MEDICINE

Nerve Banks Next?

Bits of bones, tendons and nerves in assorted sizes may some day be held in reserve for the surgeon just as the life-saving blood banks are used today.

By JANE STAFFORD

➤ JUST OVER the medical horizon appears the prospect of a new group of banks, coming to take their place beside the lifesaving blood banks, on which surgeons patching up men wounded in battle or serious accidents can some day draw.

These prospective banks will be made up of bits of nerves, bones and tendons in assorted sizes to fill the demands for spare parts to replace those lost through injury or damaged by disease. The tendon and bone banks are still in the realm of scientific speculation, though forward-looking surgeons believe them a possibility. The nerve banks have reached the rat, cat and monkey stage of laboratory development.

Even so, the jump to banks of human nerves is still pretty far in the future, warns Dr. Paul Weiss, University of Chicago zoologist who, with Dr. A. Cecil Taylor, has developed the experimental nerve bank for laboratory animals.

Today's patients with nerve injuries or nerve-destroying diseases cannot hope to have an order for a new nerve filled at such a bank. There is a chance, however, that before the war is over, nerve banks might be established for those wounded in battle.

Many of you have seen blood banks or pictures of them—rows of bottles of blood or of plasma or of vacuum bottles with a little dried plasma at the bottom. At Dr. Weiss' laboratory at the University of Chicago, I saw the animal nerve bank he is working on now.

Few Glass Jars

It consists of a few glass jars in a refrigerator. In each jar are small glass tubes sealed at both ends. Inside each tube are a few bits of chalky-looking bent rods, a little thicker than pencil lead and about a quarter to a half inch long. Those chalky bits are frozen, dried nerves from rats or cats or monkeys.

When these chalky bits are rehydrated and grafted by a special technic into gaps of nerves in animals of the same species, they heal and promote regeneration much as live nerves do. The result is a normally sensitive working nerve for the cat or rat or monkey.

The nerves were prepared for the nerve bank, somewhat as blood plasma is prepared for its banks, by freezing and drying in vacuum. The nerves for the bank are removed from the body under germ-free conditions. For human nerve banks, they would be taken from cadavers or from arms and legs that had to be amputated.

They are dropped into isopentane, immersed in liquid nitrogen at a temperature of 195 degrees Centigrade below freezing. The nerves freeze instantly and are then transferred to high vacuum maintained by mercury pumps for about one week of dehydration over phosphorus pentoxide at 40 degrees Centigrade below freezing. Finally, they are stored in sealed sterile containers.

When they are to be used to bridge a gap in a torn nerve, they are rehydrated in vapor at 40 degrees Centigrade below freezing or at room temperature in a special salt solution in vacuum. Then they are ready for grafting.

Grafting Not New

Nerve grafting itself is not new. It was tried in the last war, but results were not too good and by 1920 British surgeons were advising it only as a last resort. Lack of a suitable supply of nerves of the right size was one difficulty.

Sometimes a piece of a minor nerve was taken from the patient's own body to bridge a gap in a more vital nerve. Efforts were also made to store or preserve nerves in oil, a special salt solution, alcohol or formaldehyde. None of these methods was universally successful, though surgeons have continued in the years between the wars to do some nerve grafting.

The supply problem will be solved if Dr. Weiss' banks of dried, frozen nerves can be adapted to human use. The second difficulty applies not only to nerve grafts but to the repair of cut nerves when there is no gap between the cut ends.

A nerve often looks like a piece of string which you would think could easily be joined when cut by simply taking a few stitches. Actually, of course, the nerve is not a piece of string and even though its cut ends may be neatly joined by surgical sutures, this does not insure that the nerve will once more perform its task of carrying impulses to or from the brain.

When a nerve is cut, the fiber on the far side of the cut dies, but the part between the cut and the brain or spinal cord remains alive and starts sending out new shoots or sprouts of tiny hair-like nerve fibers. If one of these fibers can find its way into the sheath or tube of the dead nerve on the other side of the cut, it can generally continue on its way to its terminal.

Nerves Travel Blindly

Nerves, however, travel blindly. If much time elapses before a new fiber finds its way onto the old roadway, the road is likely to become blocked with other tissue cells that have grown over the nerve's road as the wound heals. This is especially likely to happen, of course, in the case of war wounds. Or the tiny sprout of new nerve fiber may have started in the wrong direction before the cut ends were sewed together.

Unless the surgeon operated under a microscope, he could hardly hope to see this and even with a microscope he might miss it, because the very tip of the newly growing fiber is probably ultramicroscopic in size.

Study of how these new nerve fibers grow has led Dr. Weiss to discovery of a way to greater success in joining the ends of cut nerves or of grafting a piece of nerve to bridge a gap between the ends. Instead of trying to sew the ends together he splices them with the aid of a sleeve made of a bit of artery.

