CHEMISTRY

Julie Ann Miller reports from Miami at the meeting of the American Chemical Society

Liquid protein: Damage by omission?

Low levels of essential nutrients, rather than a specific toxic component, are suspect in the deaths of dieters using liquid protein products (SN: 7/29/78, p. 70). Two teams of Food and Drug Administration researchers report chemical analyses of liquid protein products collected throughout the United States. Erich Grundel and co-workers find that the diet constituents do not agree with the manufacturer's claims. The individual amino acids present vary from totally absent to four times the amount claimed on the label. And some carbohydrates (and thus calories) are detectable in most samples. Dieters following the label instructions ingest only low levels of toxic elements (arsenic, cadmium and lead) compared with typical diets or World Health Organization limits, according to research by Ann O. Lee Jones and colleagues. However, the level of the essential elements calcium, magnesium, phosphorus, iron, zinc and copper is also extremely low. "The results show that use of these predigested liquid products as a sole source of nutriment results in inadequate intake of most of the essential minerals. Eventually severe multi-elemental deficiencies would occur if these products were consumed without adequate mineral supplements," Jones says.

Chemical plants for the moon

While only a dozen people have been to the moon, scientists are already envisioning turning that heavenly object to production. Robert D. Waldron of the Lunar and Planetary Institute in Houston reports an ongoing study investigating the requirements for chemical plants on the moon or in orbit to process lunar ores and soils to refined metals, silicon, oxides and oxygen for industrial use. Although Waldron sees some potential for using moon-processed materials back on earth, the main role of such a project would to supply materials for activities requiring large structures in orbit. For example, the moon materials could be used in solar power satellites and in equipment for communications, military and weather forecasting or modification projects. Moon production could save the greater energy required for lifting a mass off the earth instead of off the moon.

Waldron's study predicts that a moon chemical plant with one shuttle load (thirty tons) of material from earth could produce thirty tons of output material per week. That estimate includes just the chemical processing, he points out, not any later manufacturing steps or life support materials for moon staff. Predictions of the productivity of moon industry must consider a variety of constraints. Only seven chemical elements are present on the moon in usable amounts. New methods of extraction must be developed since hydrogen and water will not be available, unless they are brought from earth. (There will certainly be a need to recycle water and other materials originating from earth.) And artificial gravity will be required for most operations. "The ground rules will surely be different," Waldron says. He suggests successful processes may use techniques that would not work on earth. But Waldron foresees no expenditure of effort toward the details of building processing plants on the moon for at least ten to fifteen years.

Smuggling aspirin past the stomach

Aspirin maintains its sterling reputation for effective control of many symptoms, including fever and edema. But its overall value is tarnished by a serious side effect, gastric ulcers. Now aspirin is being snuck through the stomach in experiments at Abbott Laboratories in Montreal and North Chicago. Gerard Y. Paris and co-workers disguise the drug by attaching it to a triglyceride containing two fatty acids. The triglyceride, with its aspirin cargo, slips past the stomach and aspirin is liberated only after reaching the blood. In animal experiments, an oral dose of aspirin triglyceride has essentially all the systemic activities associated with the free drug, but does not cause stomach ulcers, Paris says. Because the triglyceride with an "unusual" acid (aspirin) in the middle position appears to follow natural triglycerides' metabolic pattern, Paris suggests synthetic binding of other drugs may also be feasible.

Liver enzymes as poisoning antidote

Components of the liver are being considered in a novel therapy for drug overdose. Currently, stomach pumping saves many poisoning victims, but once a drug is absorbed in the bloodstream only hemodialysis (washing the blood) can remove it. Hemodialysis is an expensive process available only at large medical centers. Peter Kastl of Tulane University is now developing a therapy that he believes could become available in the most rural doctor's office.

Kastl puts "essence of liver," the small pieces of liver endoplasmic reticulum called microsomes, in the hollow fiber device currently used as an artificial kidney dialyzer. The liver enzymes convert drugs in the blood to harmless molecules that diffuse back into the blood and are eventually excreted. This technique specifically breaks down the dangerous molecules, instead of removing a wide variety of small molecules as in dialysis. The liver microsomes, which are obtained from animals, remain in the fibers of the device, so they never enter the patient to cause an immune reaction.

Kastl and colleagues have used the microsome-containing device to remove drugs from human plasma in a preliminary simulation of emergency treatment. They used microsomes that had been freeze-dried and had not lost activity over a three-month period. A chemical regeneration system prevented depletion of NADPH, the energy molecule required for detoxification in the liver. Although the effectiveness of removal was only half that of conventional hemodialysis, Kastl feels the system shows substantive promise. The next experiment will be to poison and then treat a dog. "This is the first time any portion of the liver has been used," Kastl says. He believes his approach may be the first step toward an implantable artificial liver.

Everglades pollution low

Much of the winter vegetable crop in the United States comes from drained fields adjacent to the Everglades National Park in south Florida. The U.S. Department of Interior is concerned about contamination of the parklands by pesticides and by plasticizers from sheeting rolled out between the crop rows to reduce weed problems. Because the sheeting is usually burned or plowed into the soil after use, there is special concern about spread of polychlorinated biphenyls (PCB's) into the park.

Adolfo G. Raquejo and co-workers at the Miami Ocean Chemistry Laboratory of the National Oceanic Chemistry Laboratory of the National Oceanic and Atmospheric Administration analyzed soil collected in the park and in the farmlands to the east.

The researchers find pesticides (chlordane, DDT and its metabolites) in the active agricultural areas, but little spread into the national park. The PCB's, while ten times lower in concentration than the pesticides, show more widespread dispersal. But the spread of the plasticizers appears to be mainly in the northwest direction, away from the park. Raquejo proposes PCB's are dispersed after burning, by the wind. "It is clear that the levels [of pollutants] found in the park are as low as any site in North America," Raquejo says.