News of the arts

Unique brain scanner said to be the fastest in the world

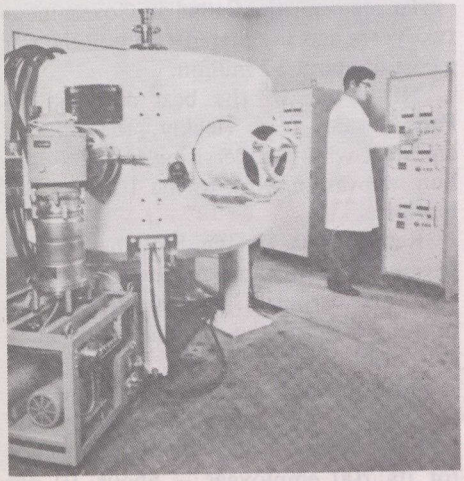
A brain scanner that shows how the brain functions rather than just what it looks like, is being produced by Atomic Energy of Canada Limited (AECL).

"For the first time, we can look inside the brain, at the vital brain functions," said Dr. Lucas Yamamoto of the Montreal Neurological Institute (MNI), who developed the scanner called Therascan.

The Therascan is a Canadian-developed nodel of a positron emission tomograph (PET), a revolutionary advance in brain scanning. It is unique in being the fastest PET in the world – it can provide information on brain blood flow or metabolic processes (such as how the brain takes up glucose) in one second – and it has already been used in the care of more than 500 patients.

Positron emission tomographs are still rare and most are being used solely for research. The Therascan is being produced for the commercial market by AECL, which hopes the $645,000-machine will be available by October 1980.

The scanner works in conjunction with a Japanese-built Mini-Cyclotron that costs nearly $1 million, for which AECL is the Canadian agent. Such a cyclotron is being installed at the MNI this autumn. Dr. William Feindel, director of the institute says it will be the first real production model working anywhere in the world. He said a prototype experimental model is at present being used in a Tokyo hospital. The miniature cyclotron is expected to give MNI unsurpassed facilities for studying illnesses such as multiple sclerosis, Parkinson's disease and schizophrenia.



The Mini-Cyclotron is the first such machine designed for a hospital setting.

The value of PET was demonstrated in the case of a woman with mysterious symptoms. The woman had seizures, headaches, numbness in her limbs, but before she arrived at the Montreal Neurological Institute she had had all the latest tests, including a CT scan – computerized tomogram, a coupling of a computer and an X-ray that takes pictures of the body in cross-section.

PET's power

Even the CT scan found nothing abnormal in her brain. The patient was told to go to a psychiatrist. But at MNI, the PET discovered a malignant brain tumour.

"It was at a very early stage – one of the smallest (of the kind) we had ever seen," said Dr. Yamamoto, who is the director of the neuro-isotope laboratory at MNI and an associate neurology professor at McGill University.

Dr. Feindel said that positron scanning was not restricted to the brain. "It is already being developed to study cross sections of the chemical activity of the heart and it may be extraordinarily important in the early diagnosis of heart disease," he said.

The brain has always been difficult to see because X-rays that manage to pass through the bony skull are then absorbed by all the soft tissue at much the same rate, making it difficult to differentiate between, for example, a tumor, a blood clot and a healthy brain.

How it differs from CT

CT scans, because of their greater sensitivity and method, enable a doctor to see brain tissue directly. Computerized tomography uses a computer to build a total picture from complex calculations derived from a succession of layers.

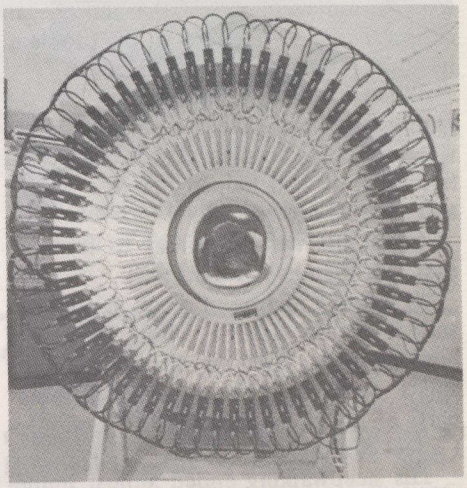
The CT scan feeds radiation into the brain from an external X-ray machine and then measures how much emerges on the other side. However, the positron emission tomograph measures radiation emerging from the brain, which is created by the decay of short-lived radioactive substances in the brain. The substances are introduced either by injection into the bloodstream or by the inhalation of radioactive gases such as oxygen 15.

Injecting into the body radioactive substances capable of detection by scanners is not a new process, but PET can employ for the first time radioactively tagged substances natural to the body, such as oxygen, nitrogen and carbon.

The Mini-Cyclotron, AECL says is self-shielding, small enough and simple enough to operate for use in a teaching hospital or research centre.

Computer traces rays

After injection (or inhalation in the case of gases), the positrons collide with electrons giving off gamma rays in predictable directions that permit the computer to calculate their position in the brain. In this way, brain functions can be followed – for example, how and where the brain is using glucose or oxygen.



A prototype of the Therascan showing the inner workings of the scanner. The completed model is expected to be on the market in October.

One of the most significant aspects of the system is that patients need no longer be exposed for long periods to heavy radiation, according to AECL's Tom Ross.

The isotopes used are short-lived: carbon 11, for example, has a half-life of 20 minutes, which means half of the isotope disappears from the system in 20 minutes. "Organic isotopes are used and there's no residual effect whatsoever," Mr. Ross said.

For the past two years, AECL has been perfecting the scanning system and developing it into a commercial product.

International interest

It is reported that the United States National Institute of Health has allocated $15 million to finance the purchase of the systems for five U.S. hospitals and

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