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UM Announces Inventions of the Year

COLLEGE PARK, Md. -- A powerful discovery for the detection and removal of viruses from the bloodstream, a robot that allows neurosurgeons to dissect brain tumors with minimal disturbance to brain tissue and a system for creating visual images from sound information are the winners of the 21st annual Invention of the Year Awards, presented this Thursday, April 17th, by the Office of Technology Commercialization (OTC) at the University of Maryland.

The 2007 winners were announced at an evening reception attended by over 100 members of the University of Maryland and business communities. The awards are presented annually to honor outstanding inventions and inventors from the previous year. Each year a panel of judges made up of both University of Maryland personnel and industry experts selects one winner from groups of finalists in each of three categories: life science, information science, and physical science. The winners are chosen based on the creativity, novelty, and potential benefit to society of each of the inventions.

Many past winning inventions have formed the basis of successful companies and/or commercial products. For example, last year's awardees (2006 Inventions/Inventors of the Year) in the life science category were university professors Steve Hutcheson and Ronald Weiner. Their powerful process for producing biofuels from many different materials, and the company (**Zymetis**) founded on that process, have been drawing wide attention from investors, local and national media and Maryland Governor Martin O'Malley and his administration. Among all winners from the past 10 years, four winning technologies (including Zymetis) have been developed into start-up companies and 15 have been exclusively licensed to companies, including Neocera, Millenium Inorganic Chemical, and Kemin Foods.

Life Science Invention of the Year

Molecularly Imprinted Polymers for the Specific Binding and Separation of Viruses
Peter Kofinas, professor, Fischell Department of Bioengineering, Clark School of Engineering; Daniel Scott Janiak, graduate assistant, Fischell Department of Bioengineering

The separation of viruses from blood and bodily fluids is a critical but tedious task in the diagnosis and treatment of numerous ailments and in the development of vaccines. Researchers at the University of Maryland have developed a low-cost, effective method for the detection and separation of viruses from cell culture and other medically relevant media. These molecularly imprinted polymers (MIPs) are "polyampholyte crosslinked polymer materials" that contain specific cavities matching the size and shape of the particular virus with which they have been designed to bind. These MIPs can be incorporated into dialysis machines, medical diagnostic systems, or chromatographic systems to selectively recognize the virus of interest.

This technology can be used to develop a dialysis system consisting of custom synthesized MIPs packaged into plastic discs (cartridges) that are compatible with commercially available hemodialysis devices. This will enable hospitals, clinics, and other healthcare organizations to turn existing dialysis systems into virus removal systems capable of lowering the viral load (concentration of virus) in patients with HIV, Hepatitis B, Hepatitis C, or other blood-borne viruses. This technology can also be used to easily produce virus-free biopharmaceuticals and vaccines.

This technology has been exclusively licensed to a Maryland-based start-up company. A U.S. patent application is pending.

Finalists in the Life Science Category: "A New Application of Aminoglycoside Antibiotics for Treatment of Viral Diseases" by Jonathan D. Dinman, associate professor, Cell Biology and Molecular Genetics, Department of Life Sciences, Jeffrey J. DeStefano, associate professor, Cell Biology and Molecular Genetics; "Scaled Production of 'Living' Plastics" by Lawrence R. Sita, professor, Chemistry and Biochemistry, College of Chemical and Life Sciences, and Associate Dean for Faculty, Research, and Diversity, Wei Zhang, graduate student, Materials Science and Engineering, Clarke School of Engineering.

Physical Science Invention of the Year
Minimally Invasive Neurosurgical Intracranial Robot
Jaydev P. Desai, associate professor, Mechanical Engineering, Clark School of Engineering; Marc J. Simard, professor, University of Baltimore, Department of Neurosurgery, Satyandra K. Gupta, associate professor, Mechanical Engineering, Rao Gullapalli, associate professor, University of Baltimore, Department of Radiology, Nicholas Pappafotis, graduate student, Mechanical Engineering, Wojciech Bejgerowski, graduate student, Mechanical Engineering.

