

Diagnostic Tools and Treatment:

Basic Research Saves Lives

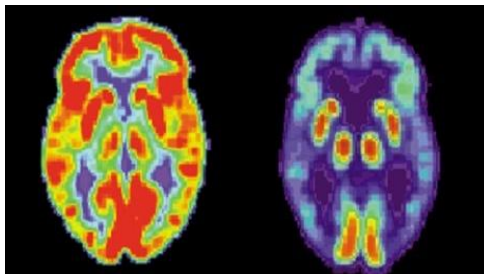
The medical imaging technologies that hospitals and clinics use routinely for diagnosing injuries, illnesses, and diseases were just science fiction 50 years ago.

It took the dedicated work of physicists, chemists, biologists, engineers, and others to turn scientific theories into the technologies and medical equipment we rely on today. These researchers were supported with funding from the National Institutes of Health (NIH), Department of Energy (DOE), National Science Foundation (NSF), National Institutes of Standards and Technology (NIST), and Department of Defense (DOD).

Diagnostic Tools Made Possible by Government-Sponsored Basic Research

Positron Emission Tomography (PET)

PET uses a specialized camera to measure the concentration and movement of radiotracers, or radioactive atoms, in the human body, aiding the diagnosis of such diseases as Parkinson's and Alzheimer's. DOE and NIH supported the initial research behind PET technology and continue to support research to advance its capabilities today.



These images of a normal brain (left) and one with Alzheimer's disease (right) were taken with PET cameras.

Images courtesy of www.nia.nih.gov



This CT scan of a liver, which pictures everything from the organ itself to its surrounding blood vessels, can help doctors detect blocked ducts, tumors, and other abnormal tissues.

Image courtesy of www.mritutor.org

Computed Axial Tomography (CT)

CT uses sophisticated computer technology to produce 3D images of the skeleton and internal organs, significantly reducing the need for exploratory surgery to diagnose disease. Since the 1970s, NIH and DOE have provided funding for the research behind CT. Today, NIH is funding research to reduce the amount of radiation in CT scans.

Magnetic Resonance Imaging (MRI)

MRI, which is useful in detecting damage to the body's soft tissues, was developed from basic research on atomic nuclei funded by NIH, NSF, and DOE beginning in the 1970s. Scientists researching the magnetic characteristics of atoms discovered that their nuclei act as if they are polarized magnets. MRI detects those polar properties with cameras to display pictures of the human body.



This MRI of a knee (left) can help doctors detect damage to fragile tissue caused by accidents, stroke, bone disease, and tumors.

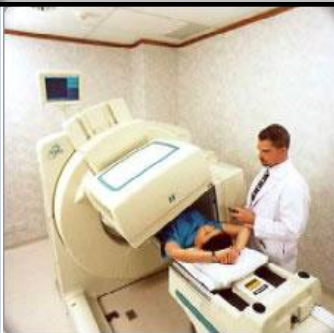
Image courtesy of www.MR-TIP.com

Basic Research: Benefiting Patients, Revolutionizing Medicine

The U.S. has been the world leader in scientific discovery and medical innovation for more than 60 years. Discoveries made through government-funded basic scientific research have led to the creation of thousands of high-paying American jobs and to life-saving therapies and treatments that benefit millions of people. However, without increased investment in basic scientific research, U.S. leadership is at risk.

PET

- A 52-year-old male with cognitive problems was referred for a PET scan to evaluate brain metabolism.
- The PET scan revealed several areas of his brain to be consistent with patterns of Alzheimer's Disease, allowing for a confirmed diagnosis and potential treatments.



The case studies at left illustrate the revolutionary care that medical diagnostics provide as a result of discoveries in basic science. Federal support of basic research has improved American lives over the course of history. Only continued investments will yield the next generation of innovative technologies and the scientists and engineers who will produce them.

CT

- Three weeks after swallowing a dental crown, a 39-year-old woman was referred for a CT scan, which confirmed that she had aspirated a foreign object.
- Incidentally, the scan also revealed a nodule in the patient's right lung, later diagnosed as lung cancer.



Physicians Rank MRI and CT as Most Important Medical Innovation

Many technological innovations have had great clinical significance in U.S. medicine. However, when asked in a 2001 survey to rank the value of 30 top medical innovations over the past three decades, physicians cited MRI and CT diagnostic interventions as providing the greatest benefit to their patients. Ranked higher than other drugs and medical tests developed during this period by a considerable margin, the basic-research-rooted MRI and CT have transformed modern medicine.

MRI

- A 23 year-old male twisted his right knee while playing football.
- After initial conservative therapies failed to improve his injury, he was referred for an MRI scan that revealed a complete tear of the anterior cruciate ligament.



The nation's investments in basic research in a variety of disciplines – including biology, chemistry, physics, engineering, and more – are critical to America's continued global leadership in innovation, improved health, and the quality of medical care and treatment. Though these investments may take years or decades to ripen, history has shown their unequivocal link to competitiveness and to the wellbeing of the American people.