BIOMEDICINE

Joan Arehart-Treichel reports from Charleston, S.C., at the American Heart Association's 9th Science Writers Forum

Progress in heart transplants

Although the survival rate from heart transplants has not been nearly as high as that for kidney transplants (SN: 11/16/74, p. 314), it appears to be improving. For instance, surgeons at Stanford University Medical Center—one of the world's leading heart transplant centers—have performed heart transplants on more than 200 patients over the last 12 years. Of these, 75 percent have lived one year, and some up to 10 or 12 years. Even better survival rates can be expected in the future, Bruce Reitz, one of the transplant surgeons, says, because of the use of cyclosporin A, which destroys T lymphocytes (the cause of organ rejection) but not other immune fighters (SN: 10/24/81, p. 263).

Reitz and his colleagues are also "cautiously optimistic" about the heart-lung transplants that they have performed on six patients with terminal heart-lung disease due to congenital heart disease or some other causes (a patient group that is considered at even greater risk than the heart transplant group). Five of the six patients are alive, with survival thus far up to 10 months. This success, Reitz explains, is due to his team's extensive experience with heart transplants, ample lab experimentation and the use of cyclosporin A on these patients.

Although the Stanford transplant surgeons are not planning to do any lung transplants alone, transplant surgeons at some other centers are. If lung transplants should eventually lead to long-term survivals, they might possibly benefit patients with diseases like emphysema and cystic fibrosis, Reitz conjectures.

High blood pressure and the CNS

Although high blood pressure is a leading cause of death in modern industrial societies, little has been known about the areas of the central nervous system responsible for its development. Two areas that may be responsible, however, appear to have been identified by Michael J. Brody and co-workers at the University of Iowa College of Medicine in Iowa City. They are the hypothalamus (the executive hormonal switchboard below the brain) and the amygdala (part of the limbic system, or more primitive area of the brain).

When a particular area of the hypothalamus called the AV3V region was removed in animals, it prevented high blood pressure due to angiotensin (a hormone known to cause high blood pressure in kidney patients) or to dietary salt (a contributing factor to high blood pressure in humans), Brody and his colleagues have found. But such removal did not affect high blood pressure due to inheritance. However, they then found that inherited high blood pressure in animals depends on the amygdala. They are now exploring which areas of the central nervous system are responsible for stress-induced high blood pressure.

Why a nerve switches loyalties

There is increasing evidence that nerve cells can not only make more than one chemical transmitter (SN: 11/29/80, p. 342), but change from secreting one to another. Yet what allows a nerve to make such a switch? David D. Potter and his team at Harvard Medical School in Boston may have the answer. They have found that muscle cells in the heart, as well as some other non-nerve cells, release a substance that causes developing cells of the sympathetic nervous system to shift from making the neurotransmitter norepinephrine to making the neurotransmitter acetylcholine. The researchers are now attempting to identify the substance. Preliminary findings point to a medium-sized protein (about 45,000 molecular weight) with some sugars attached.

PHYSICAL SCIENCES

Dietrick E. Thomsen reports from San Francisco at the meeting of the American Physical Society and the American Assoc. of Physics Teachers

Changing the monopole game

Magnetic monopoles have been the object of repeated searches by physicists even though the majority of physicists have probably had trouble believing in their existence. Monopoles would be single magnetic poles existing independently, a north-seeking or south-seeking pole standing alone. Observed magnets all possess at least one pole of each of the two varieties.

Observation to the contrary, several decades ago P.A.M. Dirac worked out a theory that predicted the existence of monopoles. What Dirac had predicted many experimenters thought worth searching for, but repeated efforts over many years have turned up nothing.

Physicists were resigning themselves to the nonexistence of monopoles when along came the grand unification theory, the attempt now going on to put together all of particle physics into one theoretical framework, one theory to explain everything. To achieve grand unification, theorists find they need the existence of magnetic monopoles, but the repeated failure to find them in the past gives the subject an aura of futility.

James Trefil of the University of Virginia now suggests that the differences in properties between the magnetic monopoles predicted by Dirac and those predicted by the grand unification theory could mean that previous experiments, which were designed to find Dirac monopoles, could not have found grand unification monopoles. The latter, therefore, may yet exist.

A magnetic monopole of either variety would be very strongly charged. It would generate electromagnetic fields more than 60 times as strong as those generated by the proton. A Dirac monopole would thus lose energy very rapidly by ionizing the matter it passed through, and so it would soon come to a stop and be captured. If the monopole got caught in this way by something that became part of the geologic stratum, it would persist for millions or billions of years and be there for the proper kind of chemical analysis to find. Many monopole searches have proceeded on this assumption.

Trefil points out that grand unification monopoles would be much more massive than Dirac monopoles. Their mass would be about 10^{15} times that of the proton or about the mass of the human blood cell. Given similar amounts of energy as Dirac monopoles, particles of this weight would travel far more slowly. Trefil shows that they would therefore lose less energy ionizing matter and be less likely to stop. This kind of monopole could go through the earth without being captured. Trefil suggests new procedures in the search.

Quantum mechanics of blood

Quantum mechanics explains the behavior of atoms. That is, it does if you can solve the equation. To use quantum mechanics in biological molecules requires the best modern computers to keep track of things.

The combination of computer calculated theory and experiments with lasers is leading to new understanding of important biological processes, according to Ahmad Waleh and Gilda H. Loew of the Molecular Theory Laboratory of Rockefeller University in Palo Alto, Calif. They have calculated all the electronic states in the photodissociation of the bond between oxygen or carbon monoxide and hemoglobin or mioglobin, as the oxygen or carbon monoxide moves farther and farther away from the heme protein. Photodissociation, the breaking of the bond by absorption of light, is not the way it happens in the blood stream, but a study of the differences between the electronic states found in the photodissociation of oxygen and carbon monoxide may help explain why oxygen competes successfully with carbon monoxide in the actual biological process.