McGowan Institute for Regenerative Medicine
A program of the University of Pittsburgh and UPMC

McGowan Institute for Regenerative Medicine Affiliated Faculty Receive Awards for Excellence

The Carnegie Science Center established the Awards for Excellence program in 1997 to recognize and promote outstanding science and technology achievements in Western Pennsylvania. The Carnegie Science Awards have honored the accomplishments of more than 400 committed individuals and organizations that have improved lives through their contributions in science and technology. Award winners were announced on January 29, 2015. On May 8, 2015, at the Carnegie Music Hall the following McGowan affiliated faculty members will be honored for their tremendous work and its impact on the vitality in the region:

CARNEGIE SCIENCE AWARDS
Honoring Innovation in Science and Technology

- Advanced Materials: Steven Little, PhD
- Catalyst: Rory Cooper, PhD
- Life Sciences: Yadong Wang, PhD
- Emerging Female Scientist (Honorable Mention): Fabrisia Ambrosio, PhD

The Advanced Materials Award recognizes accomplishments in materials science that create new materials or properties leading to significant business, economic, or societal benefits for the region.

Steven Little, PhD

Dr. Steven Little has invented and demonstrated the application of "programmable" biodegradable polymer-based biomaterials for use in advanced drug-delivery strategies such as immunotherapeutics and tissue engineering. His work has opened the door to rapid customization of the behavior of biomaterials that, although having excellent records of FDA translation (superbly safe and naturally resorbable materials), are known to exhibit extremely unpredictable release behavior, with little correlation between how the release system was formulated and how the formulation behaves. The formulation of these biomaterials through the remarkable computer models developed by Dr. Little are being used to optimize in a matter of minutes the delivery time and dose of a release system. Prior to this development, the previous trial-and-error approach could take at least months and often multiple years of testing. The new approach can save millions of dollars for each formulation to be developed.

There are many applications for controlled release of medications. One example relates to gum disease. The Little Lab has shown in preclinical studies that custom-designed, controlled-release micro-capsules can reverse gum disease, the leading cause of tooth loss in adults and sometimes termed the most serious oral health problem of the 21st century, as it is becoming associated with serious complications such as heart disease, stroke, and even pre-term child birth (to just give a

few examples). Current treatment includes scaling, root planning, and other procedures to remove the plaque and bacteria that have accumulated in pockets between the teeth and gums. The Little polymer technology employs controlled-release micro-capsules, filled with a protein that, when injected into the pockets between the gums and the teeth, acts as a homing beacon. It guides immune cells to the diseased area, reducing inflammation, creating an environment that fights the disease process, and even could create conditions favorable for gum tissue to regrow.

The Catalyst Award recognizes individuals and organizations that have come to exemplify an area of science because of the actions they have taken to create public awareness over a broad swath of society.

Rory Cooper, PhD

Dr. Rory Cooper's contributions to the science, technology, engineering, and math (STEM) fields have been significant and diverse. They range from programs from K-12, high school educators, college undergraduates, graduate programs, and programming for our returning Veterans interested in STEM fields. All of the educational and innovative programs that Dr. Cooper offers are designed to get people interested and engaged in assistive technology, to solve complex problems, and ultimately, to provide technologies for people with disabilities to empower them to become more independent and have a higher quality of life. The mission of the Human Engineering Research Laboratories is "to continuously improve the mobility and function of people with disabilities through advanced engineering in clinical research and medical rehabilitation," and the vision is "to create a world where all people with disabilities have unencumbered mobility and function so that they can fully participate in and contribute to society." Dr. Cooper consistently demonstrates that by not only the programming that he has created, but also on an individual basis, consistently challenging people with disabilities to stay and remain engaged, overcome obstacles, and to exceed goals they have set for themselves.

The impact that Dr. Cooper has on the local, regional, national, and international community is quite significant. With the multitude of non-profit organizations he works with or is a chair member of, he impacts the local community by being an advocate for our Veterans and people with disabilities. Regionally, he serves as a Civilian Aide to the Secretary of the Army, where he advises senior military leadership on transitional issues for Veterans with disabilities, aiming to give them a successful transition into civilian life. Nationally, he is having some of HERL's programming replicated throughout the United States to increase interest in STEM and technology to assist those with disabilities. And internationally, he has a significant influence on other laboratories dedicated to supporting the needs of the disabled; ranging from countries with significant capabilities to do such to third world regions of the world.

