TECHNOLOGY

EMP—a new electrokinetic phenomenon

"We've got something that works—but we don't know how it works: That's the first fact," explains Norman Haber when discussing electromolecular propulsion — or EMP. However, he adds, "I can explain it sufficiently to get it to work very well," and he says he can teach others to harness it too. Briefly, EMP uses a homogeneous direct-current electric field to separate materials into constituent molecules. In concept, it's somewhat analogous to electrophoresis.

But there are important differences. With EMP, molecular separations occur at hundreds to thousands of times the speed of ordinary electrophoresis (Haber has gotten many molecules to speed along at 17 to 20 centimeters per minute). More important, unlike electrophoresis, the molecules to be separated need not be electrically charged nor do studies have to be conducted in a water-based environment. Already, Haber has worked with more than 1,000 chemicals in brewing chemistries necessary to achieve rapid separations for a wide range of organic and inorganic materials.

The chemistry of EMP cells must be custom-tailored for the materials to be separated. The medium through which molecules will move — be it liquid, gel, even gas — must be "quasi-conducting," so that it won't heat up when high voltages are applied to impel molecules. If the medium is normally nonconducting, charge-transfer salts may be used to "dope" it (selectively implant key impurities) into conducting. In addition, the dielectric constant of the medium must match that of the material to be separated.

Haber, president of Haber Inc., was in Washington recently to showcase an experimental EMP cell and to drum up contacts and interest among scientists who might wish to investigate the newly discovered electrokinetic process. Though the entrepreneurial chemist has been working on developing systems to employ EMP since 1968 (and has patented both high- and low-voltage applications), his first detailed account of the phenomenon appeared only this past January in the PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES. Haber thinks EMP has always existed in nature, but remained unobserved. It might explain, he suggests, the rapid manner with which certain chemicals move down nerve axons.

Haber's ultimate goal is to market power packs and preformulated reaction-cell inserts separately. A system only slightly larger than a hand-held calculator might sell for $100. Under development now is a cell to separate high-density lipoproteins in one minute. It could prove a diagnostic test for measuring the body's store of "good cholesterol"—believed a significant indicator of cardiovascular risk in human beings. A metallurgical process is also being developed by Haber, together with some mining firms, to purify high-value minerals, such as silver and gold, from natural ores. It has even been suggested that sulfur and heavy metals might be inexpensively removed from petroleum via EMP.

Federal-laboratory inventory

A review of the nation's federal laboratories, the first in 20 years, "will occupy a lot of time in coming months," according to James Ling of the Office of Science and Technology Policy. Addressing the White House Science Council (SN: 3/6/82, p. 152) at its premier meeting March 9, Ling said the survey would tally the institutions (there were 770 at last count), inventory what they're doing, and assess their performance. Fueled by concern that the "U.S. as a whole may not be getting the best return" on money spent by these labs, the survey could lead to the redefining of missions for some laboratories and the closing of others at some unspecified time.

BIOMEDICINE

The psyche and high blood pressure

Anxiety, insecurity, repression of negative emotions, extreme sensitivity to stress and several other psychological factors have been identified in high blood pressure patients, suggesting such factors might bring about the condition. Now clues to the physiological pathway by which such factors trigger high blood pressure may have been found by Vincent DeQuattro of the University of Southern California Medical Center in Los Angeles. The pathway appears to involve the involuntary nervous system and the neurotransmitter noradrenaline.

DeQuattro studied the psychological characteristics of high blood pressure patients and of persons with normal blood pressure. He also investigated the levels of noradrenaline in the cerebrospinal fluid and blood of both groups of subjects; his previous research had suggested that the involuntary nervous system, and especially one of the neurotransmitters it uses — noradrenaline — might translate certain psychological factors into high blood pressure.

Indeed, as he reported at the Ninth Annual Scientific Meeting of the International Society of Hypertension in Palm Springs, Calif., recently, high blood pressure patients experienced significantly more anxiety and repressed anger than did persons with normal blood pressure, and they also had more noradrenaline in their cerebrospinal fluid and blood than did the latter. So the involuntary nervous system, and especially noradrenaline, may be the channel by which certain psychological factors bring about high blood pressure.

Studies shed light on impotence

In spite of society's greater openness about human sexuality today than a few years ago, certain sexual questions have still remained more or less off limits, even for medical science; one of these is how the penis becomes erect during sexual excitement. Now, however, Gorm Wagner and colleagues from the University of Copenhagen *have* tackled it, and as they report in the Feb. 20 LANCET, the answer is that the penis contains certain "shunt" arteries that constrict during sexual arousal, thus redirecting blood destined for the bottom side of the penis to the top side.

In 1900 a German scientist reported that penile erection is due to the relaxation of pads of long smooth muscle projecting into the arteries supplying blood to the penis. During the past two decades, though, several other investigators have questioned this hypothesis because such pads are not always present in penises and because the rate of blood flow in the corpus cavernosum (topside of the penis responsible for erection) does not increase during erection. So Wagner and his colleagues attempted to answer the question. They obtained 47 cadaver penises and studied them by dissection, microscopic visualization and other techniques. And as they found, certain "shunt" arteries connect the corpus cavernosum (penis topside) to the corpus spongiosum (penis bottomside). Before, the blood flow to these two areas had been thought to be totally separate.

Penile erection, they conclude, may occur when these shunt arteries constrict, forcing blood normally destined for the corpus spongiosum into the corpus cavernosum. The result: penis tumescence and erection.

Wagner and his co-workers also found that a number of penises they studied did not have shunt arteries, suggesting that such a lack might be responsible for certain cases of male impotence. They also suspect that psychologically induced male impotence may be mediated by the involuntary nervous system failing to constrict the shunt arteries since a low concentration of the involuntary nervous system neurotransmitter noradrenaline has been found in the penises of some impotent patients.