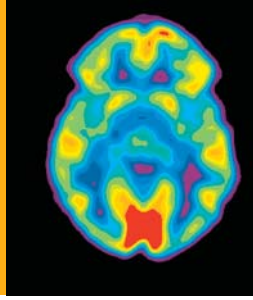
Positron Emission Tomography (PET)

A REVOLUTIONARY DIAGNOSTIC AND IMAGING TOOL



PET scan of the brain

Viewing Body Chemistry

Since the invention of the X-ray in the 1890s, medicine has searched for better ways to look inside the human body. Today, common imaging techniques such as CT (computerized tomography) and MRI (magnetized resonance imaging) allow physicians to see the body's structures—detecting broken bones or tumors. Positron Emission Tomography (PET), in contrast, offers physicians a view of body chemistry. Since virtually all diseases alter body chemistry, PET can often provide answers that cannot be reached using other imaging techniques. For example, by highlighting how cancer cells consume resources, PET can reveal cancer before structural changes appear with MRI.

Used for research since the 1970s, PET emerged as a tool for diagnosing, staging, and monitoring diseases in patients during the mid 1990s. Since then, PET has experienced remarkable growth in the United States. "PET is revolutionizing the fields of oncology (cancer), cardiology, neurology, and psychiatry, with a major impact on patient management," says **Ronald L. Van Heertum, MD**, *Director*, Morton A. Kreitchman PET Center, and *Professor* of Radiology at Columbia University College of Physicians & Surgeons.

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How PET Works

Before undergoing a PET scan, patients receive an injection of a harmless *tracer,* an imaging agent that the body easily absorbs and eliminates. The patient lies on a table that slides slowly through the scanner. Unlike an MRI machine, a PET scanner covers only a small portion of the body at a given time. By detecting the tracer in the patient, the PET scanner can create a color-coded image of the body's chemical function.

PET scans typically take about one half hour (cardiac cases take longer) and expose patients to a safe level of radiation. Most patients can return to their normal activities immediately following the scan. Specially-trained radiologists, such as the faculty of the Columbia Kreitchman PET Center, read the PET scans and write up detailed reports explaining their findings. The referring physician then reviews those findings with the patient.

A Powerful, Versatile Technology

Currently, physicians employ PET as a diagnostic technique for patients with cancer, heart disease, and neurological disorders. Researchers are investigating its potential applications for psychiatric disorders.

ONCOLOGY—PET is used to *diagnose, stage, restage,* and *evaluate* the response to therapy for lung, colorectal, esophageal, head and neck cancers, as well as lymphoma and melanoma. In addition, it is used to evaluate response to therapy for breast cancer. According to **Rashid A. Fawwaz, MD**, *Professor* of Clinical Radiology at Columbia, "Oncologists frequently change their patient treatment plans based on PET findings—including eliminating surgical procedures and changing the course of chemotherapy by either reinstituting chemotherapy or altering the chemotherapeutic regimen."

CARDIOLOGY—PET provides the highest accuracy level of any noninvasive cardiac test. It can help *delineate* blood-flow patterns, *assess* the viability of heart muscle, and *determine* the optimal treatment path. "Currently, only 25-50 percent of patients eligible for a heart transplant receive a donor heart," says **Steven R. Bergmann, MD**, *Margaret Milliken Hatch Professor* of Medicine

PET scan of the body. The darker regions correspond to areas with higher metabolic activity, such as the brain and bladder.

COURTESY SIEMENS MEDICAL SOLUTIONS

and *Professor* of Radiology at Columbia. "By establishing whether healthy heart muscle exists, PET can help cardiologists to determine whether a patient can still benefit from bypass surgery or must be placed on the transplant list."

NEUROLOGY—PET can reveal abnormal patterns in the brain, aiding neurologists in diagnosing and treating seizures and dementia disorders. For epilepsy patients, PET can *localize* areas of the brain causing seizures—determining whether surgery is an option. For patients with dementia disorders, PET can *identify* distinctive patterns, helping to *differentiate* among Alzheimer's disease, Parkinson's disease, and Huntington's disease.

PSYCHIATRY—Today, psychiatry researchers are conducting groundbreaking investigations into PET's potential to help with the diagnosis, treatment, and monitoring of major psychiatric disorders, including depression, schizophrenia, and obsessive compulsive disorder. "We are approaching the era where brain scanning will become a standard part of psychiatric practice," explains **John Mann, MD**, *Professor* of Psychiatry and Radiology at Columbia.

Future Applications

In addition to serving a valuable diagnostic role, PET may soon play an important part in drug development and drug treatment selection. Columbia researchers are demonstrating PET's ability to reveal precisely how the brain "picks up" or uses particular drugs. Such visualizations can not only help researchers to develop new, more targeted medications, but they can also help physicians to establish individualized dosage levels for their patients—achieving therapeutic results without causing side effects. "We have only reached the tip of the iceberg with PET," concludes Dr. Van Heertum.

For more information, please contact the Columbia Kreitchman PET Center at 212.923.1555 or info@columbiapet.org.

About Columbia Kreitchman **PET** Center

Columbia Kreitchman PET Center offers adult oncology, neurology, and cardiology PET, as well as pediatric oncology and neurology PET. Columbia radiologists perform scans, consult on patient findings with referring physicians, and provide second opinions.

EXPERIENCE—Columbia radiologists have decades of experience in performing and interpreting PET scans.

EXPERTISE—The doctors' doctors, Columbia radiologists often help to interpret PET findings (provide a second opinion) for other physicians.

RESOURCES—Columbia offers an all-inclusive imaging center at one of the nation's leading medical centers, with extensive expertise in oncology, neurology, cardiology, and pediatrics.

TRAINING—Physicians and technicians from around the world come to Columbia to learn about PET.

CLINICAL RESEARCH—Aided by research grants from NIH and other funders, Columbia physicians and researchers are at the forefront of new applications for PET, including the expansion of PET imaging into new clinical areas.

BASIC RESEARCH—Columbia jointly produces and helps distribute the specific isotope currently used by many of the PET scanners in the region and is conducting ongoing research into new types of isotopes.

INNOVATION—In recognition of Columbia's leadership in PET innovation, the PET Center was recently included in an $11 million NYSTAR grant from New York State.

FACULTY Columbia Kreitchman **PET** Center

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