CYCLOTRON and Radiochemistry Facility at the Montreal Neurological Institute and Hospital

The Neuro

In 1981, the Montreal Neurological Institute and Hospital – The Neuro, became the first medical institution in Canada to be equipped with its own isotope production facility: THE CYCLOTRON. The move to include such a facility within its walls was somewhat revolutionary at the time. By producing its own radioactive tracers used for Positron Emission Tomography (PET) imaging, The Neuro enabled researchers to uncover the mysteries of how the brain works and clinicians to increase the speed and accuracy of patients' diagnosis and treatments.

Today, medical cyclotrons are found in cities across the country and isotopes are used around the world for research, and cancer diagnosis and treatment.

What is a Cyclotron?

IBA Cyclone 18/9 cyclotron: the model being used at The Neuro

A cyclotron is a particle accelerator used to produce medical isotopes needed for PET scans. It uses a combination of high-powered magnets and alternating voltage to convert stable atoms into radioactive isotopes. This process involves spinning charged particles in ever-expanding circles until they strike a target. The cyclotron's magnets pull the charged particles in a circular motion, while the alternating current charges particles with energy each time they cross a threshold down the middle of the circular path. When the particle beam interacts with the stable atom in the target, a nuclear reaction occurs creating radioactive isotopes.

neuro

Institut et hôpital neurologiques de Montréal
Montreal Neurological Institute and Hospital

CYCLOTRON and Radiochemistry Facility at the Montreal Neurological Institute and Hospital

The Neuro

What are isotopes used for?

Tiny doses of radioactive isotopes are injected into patients or research study subjects who undergo Positron Emission Tomography (PET) scans. The isotopes act as tracers that the scanner detects in the body. For clinical use, the scanner can diagnose or detect cancerous growths, brain diseases such as Alzheimer's disease and coronary heart disease. Visualization of cancer then allows physicians to stage the cancer and plan treatment.

At The Neuro isotopes are used mainly for research protocols such as drug testing or investigating functions and diseases of the nervous system.

The Cyclotron and Radiochemistry Facility

The Cyclotron and Radiochemistry Facility is specifically designed to enable researchers and staff to work safely with radioactive materials. Much of the work is done using remote systems through shielded chambers called 'hot cells.' All of the radioisotopes are intended for use in biomedical imaging or clinical research, hence the laboratory is regularly visited by Health Canada inspectors for quality and safety control purposes.

Are there any risks from working or living near the facility?

Designed and operated to meet or exceed the highest federal safety standards, the facility is regulated by the Canadian Nuclear Safety Commission and Health Canada, and conforms to The Neuro's health and safety policies.

Access to the cyclotron and the associated laboratories is tightly controlled through a variety of safeguards. Specialized air and waste handling systems guard against accidental releases of radioisotopes outside the facility. Lab work with radioisotopes takes place in sealed and shielded hot cells designed to contain spills. Because the isotopes produced in the facility are designed to be injected into humans, they do not last very long and decay to negligible amounts in a matter of hours.

neuro
Institut et hôpital neurologiques de Montréal
Montreal Neurological Institute and Hospital

CYCLOTRON and Radiochemistry Facility at the Montreal Neurological Institute and Hospital

The Neuro

What are the risks of being exposed to radioactive isotopes?

The risk for a member of the public to be accidentally exposed to medical isotopes is extremely low.

The main isotope for clinical use, fluorine 18, has a half-life of 110 minutes. For research, we mainly use Carbon 11 with a half-life of just 20 minutes. This means that radioactivity decays rapidly. The doses produced are designed to be safe for injection into patients and research study subjects.

The facility is designed so that radiation produced by the cyclotron is contained within the controlled areas that are accessible only to authorized personnel. Heavy shielding is incorporated into the building walls to keep radiation to normal background levels at all times outside the facility and to ensure that there are no radiation exposure risks to any workers, members of the public or the environment. Personnel working in the cyclotron unit, as well as all staff working with radioactive chemicals wear monitoring equipment (badges) that measure exposure to radioactivity. Badges are turned in and checked regularly. The packaging and transport of the radioactive substances for delivery to local hospitals is done safely in accordance with Transport Canada regulations for the transport of dangerous goods (TDG, class 7).

Location

The CYCLOTRON and Radiochemistry Facility is located at the Montreal Neurological Institute (3801 University Street). This location is ideal due to its proximity to local downtown Montreal hospitals, permitting rapid shipment of medical isotopes to end users before they decay.

Today, The Neuro's CYCLOTRON and Radiochemistry Facility produces the longest list of radiotracers used in PET imaging in North America, serving a local community of researchers and hospitals.

neuro
Institut et hôpital neurologiques de Montréal
Montreal Neurological Institute and Hospital

CYCLOTRON and Radiochemistry Facility at the Montreal Neurological Institute and Hospital

The Neuro

Do you have a question?

For any questions or comments about the CYCLOTRON and Radiochemistry Facility, please contact:

Gassan Massarweh, Ph.D.
Director of the CYCLOTRON and Radiochemistry Facility
Montreal Neurological Institute
Tel: 514 398-8527
Email: gassan.massarweh@mcgill.ca

For more information on isotopes visit the Health Canada website:
www.hc-sc.gc.ca/dhp-mps/brgtherap/activit/fs-fi/isotopes-med-faq-eng.php

McGill

Centre universitaire de santé McGill
McGill University Health Centre

neuro
Institut et hôpital neurologiques de Montréal
Montreal Neurological Institute and Hospital