PHYSIOLOGY

Key to Nerve Cell Seen

A new theory explaining how electricity and chemistry are linked in the nervous system has been proposed—By Patricia McBroom

➤ A KEY to the workings of billions of tiny nerve cells has perhaps been found. The new theory, proposed by a U.S. chemist and an Australian mathematician, explains the link between electricity and chemistry in nervous system function.

Scientists have known for years that the nerve impulse is both electrical and chemical. The puzzle was how these two worked together.

Engineers, on one hand, have taken delight in comparing the workings of the nervous system with the electrical circuits of a computer. Neurophysiologists, meanwhile, have poured their talents into a study of sodium and potassium ions, coming up with the revelation that the nerve impulse is in reality a "sodium impulse."

Now the missing clue may have been discovered in a years-old phenomenon, already well known to electrical engineers, believe Dr. Walter J. Moore, an Indiana University chemist, and Dr. Ludvik Bass of the University of Queensland in Brisbane.

Early twentieth-century physicist, Wilhelm Wien, once observed that where there existed a high electrical field, a reduction in that field would also reduce the strength of acids in solution. Nothing in particular resulted from Dr. Wien's discovery. It was simply a "laboratory" effect that every student of electrical engineering learns in the course of his study.

Drs. Moore and Bass think it is exactly this Wien effect that is operating in nerve cells.

The nerve cell rests in a highly charged state, Dr. Moore told SCIENCE SERVICE. On the outside of an extremely thin membrane are about 10 times as many sodium ions as potassium ions, while the reverse is true on the inside. As a result, an astounding electrical field of 100,000 volts per centimeter exists in this thin membrane forming the walls of the cell.

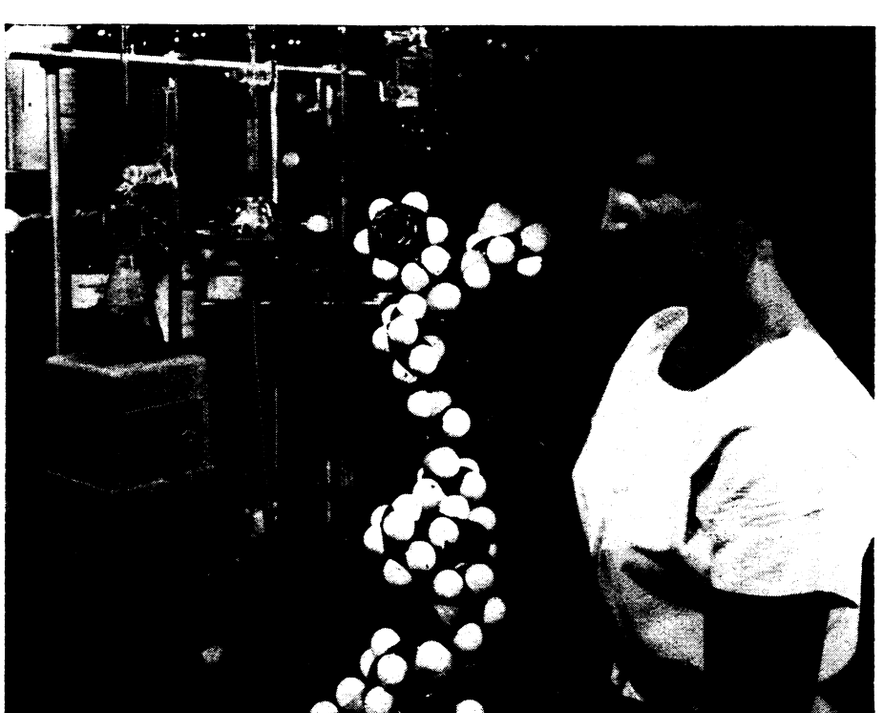
A high field is an acid condition, said Dr. Moore. As long as the cell remains acid, it will not "fire." But something happens to make the cell more alkaline. The membrane then "opens its gates," and sodium ions rush in to set off a current and fire the cell.

Dr. Moore explained that when an impulse from one cell reaches another, it causes about a 30% drop in the second cell's electrical field. Using the Wien effect, he and Dr. Bass have calculated that such a drop will cause enough alkaline condition to fire the nerve.

If this is true, said Dr. Moore, it should be possible to set up equations for nerve impulses.

The new theory also "makes one think a lot more about ways of controlling the acid-base ratio in nerve cells," noted Dr. Moore. At one time, he said, people thought epileptics needed an acid diet. Actually the diet worked to some extent, but better ways of controlling convulsions were later developed.

The two scientists did their work at the University of Queensland, presenting their theory at a meeting of the Australian Physiological Society in Brisbane.



Pharmaceutical Manufacturers Association

MOLECULAR REPRESENTATION—This model, first synthesized in 1961, represents kallidin II, a "local hormone" which may be involved in biological reactions such as asthma, and the blistering or swelling of skin which follows burns, blows, or infections.

MEDICINE

Drugs Add to Success Of Kidney Transplants

➤ THE DRUGS used to prevent rejection of a kidney transplant may also prevent infection of the new kidney with the same disease that caused the original kidneys to fail, a Harvard pathologist reported. If both rejection and infection of the new kidney can be avoided, the transplant has a much greater chance of success.

Dr. Gustave J. Dammin's statement applied to a particular kidney infection, called glomerulonephritis, often brought on by a streptococcal infection and involving the tiny tufts of capillaries in the kidney. His report supports the often advanced hypothesis that glomerulonephritis is a result of alteration of kidney tissues from bacterial infection, and the subsequent production of antibodies against the altered kidney tissue, which is now interpreted as "foreign" by the body's immune defenses.

In transplants between identical twins, noted the doctor, the disease "has occurred with disturbing frequency. Of 15 identical twins whose renal insufficiency was due to glomerulonephritis, 11 have developed a similar form of glomerulonephritis in the kidney received from the identical siblings."

The disease has also appeared in transplants from unrelated donors, he said.

How the drugs work to deter rejection of the transplant and prevent glomerulonephritis is not known, Dr. Dammin said, at the Sixth International Congress of the International Academy of Pathology in Kyoto, Japan, but it is being investigated.