

2.6 RESEARCH Life Sciences



Taking Research On the Road

Carnegie Mellon University's Data Truck is a 36-foot mobile social science laboratory allows the university to conduct research involving groups of people, such as senior citizens, who cannot readily come to campus. The truck's trailer is outfitted with a waiting area and eight workstations where research participants will answer surveys, work on computers or test new products. Researchers plan to use the Data Truck to study how people learn to use new technologies. This kind of research has important applications for developing devices that will help senior citizens and people with disabilities lead more independent lives, which is a major focus of Carnegie Mellon's Quality of Life Technologies Initiative. The initiative is a joint venture with the University of Pittsburgh that is supported by the National Science Foundation.

<http://cbdr.cmu.edu/datatruck>

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Pittsburgh's steel mills may have burned out long ago, but Carnegie Mellon's technology is contributing to the city's new status as a hotbed for biotechnology research and innovation. The university doesn't have a medical school in the traditional sense, but its highly specialized biotechnology and cognitive studies programs are having an impact everywhere, from the operating table to the way we rehabilitate stroke victims.

Collaborations between Carnegie Mellon and other institutions have already resulted in better dyes and modeling for studying cells, a revolutionary approach to hip replacement surgery and a new understanding of how infants think. And, its educational programs are training the researchers that will lead the growth of these sectors into the future.

Molecular Biosensor and Imaging Center:

The MBIC's approach to biosensor research promises to yield sophisticated molecular sensors that could be used to detect real-time behavior of the building blocks of life, including a subject's RNA, DNA, protein, peptides, lipids and hormones. Biologist Alan Waggoner leads a team working on fluorescent probes, which use dyes to signal changes in target molecules. These sensors will provide a very powerful tool for detecting a wide range of important biological processes involved in health and disease. Likely applications for the technology are as varied as hospital bed monitoring devices, handheld biohazard scanners for field use and food freshness detectors.

www.mbic.cmu.edu

Center for Cognitive Brain Imaging: The CCBI investigates high-level cognition — language comprehension, problem-solving,

visual thinking and executive processes — through the use of function magnetic resonance imaging (fMRI) and related approaches. Its research goal is to develop a unified theory that explains how thought emerges from brain function. The center uses state-of-the-art scanners at the new Brain Imaging Research Center, as well as behavioral studies, eye fixation studies and therapy studies of people with brain damage. The main applications are to the understanding and treatment of brain damage and to the enhancement of human performance in high-technology environments.

www.ccbi.cmu.edu

Center for Automated Learning and Discovery:

CALD applies machine-learning methods in order to classify the cognitive state of a human subject based on fMRI observations. That is, the project has successfully "trained" artificial-intelligence systems to determine from

brain images whether a subject is looking at a picture or a sentence, reading a noun or a verb, etc. Eventually, these systems will lead to “virtual sensors” that can detect hidden cognitive states of a subject, providing a key tool for diagnosis of mental processes in patients with brain injuries. www.cald.cs.cmu.edu

Center for the Neural Basis of Cognition: A joint endeavor of Carnegie Mellon and the University of Pittsburgh Medical Center (UPMC), the CNBC is dedicated to the investigation of the neural mechanisms that give rise to human cognitive abilities. UPMC serves a large population of patients with functional and/or neurological disorders, including epilepsy, stroke, Parkinson’s disease, schizophrenia, affective illness and Alzheimer’s disease, and employs state-of-the-art functional imaging techniques for identifying sites of neurological damage. Carnegie Mellon’s expertise in cognitive psychology imparts another layer of scientific analysis of the psychological disturbances these patients experience. Using experimental computational models, our researchers can study the neural pathways of normal brains and uncover the effects of structural damage on brain function and human performance. www.cnbc.cmu.edu

Bone Tissue Engineering Center: The BTEC is a collaboration between Carnegie Mellon, the University of Pittsburgh Medical Center, Children’s Hospital and Duquesne University. Its mission is to develop bone and cartilage therapies to treat developmental deformities, ablative injuries, degenerative changes, tendon/ligament healing, hypoplastic fat and vascular insufficiencies. The center also encourages the transfer of developed technologies and treatments to enable new biotech ventures. www.btec.cmu.edu

