Myasthenia gravis: Cleansing the blood

Many people got their first glimpse of the debilitating effects of myasthenia gravis in a wirephoto of Aristotle Onassis that was circulated three years ago. But this disease does more than cause droopy eyelids and sagging face muscles. In more severe cases profound fatigue grips the entire body. Some victims cannot roll over in bed, swallow or even breathe without mechanical aids.

Recently, two California researchers announced development of a procedure that makes it possible for those with the disease's more malevolent forms to lead normal lives again. Neurologist Peter C. Dau of the Children's Hospital in San Francisco and biochemist Jon Lindstrom of the Salk Institute in La Jolla report in the Nov. 24 NEW ENGLAND JOURNAL OF MEDICINE that a blood cleansing process known as plasmapheresis brought "remarkable improvement" to eight patients who failed to respond to conventional therapies.

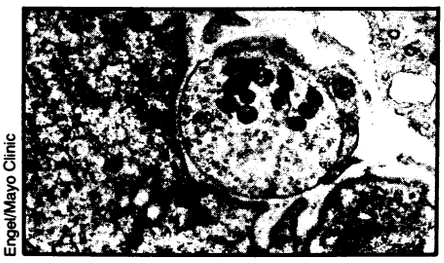
As with rheumatoid arthritis, myasthenia gravis occurs when the body mistakes itself for invading antigens. Miscued, the immune system generates antibodies that travel through the bloodstream to neuromuscular junctions and disrupt the chemical fluxes that pass impulses from nerve to muscle.

Normally, these signals are propagated by acetylcholine "messenger" molecules that surge across the gap between nerve and muscle membrane to bind with receptor proteins. In myasthenia gravis, however, acetylcholine crosses the gap only to find its receptors tightly bound by antibody. There is, in effect, nothing to receive the message. The neglected muscles remain flaccid, and the body goes limp.

"Most therapies," Dau told SCIENCE NEWS, "try to give acetylcholine the edge over the competing antibody." One drug increases the number of messenger molecules, he explained, thereby statistically increasing the chance for interactions with unbound receptors. Other treatments try to lower antibody levels: in many cases the thymus, long thought to be the center of antibody production, is removed; sometimes a "cytotoxic" drug, azathioprine, is used to kill the cells that, like factories, direct antibody synthesis; and the "antimetabolite" prednisone is also used to block the pathways that, as in a production line, actually construct the antibody protein.

A small number of sufferers, however, fail to respond to these therapies. But British researchers have used a cleaning machine to rid patients of similar antibodies in a kidney disease. Dau has now used that technique on patients who suffer from the more intractable forms of myasthenia gravis.

Dau channeled patients' blood through a "celltrifuge." Spinning fast enough to exert a centrifugal force 100 times that of gravity, it causes heavy blood particles — including red and white blood cells — to separate from the lighter plasma fraction, which contains the antibodies. The heavier sediment is returned to the patient, but the plasma is discarded.



Engel/Mayo Clinic

Dark lines in healthy neuromuscular junction (top) indicate acetylcholine receptor, not seen in myasthenic victim (below).

Does that rob the patient of other antibodies crucial to fighting infection? "Absolutely," said Dau. "So then we give injections of immune serum globulins, standard antibodies taken from healthy persons." The bottom line is that the patient is "just like before, except minus the deleterious antibody."

Plasmapheresis, the cleansing process, not only rids the system of antibody, it helps the physician to prevent antibody production as well. As with hormone production, cells stop producing antibodies when they sense high levels in the bloodstream. When the levels go way down (with plasmapheresis), the cells get busy again. "They start cloning, dividing very rapidly, and this high mitotic activity makes them easy prey for azathioprine [which kills antibody-producing cells]."

When used along with such immunosuppressive drugs, then, plasmapheresis may help cure the disorder. Dau hopes that in the future the treatment will prove as effective with other forms of autoimmune disease, and perhaps even prevent patients from rejecting transplanted organs.

Could plasmapheresis also be used to stem hyperallergic reactions such as hay fever? "Unfortunately not. In those cases, the [culprit] antibody sits right in the target organ [in this case, the mucosal layer of the sinuses], and can't be reached." But for the large number of disorders in which harmful antibodies travel through the bloodstream, the centrifuge process may be a boon. □

Interstellar methane

A compound that is rather common on the large planets of the solar system, methane, has now been found in interstellar space. It was reported recently to the Astronomical Telegram service by Kenneth Fox and Donald E. Jennings of the Goddard Space Flight Center in Greenbelt, Md., using the telescope of the National Radio Astronomy Observatory. Methane was identified by two spectral lines near 76 gigahertz frequency, which were within 2 megahertz of their calculated values. Methane is a spherical molecule, and so its rotations would normally not be expected to produce radio microwaves, Jennings says, but, as it turns out, centrifugal forces make small distortions that allow weak microwave signals to be generated. □

Women, minority Ph.D.s

Women and Minority Ph.D.s in the 1970s: A data book gives uninterpreted statistics on the employment, education and family background of United States scientists and engineers receiving Ph.D.s between 1973 and 1976. The National Research Council's Commission on Human Resources prepared the report, focusing on information it deems useful for planning employment and educational opportunities for these groups and for understanding factors that contributed to their current status in schools and the work force. □

DNA impact statement

"Acceptably small" is the level of risk the National Institutes of Health assign to experiments using recombinant DNA and following the NIH guidelines (SN: 7/3/76, p. 3). After numerous delays (it has been more than 16 months since the guidelines were released), the contents of the final environmental impact statement are unsurprising. They include various by-now familiar themes: no known hazardous organism has yet been produced by recombinant DNA research, even a small chance of causing severe illness cannot be ignored, and adherence to safety rules may postpone anticipated benefits of the work. In the absence of firm statistics on the hazards of the experimental organisms, the report examines the record of laboratory-acquired infections among people working with disease-causing organisms at Fort Detrick between 1943 and 1969. That experience demonstrates that the required laboratory safety procedures can reduce, but not totally eliminate, the risk of infection. The NIH statement also points out that the cost of building the laboratory required for high-risk (P4) research runs about $750,000. The report estimates 175 projects using recombinant DNA outside the United States, all following some type of safety guidelines. □