The Life Sciences Award recognizes and honors scientific advances in new and innovative biomedical and life sciences endeavors.

Yadong Wang, PhD

Dr. Yadong Wang is the founder of the "Pittsburgh Biomaterials Foundry," a state-of-the-art research lab and materials preparation facility whose goal is to improve lives through biomaterials innovation. Using a multidisciplinary approach combining chemistry, biology, and materials science and engineering, Dr. Wang has created functional biomaterials that will enable new treatments in regenerative medicine. He is advancing the field through innovations in biomaterial design, processing, and application. His development of a cell-free, biodegradable artery graft offers a transformative change in coronary artery bypass surgeries: Using the technology that he has developed, within 90 days after surgery, the patient will have a regenerated artery with no trace of synthetic graft materials left in the body. Dr. Wang has designed grafts to harness the body's regenerative capacity. This new approach is a philosophical shift from the predominant cell-centered approaches in tissue engineering of blood vessels. Because the grafts are highly porous, cells can easily penetrate the graft wall, and mononuclear cells occupied many of the pores within 3 days. In preclinical studies, within 14 days, smooth muscle cells--an important blood vessel builder--appear. At 90 days, most inflammatory cells are gone, which correlate with the disappearance of the graft materials. The artery was regenerated in situ and pulsed in sync with the host. Furthermore, at 1 year the composition and biomechanical properties of the regenerated arteries are the same as native arteries. This study is the first that shows a complete transformation of a synthetic plastic tube to a new artery.

Current approaches toward tissue-engineered arteries require a long production cycle because of the required cell culture steps. The newly developed graft is made in a few days, stores in a dry pouch at ambient temperature, and is readily available off the shelf. The ease of use and storage are similar to the conventional Dacron® grafts. Also, Dr. Wang's invention of a truly biodegradable and biodegradable elastomer has led to an explosion in research in bioelastomers. *Science Translation Medicine* called this research "a departure from traditional tissue engineering" and "bridging the gap for small-diameter vascular grafts." Companies are competing to license this technology.

The Emerging Female Scientist Award recognizes a female leader whose cutting-edge work inspires change in math, science, or technology. The awardee is generally at an independent stage of her career whose emerging impact is reflected in an upward career trajectory. As such, nominators may wish to comment on recent publications or projects that demonstrate this upward trajectory.

Fabrisia Ambrosio, PhD

Tissue engineering has been the core technology behind many recent advances in regenerative medicine. An example is the use of tissue engineering for the regeneration of lost muscle in the extremities due to trauma. Dr. Fabrisia Ambrosio, a rehabilitation scientist, has been one of the visionaries that have recognized that there needs to be a "fusion" between regenerative medicine and rehabilitation. Most have assumed that rehabilitation therapy is an important aspect of recovery after volumetric muscle loss. However, the traditional rehabilitation approach involves a period of rest and passive loading followed by gradual active loading. The tissue engineering of the lost muscle is accomplished through the use of extracellular matrix (ECM) which is a naturally occurring material consisting of structural proteins which provide mechanical strength, structural support, and functional molecules with diverse bioactive properties. The research by Dr. Ambrosio and her colleagues has shown that the addition of aggressive regenerative rehabilitation protocols immediately after surgical implantation of an ECM scaffold to an area of volumetric muscle loss has significant benefits for ECM remodeling. Rehabilitation exercises likely provide the needed mechanical signals to encourage cell migration and site-specific differentiation in the temporal framework required for constructive remodeling.

The significance of this outcome is profound. Consider the case of Marine Corporal Hernandez, then 19, who was injured when an enemy mortar exploded nearby, blasting him with shrapnel. "Pretty much anything that wasn't covered -- arms and legs -- was hit," he said. Worst hit was his upper right leg, which was so damaged he could hardly use it. After multiple surgeries using traditional procedures, Corporal Hernandez was considering having the leg amputated as he thought he could have more functionality with a prosthetic leg. However, he had an opportunity to participate in the ECM-based therapy trial, and today he rides mountain bikes and takes part in other rigorous activities. This was a multidisciplinary endeavor involving surgeons, tissue engineering specialists...and a rehabilitation pioneer, Dr. Ambrosio. It was the fusion of the clinical expertise, the tissue engineering and regenerative medicine technologies...AND the rehabilitation expertise from Dr. Ambrosio that led to the incredible outcomes shared herein.

Illustration: Carnegie Science Center.

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