Major electronic breakthrough for the severely deaf

A delicate electronic implant that can be threaded into the inner ear may soon help profoundly deaf people distinguish key sounds and speech patterns, according to the Ottawa *Citizen*.

Researchers at Ottawa's Carleton University, the University of Sherbrooke Quebec, and Toronto's Hospital for Sick Children are building a device to stimulate the cochlea, the spiral-shaped section of the ear from which sound impulses travel to the brain.

Carleton's contribution is a tiny, electrode array. When attached to a device being developed at Sherbrooke, it could help many of Canada's 100 000 profoundly deaf people hear.

"Sitting down and listening to Beethoven's *Fifth* will still be out," says Patrick van der Puije, the electronics engineer who leads Carleton's research team.

"But a deaf person may be able to differentiate between the sound of a doorbell and that of a telephone. Or he may be able to detect through sound whether or not a car is coming." Mr. van der Puije predicts at least three more years of work before a product is developed to serve the needs of most deaf people.

Research costs

The work funded by the Medical Research Council, has so far cost $325 000 and it is expected to cost a further $450 000 before it is finished. It is being co-ordinated by Dr. Ivan Hunter-Duvar at the Hospital for Sick Children.

Engineers at Sherbrooke are developing one part of the device — a nerve stimulator with the electronics on a microcomputer chip. That chip will be inserted behind the ear.

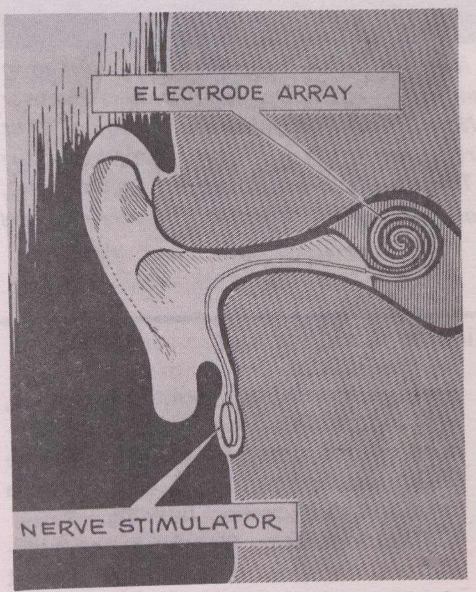
Carleton researchers are putting together the second part — a string of tiny electrodes that will remain in the inner ear for several years and be attached to the nerve stimulator.

The two devices must be used with a Walkman-type headset worn by the user. The headset is attached to an electronic package containing a microphone, which can be carried in a breast pocket like a hearing aid. But hearing aids are only useful to those who still have some hearing. The nerve stimulator device is a major breakthrough for the severely deaf.

In normal hearing, sound vibrations hit the eardrum, making it vibrate. Those vibrations set off a piston-like motion of the three small bones in the middle ear — known to laymen as the hammer, anvil and stirrup.

The bones are linked to the snail-shaped cochlea, in which the fluids of the inner ear flow. Pressure changes in the fluid, caused by the movement of the three bones, are detected by sensitive hair cells. These stimulate any of the more than 30 000 nerve endings in the cochlea. The nerve centres fire off impulses to the brain.

The hair cells can be damaged by disease or drugs, but many of the nerves that connect with the brain may still be in working order. The electrodes being constructed by van der Puije's group will replace damaged hair cells, making direct contact with the nerves.



But there will be only 16 electrodes in the array, compared with the 30 000 nerve endings of the cochlea. That means deaf people will only be able to pick up key frequencies.

Although the device won't allow the deaf to follow every sound in a conversation, it should be a tremendous aid to those who already have some lip-reading ability, said van der Puije.

Problem of insertion

Considerable ingenuity has gone into the project. To solve the problem of inserting something small into the cochlea, which is only about one millimetre wide, the Carleton group has been working with a relatively new metal alloy called nitinol — "a metal with a memory", as van der Puije describes it.

At high temperatures, nitinol can be bent into the desired shape, then flattened out as the temperature is lowered. If it is then reheated, it reverts to the shape it had at the higher temperature.

This means a surgeon implanting the device could shape it to fit the cochlea spiral while it is still outside the ear. He would then straighten it out so it could be inserted through the tiny opening to the cochlea. As he put it into the cochlea, it would reheat to body temperature, reverting to the shape the surgeon had moulded it to previously.

The researchers hope to perfect a device that will stay in a patient's ear for 20 years or more. Trials to ensure the array won't hurt the body are to start in Toronto this year, first using animals, and later, volunteers. The final, polished product will be detectable only by a slight bump under the surface of the skin behind the earlobe.

Canadarm reaches out

Canadarm, the Canadian designed and built remote manipulator system on the United States' space shuttle, will generate a spin-off industry in robotics. The National Research Council and Diffracto Ltd. of Windsor, Ontario have agreed to co-operatively develop a "real-time photogrammetry" system to be applied to handling parts and materials on earth-bound conveyor belt assembly lines.

The technology is based on an NRC design concept for use in placing and retrieving cargo in space. By coupling the manual control of the arm with a computer aboard the shuttle, the operator is given an indication of the payload's position even when he cannot see it. The original prototype of the system was developed by NRC and Leigh Instruments of Ottawa, and is expected to be used in future shuttle missions. Through the agreement with Diffracto, the system is expected to be of use on factory floors by allowing industrial robots to locate parts and grasp them for relocation or assembly.

The agreement provides for an intensive market survey of conveyor manufacturers, automobile builders, makers of industrial robots, and the aerospace industry. Following this, and the development of a prototype in NRC laboratories, a plant installation will be constructed and applied to factory conditions. It is hoped the first working installation will be in the factory by the end of 1985.