So far, he has applied his method of nerve splicing only to cuts in animal nerves, but it seems likely that its benefits can be applied to joining cut human nerves also and, eventually, to aid in the use of grafts from nerve banks when and if these become established for humans.

The artery sleeve helps the newly growing nerve fiber to find its way partly by providing a tunnel for it in which nerve fluid collects, forming a superior medium for the growth of the nerve

NERVE BANKER—Dr. Paul Weiss, University of Chicago zoologist who has been experimenting with animals, hopes that some day banks similar to the blood banks may supply fragments for splicing torn nerves.

fiber and its sheath. The most important thing it does, Dr. Weiss believes, is to furnish a lengthwise pull on the fiber. Scientists have long speculated on how the blind nerve fibers ever find their way in the first place to the spot they are supposed to reach in the body. There have been theories that the region needing to be supplied by a nerve furnished some sort of chemical or electrical attraction that pulled the nerve in the right direction.

According to Dr. Weiss' theory, the growing nerve feels its way by contact with the surface along which it travels. The movement of the fibers and their direction are guided by surface forces, something as surface forces guide the spreading of oil on water. In the case of nerves, the surface forces guide by a lengthwise pull.

When anything upsets the molecular orientation of the surface over which the nerve travels, so that it does not exert this pull, the growing nerve fiber will wander about at random. An injury in which a nerve was cut might also cause disorientation of the surface so that the tiny tip of new nerve fiber could not find its correct road.

The artery sleeve helps remedy this situation because the blood clot inside it exerts a lengthwise pull as it shrinks in size. This pull guides the nerve fiber over the cut and onto the old nerve pathway on the other side.

Dr. Weiss is not the only scientist who has been studying this problem of nerve growth and methods of repairing nerve injuries. British surgeons have developed a method of using plasma to "glue" the ends of cut nerves together, instead of sewing them, and of fixing nerve grafts in plasma, something as vegetables are set "in aspic," to make the soft, slippery fresh nerve grafts easier to handle as well as to make them stay in place without stitches.

Early this year an American scientist, Dr. David Bodian, of Johns Hopkins University, reported still another way of closing gaps in cut nerves. He cuts loose the nerve sheath and underlying outer bundles of nerve fibers from one end of the cut nerve and slides this sleeve up to meet the other end, to which it is attached by stitches. New fibers growing from the living end of the nerve are protected by this sleeve from encroachment by non-nervous tissue and enabled to grow down their old pathways to their ultimate terminations.

Science News Letter, July 24, 1943

CHEMISTRY

Infra-Red Tests Fuels

A high speed analysis of complex chemicals can be made by shooting invisible rays through them, and the impurity of the chemical can also be estimated.

➤ HIGH SPEED analysis and impurity tests on certain organic chemicals, such as fuels and rubber compounds, can be made by shooting invisible infra-red rays through them.

Experiments reported to the meeting of the American Physical Society by R. S. Rasmussen, R. R. Brattain and O. Beeck of the Shell Development Company, Emeryville, Calif., revealed that the method can also help to show how the molecules of the chemical are constructed.

Infra-red rays—the heat rays of longer wave-length than ordinary light—cannot shoulder their way between all the atoms of the chemical tested. Some are blotted out; others pass through to form a pattern which scientists call an absorption spectrum.

Since the pattern is made up of heat rays, an apparatus is used to measure minute differences in heat along the spectrum. From this the scientists can interpret the identity of the chemical tested and roughly how much of various constituents is present.

Where characteristic bands of heat appear for specific chemical groups, the scientists reported that the method may also be used to help establish the structure of molecules. Sometimes the chemical mixtures are so complex that the many tell-tale bands are a jumble. To get around this the scientists separate the mixture into parts by distillation, then identify each one separately.

Workers at the Shell Development Company have applied the method to the organic compounds called the higher isomeric paraffin and olefin hydrocarbons.

Science News Letter, July 24, 1943

AGRICULTURE

Hot-Weather Plowing Kills Worm, Saboteur of Crops

➤ A LOW-LIFE saboteur of war-vital tomato and other vegetable crops has been defeated with no more secret a weapon than an ordinary plow, by a method developed under the direction of Dr. G. H. Godfrey, Texas Experiment Station plant pathologist.

The villain in the piece was a species of threadworm or nematode, that infests plant roots, makes big, ugly knots and cuts down yield materially. It lives in the soil from crop to crop, ready to attack the next roots that come its way.

Dr. Godfrey found that by giving infested fields three extra plowings, with the thermometer near 100 degrees, he could turn up and thus kill off the greater part of the troublesome worms, which are very sensitive to heat and dryness. A comparison of yields from treated and untreated fields showed increased tomato yields worth more than $100 an acre extra in favor of the treated soil, after deducting the increased cost of the additional plowings.

Science News Letter, July 24, 1943

America made 10,250,000,000 rounds of *small-arms ammunition* in 1942.