Laboratory for International Privacy: Carnegie Mellon’s “Data Privacy Lab” is dedicated to creating technologies and related policies with provable guarantees of privacy protection while allowing society to collect and share private or sensitive information for many worthy purposes, such as biomedical research. The Lab partners with institutions, agencies and corporations to develop answers to questions such as: What are good and bad privacy practices for sharing DNA sequences? <http://privacy.cs.cmu.edu>

Real-time Outbreak and Disease Surveillance: RODS is a computer-based surveil-

lance, analysis and communication system that monitors public-health data and looks for patterns that suggest an abnormal or hostile occurrence. In this way, it provides early warning of naturally occurring disease outbreaks as well as terrorist attacks employing biological pathogens. The Biomedical Security Institute that runs RODS is a collaboration between Carnegie Mellon, the University of Pittsburgh and the Allegheny County Health Department. www.rods.pitt.edu

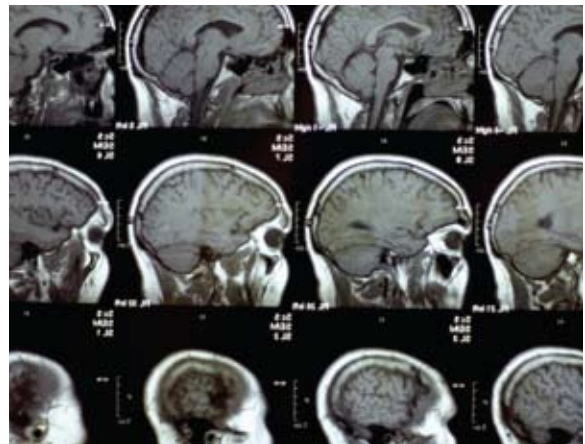
Quality of Life Technologies Engineering Research Center: June 2006, will see the creation of Carnegie Mellon’s newest life-sciences hub: the Quality of Life Technologies Engineering Research Center (QoLT ERC). A joint venture with the University of Pittsburgh, the QoLT ERC will be dedicated to improving and sustaining the quality of life for a large and growing segment of our population: people with reduced functional capabilities due to aging or disability. As families, communities and individuals, we face new challenges to attain, prolong and preserve quality of life. Future QoLT systems will not just be gadgets for

convenience, they will be intelligent assistants that fundamentally enhance the lives of both the infirm and their caregivers. Projects include nurse robots, fall-prevention technologies, robotic walkers and remote people-monitoring. www.qolt.org

Pittsburgh Mind-Body Center: Increasingly, medical science recognizes the importance of understanding the common pathways — psychological, behavioral, and psychobiological — that connect environmental factors with the onset of and recovery from diverse physical illnesses. That’s why Carnegie Mellon and the University of Pittsburgh, supported by the NIH, founded the Pittsburgh Mind-Body Center. Each of the center’s four major research initiatives is working toward a better understanding of how the mind influences a person’s physical experience with a particular disease. Two of the studies — on osteoarthritis and breast cancer — are designed to serve as interventions, while the other two — on infectious flu and cardiovascular disease — are oriented toward examining risks for disease. www.wpic.pitt.edu/pmbc

Researchers Use Brain Scans To Predict When People Will Buy Products

For the first time, researchers have used functional magnetic resonance imaging (fMRI) to determine what parts of the brain are active when people consider whether to purchase a product and to predict whether or not they ultimately choose to buy the product. The study appears in the journal *Neuron* and was co-authored by scientists at Carnegie Mellon University, Stanford University and the



MIT Sloan School of Management. This paper is the latest from the emerging field of neuroeconomics, which investigates the mental and neural processes that drive economic decision-making. The results could have a profound impact on economic theory, because the decision of whether to purchase a product is the most basic and pervasive economic behavior. Twenty-six adults participated in the study, in which they were given \$20 to spend on a series of products that would be shipped to them. If they made no purchases, they would be able to keep the money. The products and their prices appeared on a computer screen that the participants viewed while lying in an fMRI scanner. The authors were able to successfully predict whether the study participants would decide to purchase each item. The results of this paper support an alternative perspective that views consumers as trading off the immediate pleasure of making a purchase against an immediate pain: the pain of forking out the money for the item. The results can explain the growing tendency of consumers to overspend when purchasing items with credit cards instead of cash, because consumers do not immediately pay for items charged to credit cards and the “pain” of the potential loss is minimized. Economic policies designed to promote savings would thus need to take this into account. It also suggests that differences in how much people spend and save may be partly explained by differences in the degree to which they find spending money painful.