Brain tumors, which occur in 20-40 percent of adult cancer patients, are among the most feared complications of the disease. Despite numerous advances in treatment, the prognosis for these patients is poor, with a median survival of 4-8 months. The primary reasons for the poor survival rate are the lack of way to get good continuous imaging during intracranial surgery and the inability to remove the complete tumor tissue due to its placement in the brain and the corresponding space constraints to reach it. Use of magnetic resonance imaging (MRI) during surgery supplements the surgeon's visual and tactical senses in a way that no other imaging device has achieved, resulting in less trauma to surrounding healthy brain tissue during surgery. To minimize the trauma to surrounding healthy brain tissue, it would be beneficial to operate through a narrow surgical corridor dissected by a neurosurgeon.

Researchers at the University of Maryland, in conjunction with researchers at the University of Maryland School of Medicine, Baltimore, have invented a robot that would allow a neurosurgeon to remove brain tumors and other intracranial masses in human patients in a minimally invasive manner while the patient is undergoing brain imaging. This invention comprises a highly dexterous robot capable of removing intracranial tumors and masses while operating through an extremely narrow corridor in the brain, thus producing minimal disturbance or damage to normal brain tissues. Unique features include:

- Sufficiently small size to allow removal of tumors while the patient's brain is imaged
- Fabrication of materials that are entirely compatible with magnetic resonance imaging
- A virtual interface between the imaging process (MRI) and the robot that allows the neurosurgeon to conduct the surgery without having to directly visualize the tumor during its removal. The neurosurgeon has direct control of the robot guided by the imaging.
- Ability to manipulate instruments required to destroy tissues, including but not limited to monopolar and bipolar electrocautery, laser, radio-frequency ablator and ultrasonic cavitator
- Ability to manipulate instruments required to remove tissue debris, including irrigation and suction

A U.S. patent application is pending.

Finalists in the Physical Science Category: "Wave Fingerprint of Complicated Enclosures" by Sameer Hemmady, graduate student, Electrical and Computer Engineering, Clark School of Engineering, Steven Mark Anlage, professor, Physics,

College of Computer, Mathematical and Physical Sciences; "Lateral Two-Terminal Nanotube Device and Method for their Formation" by Parag Banerjee, graduate assistant, Center for Automation Research, Israel Perez, graduate student, Materials Science and Engineering, Clarke School of Engineering, Gary W. Rubloff, professor, Institute for Systems Research, Sang Bok Lee, assistant professor, Chemistry and Biochemistry, College of Chemical and Life Sciences, Erin Robertson, graduate student, Materials Science and Engineering.

Information Science Invention of the Year
Audio Camera for Efficient Sound Localization
Ramani Duraiswami, associate professor, Institute for Advanced Computer Studies, Adam O'Donovan, research assistant, Institute for Advanced Computer Studies, Nail A. Gumerov, research assistant, Institute for Advanced Computer Studies.

Much as an optical camera creates images from captured light intensity to create a real time picture, an audio "camera" developed by researchers at the University of Maryland creates a real- time audio image out of sound arriving from all directions to a specific point – the location of the camera. The audio images can be projected onto a corresponding video image for a complete understanding of where the sound originates. Audio images are created using a spherical microphone array "beam former" and then related to video images using standard computer vision techniques.

This audio camera can be extremely useful in many areas, such as the automobile industry, defense applications, etc. In the automobile industry, where auto designers are constantly struggling to produce the quietest luxury cabins, designers could benefit from the identification of the spatial origin of noise in real-time. Conventional technology does not allow real-time noise detection and hence relies on data storage for post-processing of the detected signal. This novel audio camera alleviates the harsh memory restrictions of conventional technology and provides near infinite duration monitoring of the acoustic field.

The novel technology also can be used in defense applications such as "sniper identification," where the spatial direction of gunfire must be determined. And this technology can be used by architects to design better concert halls. It gives them the capability to associate sound reflections in different parts of the concert hall without trial and error. A U.S. patent application is pending.

Finalists in the Information Science Category: "Geometry Based Search Software," by Satyandra K. Gupta, professor, Mechanical Engineering, Clark School of Engineering, Antonio Cardone, research associate, Mechanical Engineering, Maxim Schwartz,

research assistant, Mechanical Engineering; “Context Aware Distribution of Information to Improve Quality of Life” by Ashok K. Agrawala, professor, Computer Science, College of Computer, Mathematical, and Physical Sciences and Director of the Maryland Information and Network Dynamics Lab, Amitabh Varshney, professor, Computer Science.