Biomedicine

ATP: The finger in the dike

Enzymes leak out of cells that have been damaged by viruses, toxic chemicals, trauma, lack of oxygen, cancer or other factors. The leakage may occur because the cells fail to synthesize ATP in adequate amounts, J. H. Wilkinson and Jean M. Robinson of the Charing Cross Hospital Medical School report in the June 14 NATURE. ATP is cells' major energy molecule.

In an attempt to devise a model to study factors affecting the liberation of cell enzymes, the London chemical pathologists recently studied the effects of phospholipases on enzyme release in rat and human white cells. In those experiments, the porosity of the cell membrane was increased, leading to the outpouring of enzymes. They then turned to investigating the actions of a number of substances that might protect the cell against the effects of phospholipases as judged by a reduction in the leakage of the enzyme lactate dehydrogenase. One of these was ATP.

"The protective effect of ATP . . .," they conclude, "is consistent with the view that maintenance of cell membrane integrity is associated in some way with the energy content of the cell. This indicates that any condition that leads to a diminution of intracellular ATP is likely to result in leakage of enzymes and other proteins."

Coffee creates anxiety

A 37-year-old male was referred to a psychiatric outpatient clinic with a history of "chronic anxiety." Symptoms included dizziness, tremulousness, apprehension, frequent diarrhea and difficulty falling and remaining asleep. Three complete medical workups revealed nothing, and various drugs gave no relief during a 10-month period. Finally, when questioned by a physician, the patient reported consuming at least 14 cups of coffee and three or four colas per day plus a bedtime cup of cocoa. Total caffeine intake was about 1,200 mg per day (250 mg is considered a large dose).

This case was reported at the recent meeting of the American Psychiatric Association by John F. Greden of Walter Reed Army Medical Center. Greden was warning of the dangers of undiagnosed caffeinism. When the patient reduced his intake of caffeine for four weeks, his anxiety went away.

The making of an antibody

Five kinds of human antibodies (immunoglobulins) are now known—IgG, IgD, IgE, IgA and IgM. Each antibody comprises from 4 to 20 polypeptide chains. The biggest antibody, IgM, is star-shaped. Each arm of the star contains two heavy polypeptide chains and two light polypeptide chains. As if this structure weren't confounding enough, still another polypeptide chain was recently discovered to be stuck onto IgM. It's called a J chain.

The J chain becomes attached to IgM during its assembly, specifically to the two heavy chains in each arm of the star. But where on these chains exactly? Jiri Metstecky and Ralph E. Schrohenloher of the University of Alabama wanted to find out.

They report in the June 14 NATURE that the J chain and the heavy chains are connected by a disulfide bridge between cysteine amino acids on the J and heavy chains. Exactly how this chemical connection might help the J chain organize the IgM molecule into a star remains to be determined.

Aerospace

Aircraft operation near terminals

A "blind" second cockpit filled with advanced instrumentation has been built into the passenger section of a Boeing 737 jetliner, in a study of aircraft operations near airports.

Data displays from the windowless, rear cockpit will be provided in the forward cockpit so that the regular pilot can take over in the event of a problem, but it will be possible for the rear crew to make completely automatic approaches from their own flight deck. In addition, a variety of experimental techniques and equipment will be evaluated, including electronic displays, flight controls, guidance systems and airport-vicinity operations procedures.

NASA, which calls the plane its TCV (Terminal Configured Vehicle—everything the space agency touches turns to jargon), plans also to use it in human-factors studies such as pilot workload and crew interaction. The overall TCV program covers the aircraft end of a broad air operations research program for which the Department of Transportation and the Federal Aviation Administration are working on the ground equipment and air-traffic-control procedures.

Putting the heat to Helios

Helios, a space probe scheduled to go closer to the sun than any other manmade object ever launched, has successfully survived a ground test that exposed it to temperatures believed to be as high as any it will face during its mission.

In a vacuum chamber at Jet Propulsion Laboratory, a battery of mirror-focused xenon arc lamps poured out energy equivalent to 11 times the solar intensity at the outer edge of earth's atmosphere. At the same time, the probe was spun at 60 revolutions per minute to distribute the heat load, just as it will be distributed in flight. During the test, parts of the spacecraft reached—and survived—temperatures up to 700 degrees F. Helios, to be launched in October, will pass within 28 million miles of the sun.

Mercury probe heads for daylight

The choice has been made. When the Mariner 10 spacecraft comes around on Sept. 21 for its second encounter with Mercury, it will fly by the planet's sunlit side, rather than taking the night flight as it did on its first flyby in March.

The other option would have been a darkside pass to provide additional data on the interaction between the solar wind and Mercury's previously unsuspected magnetic field. The sunside pass will enable television photography of the planet's south polar region, not covered in the first encounter, as well as providing better viewing angles of some areas already photographed to study the height of surface features, reflectivity and other characteristics.

Another important factor in picking the sunside route was that it will enable a third encounter in late March of 1975, during which the darkside studies can be carried out. Doing the darkside pass first would not allow the third encounter, says Mariner project scientist James Dunne of Jet Propulsion Laboratory.

Mariner will fly past the planet at a distance of about 47,360 kilometers in the September encounter, yielding photo resolution of about one kilometer. The initial encounter came to within 689 km. of the surface, giving 100-meter resolution, but the greater distance is desired on the second pass to give the cameras more time at their closest approach. The 1975 encounter will be "as close as we can make it," says Dunne, and certainly less than 1,000 km.