microbes and to provide physicians with a wider selection of donors. Armand M. Karow Jr. of the Medical College of Georgia now reports that semen freezing has the added advantage of decreasing incidence of birth defects and spontaneous abortions. He suspects freezing the semen kills abnormal spermatozoa. A study of several hundred pregnancies, initiated by thawed sperm, detected spontaneous abortions in less than 8 percent of the cases and congenital abnormalities in less than 1 percent of the births. In contrast in the general population, Karow says, spontaneous abortions end 10 to 15 percent of pregnancies and congenital abnormalities occur in 6 percent of infants at birth. Karow also points out that a peculiarity of artificial insemination is that both fresh and thawed sperm tilt the sex ratio of births. In the general population, 51 percent of newborns are male, but among those resulting from artificial insemination, 60 percent are male.

At present, sperm freezing preceding vasectomy is not useful as a general family planning scheme. Karow says that sperm from only about 15 percent of donor candidates adequately survive freezing to initiate pregnancy. Investigators do not yet know what characteristics distinguish those hardy sperm. However, few men among those who undergo voluntary sterilization express interest in freezing semen, Karow says.

Life in the deep ocean

Life in the deep ocean has long been thought to be limited by low food supply. Deep-water species, for example, have much lower oxygen consumption rates and about one-third the metabolic energy (in terms of caloric value by body weight) of their shallow-water cousins. But when James J. Childress and co-workers at the University of California at Santa Barbara began collecting deep- and shallow-water species, they found an apparent paradox. The deep dwellers have higher and more constant growth rates, grow larger and live as long as the shallow-water species.

The paradox is resolved by the greater growth efficiencies of the deep-water animals. Moreover, Childress says, their efficiency comes from putting off reproduction until the ends of their lives. By not consuming energy by reproducing at midlife, more energy is available for growth. Such strategy is unusual in the animal world because it risks lower egg production and reduces chances for multiple reproduction. But it is an appropriate adaptation to the deep ocean, Childress says, because it takes advantage of the stable, unchanging environment where such risks become negligible.

From culture to corn

Going from a plate of cells to a plantlet is a major hurdle in applying new approaches in genetic modification to economically important crops. Until recently, for no major crop could scientists grow tissue in the laboratory and then regenerate the whole plant. However, maize has now been boosted over the regeneration barrier: Cells from three different maize tissues have been grown into plants.

The first maize regeneration, achieved by researchers at the University of Minnesota, used cells derived from immature embryos. But a corn embryo is a relatively inconvenient source of cells. Now Phillip N. Gordon of Pfizer Central Research in Groton, Conn., reports that he and co-workers have succeeded in using tissues also from 14-day-old seedlings and from tassel flowers. The trick is to choose among the proliferation of cells on the laboratory plate tissue of a particular type. When Gordon reduces the concentration of auxin in the cell medium, some of the tissue grows to resemble physically the tissue culture growth of scutellum — the interface that surrounds a plant embryo and converts a seed's stored food into a form useful to the embryo. That scutellar-like tissue, whether derived from immature embryo, seedling or tassel, grows into viable plantlets. Gordon hopes this regeneration procedure — visually selecting, isolating and growing appropriate cultured tissue — will spring all varieties of corn, other cereal species and even soy over the tissue culture regeneration hurdle. The next challenge, Gordon says, is to get expression at the cellular level of traits that can be related to agronomically important plant traits.