

Biomedical Engineering Innovative by Design

The Joint Department of Biomedical Engineering unites two prestigious university traditions: NC State's College of Engineering and UNC-CH's School of Medicine. Established in 2003, the concept itself is innovative. The intellectual property developed from this merger is even more impressive.

Biomedical research depends on sophisticated diagnostics and clinically progressive technologies. Researchers at NC State are taking up that challenge and advancing the architecture of biomedical microdevices.

In FY2007, NC State researchers developed a concept for an improved microfluidic device for spheroid cultures.

Biomedical researchers use microfluidic devices for DNA analysis, cell manipulation, cell separation and clinical diagnostics.

Dr. Glenn Walker observed the disadvantages of the current method of culturing spheroids using a culture dish and shaker. This traditional method introduces multiple cells into a relatively large volume of medium, which can result in spheroid fragmentation and re-aggregation.

Dr. Walker's microfluidic system solves this problem by culturing single spheroids in a chamber, the diameter of which is slightly larger than a single spheroid (~300µm). Because spheroids are inherently self-limited in their growth, they can be maintained at a constant size indefinitely within the chamber.

The microfluidic connections to the culture chambers allow the spheroids to be gently perfused with medium or exposed to arbitrary challenges. Spheroids can also be visualized *in situ* which allows them to be monitored continuously during experiments.

Dr. Walker's innovation paves the way for biomedical researchers to manipulate and observe spheroids in ways not possible with current technology.

While faculty members lead advances in biomedical research, they are also charged with NC State's core education mission. Enter Biomedical Engineering's Senior Design class.

Andrew DiMeo, Biomedical Engineering Program Director for Industrial Relations, leads groups of undergraduate seniors through product development from concept to reality. Implementing industry standard design control processes, students learn the strategic skills necessary to find unmet needs and develop innovative solutions.

When Jennifer Boyd, Jennifer Hawthorne, Eric Rush, and Tabitha Staniszewski learned that 1 in 200 Americans use a wheelchair, they identified a need for a stationary

rehabilitation setting and developed their senior design project: a variable resistance treadmill for use with a manual wheelchair.

In FY2007, Senior Design Teams submitted seven invention disclosures to the Office of Technology Transfer. These innovations range from physical therapy devices, to wireless communication components, to a Sudden Infant Death Syndrome (SIDS) Intervention Device. The innovations are as diverse as the needs identified by each team.

The contributions of intellectual property made by the Department of Biomedical Engineering are significant. Disclosures received from the department and senior design teams account for 10% of all innovations reported this fiscal year.

