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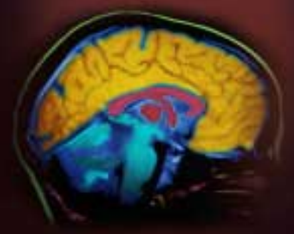
Spotlight on...Medical Technology is a special issue of EIC's health news brief that focuses especially on brain imaging techniques. This issue was developed in response to requests for medical information through our ***First Draft*** technical assistance service.

NIDA
NATIONAL INSTITUTE ON DRUG ABUSE



Spotlight on . . .
Medical Technology

A Newsbrief of the Entertainment Industries Council, Inc. No. 19

Mapping the Mind

From the ***CSI*** and ***Law and Order*** franchises to hospital shows like ***Scrubs, Strong Medicine*** and ***E.R.*** and genre-busting shows like ***Six Feet Under***, medicine and forensics have taken television by storm, and are in increasing demand among viewers. What's more, with the rise of reality television, audiences expect *realistic* depictions of technical information on their television screens. This issue of *Spotlight on...* will detail techniques for brain imaging, which serves many medical and forensic purposes. It will also show you how different substances affect the human body in a very detailed and easy-to-understand way.

Neuroimaging (noun)— Newly developed techniques that can create visual images of a brain in action, with an indication of which regions of the brain show the most neural activity during a particular task. One of the most widely used neuroimaging techniques is positron emission tomography (PET).

If you have any questions about brain imaging or any other form of medical technology, our *First Draft* experts are just a call away. Call (866) 289-4347.

Despite not knowing the ultimate peripheral effects of smoking on the body, the PET scan below shows conclusively that smoking *does* affect the entire body on an enzymatic level.

New research shows that cigarette smoke also decreases levels of a critical enzyme called monoamine oxidate B (MAL B) in the kidneys, heart, lungs and spleen. Too much or too little of this crucial enzyme can have an effect on a person's mental or physical health. MAO B is important because it breaks down the chemicals that allow nerve cells to communicate and regulate blood pressure.

"When we think about smoking and the harmful effects of smoke, we usually think of the lungs and of nicotine," says National Institute on Drug Abuse (NIDA) Director Dr. Nora D. Volkow, one of the authors of the study. "But here we see a marked effect on a major body enzyme in sites far removed from the lungs that we know is due to a substance other than nicotine. This alerts us to the fact that smoking, which is highly addictive, exposes the whole body to the thousands of compounds in tobacco smoke."

The illustration shows the concentration of radioactive tracer bound to monoamine oxidase B (MAO B). Red shows the highest concentration. Clearly, lower concentrations are seen in the smoker. In certain areas, such as the lungs and brain, concentrations are so low as to be virtually absent. This demonstrates decreased amounts of MAO B in the peripheral organs of smokers compared with nonsmokers.

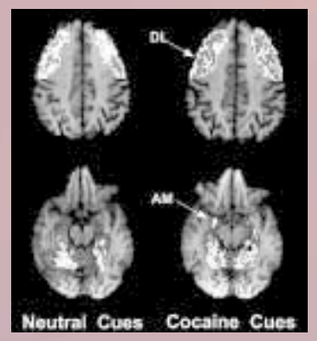
Proceedings of the National Academy of Sciences, September 6, 2001, "Low Monoamine Oxidase B in Peripheral Organs in Smokers."

An Artist's Vision

Before medical science let us in on the inner workings of the human brain, Vincent Van Gogh painted "Skull of a Skeleton with Burning Cigarette" (1886). Artists like Van Gogh and Leonardo Da Vinci contributed their knowledge of human anatomy to the world of medical science. EIC is proud to work with entertainment creators to continue the tradition of combining art and science to make a difference in public health.

Brain on Cocaine

An MRI's Vision



A Doctor's Vision

Dr. Scott Lukas and his colleagues at McLean Hospital and Harvard Medical School combined electroencephalograms and MRI to create this topographic brain map. The image above shows the increase in alpha wave activity during cocaine-induced euphoria.

Mapping the Body

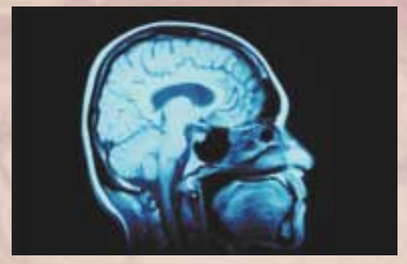
Medical technology has come a long way in a very short time. In the 1920s, an Austrian scientist named Hans Berger tapped into the somewhat common knowledge that the human brain produces electrical activity, and recorded this activity with an **electroencelaphogram (EEG)**. While EEG technology does not draw images of the brain per se, it maps out brain activity and can be said to be the first-ever brain imaging technique.

EEGs, which are still used today, were the only way of charting brain activity until the 1970s, when **Computerized Axial Tomography**, or **CAT/CT**, scans were developed. CAT scanning is a process that combines many 2-dimensional x-ray images to generate cross-sections or 3-dimensional images of internal organs and body structures, including the brain.

Positron Emission Tomography, or **PET**, scans, also developed in the 1970s, show blood flow or metabolism in all parts of the brain. PET scan subjects are injected with a small amount of radioactive glucose; the scanning machine then scans the absorption of radioactivity externally. Brain cells use glucose as fuel, and PET works on the theory that if brain cells are more active, they will consume more of the radioactive glucose, and if less active, they will consume less of it.[1] Unlike EEG, CAT and MRI technology, PET scanning produces high-quality **color** images of the brain to allow for greater depth of viewing and isolation of inactive areas.

In 1997, **Magnetic Resonance Imaging**, or **MRI**, technology was invented. MRI uses magnetic fields and radio waves to produce high-quality two or three-dimensional images of brain structures without injecting radioactive tracers.[2]

The newest brain scanning technology is called **magnetoencelography** (**MEG**). MEG measures magnetic output that originate *in* the brain as the result of brain activity. In MEG, coils surrounded by liquid helium are suspended over a person's head. The magnetic field generated by the brain produces a current in a very sensitive device called a superconducting quantum interference device, or SQUID.



While MEG produces the most accurate resolution of nerve cell activity, it is also the most expensive technique available, costing millions of dollars just to manufacture and install the machines. The machinery is also very heavy, weighing eight tons. Because of these reasons, MEG technology is scarce, with only a few available worldwide.

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[1] PBS. "The Secret Life of the Brain." Available online: http://www.pbs.org/wnet/brain/scanning/pet.html. Accessed December 15, 2003.

[2] Aine, C.J. A conceptual overview and critique of functional neuroimaging techniques in humans: I. MRI/fMRI and PET. *Critical Reviews in Neurobiology* 9(2-3): 229-309, 1995. From *NIDA Notes*, November/December, 1996.