Center for Affordable Nanoengineering of Polymeric Biomedical Devices (CANPBD)

NSF NSEC Grant 0914790
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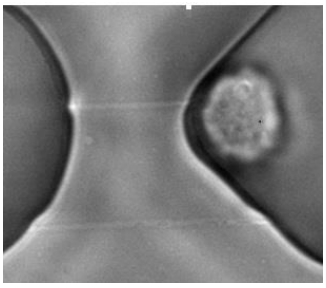
The primary goal of the Center for Affordable Nanoengineering of Polymeric Biomedical Devices (CANPBD) is to develop polymer-based, low-cost nanomaterials and nanoengineering technology to produce advanced medical diagnostic devices, cell-based devices, and multifunctional polymer-nanoparticle-biomolecule nanostructures for next-generation medical and pharmaceutical applications. Although challenging, this goal provides not only opportunities for scientific breakthroughs and the development of cutting edge technologies, but also novel and demonstrable interdisciplinary system integration. Fundamental science and engineering is one of the major foci of our center. We have established a nanotechnology system in Phase II to address the need for:

(1) 'up-stream' fundamental science,

(2) high risk technologies meeting long-term research objectives,

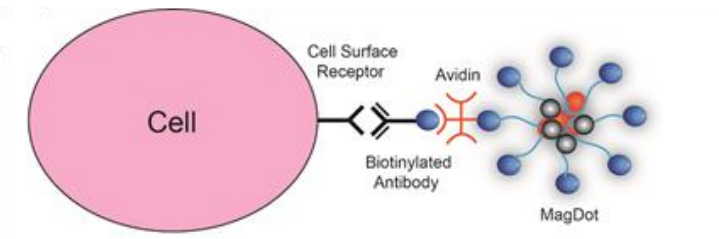
(3) 'down-stream' devices and nanoconstructs requiring integrated system-level effort.



Cell at tip of microchannel for transfection

The interconnections among fundamental sciences, technology innovations and medical applications of our research efforts in Phase II are organized into three highly integrated 'nanofactory assembly (or disassembly) systems for personalized nanomedicine. The first two consist of an Automated Cell to Biomolecule Analysis (ACBA) 'liquid biopsy' System for early cancer detection and the third is a smaller Multifunctional Nanoparticle Design and Synthesis (MNDS) System for simultaneous delivery of therapeutic, imaging and probing reagents. One ACBA system is based on an Optical Tweezers platform, while the other is based on a Magnetic Tweezers platform. All three systems share many similar nanotechnologies and nanomaterials to address a broad range of biomedical needs. In the past year, we enhanced the application of our research results to specific medical uses including early cancer detection, nanocarriers for drug/gene delivery, and non-viral gene transfection for regenerative medicine.

The center's research team has been very productive over the last decade. For example in the last year, our faculty and students published 87 peer reviewed technical papers (422 papers since 2009). In addition, 9 patents were licensed (12 since 2009), 7 patents were filed (39 patents filed since 2009), 4 patents



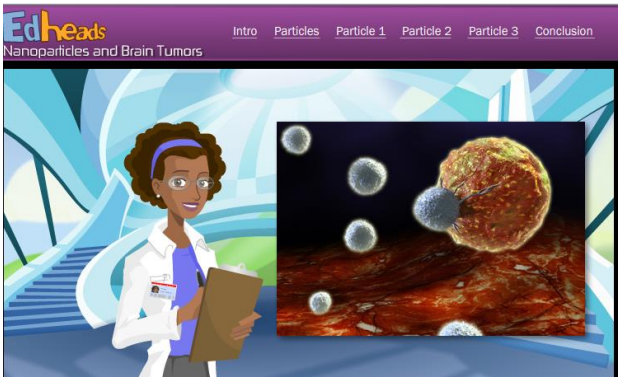
Conjugation of a fluorescent-magnetic micelle to a cell for magnetic manipulation.

were awarded (11 patents awarded since 2009), and 5 inventions were disclosed (26 inventions disclosed since 2009).

Our research program and industrial collaboration are strongly enhanced by $2.5M in federal grants, over $780,000 in research and commercialization grants from industry, and SBIR Phase I and II grants. We have designed, built and successfully demonstrated nanotechnology based cancer detection and gene transfection prototypes in many medical applications.

Since its beginning, CANPBD has funded 51 faculty and 110 graduates in over 12 research areas. The Center activities were enhanced by research collaborations in the US at Duke University, UC San Francisco, the University of Illinois, the University of Michigan, and MIT. Our international collaboration activities remain extensive and strong in Asia, Europe, the Middle East and South America.

Excellent progress has also been made in teaching, training, outreach and diversity since the inception of the Center. For instance, twenty one courses were taught over the past year that featured CANPBD research themes as part or all of the content, reaching over 650 undergraduate and graduate students. The graduate fellows of CANPBD continued the student organization (CONGS) to better integrate the student researchers and provide a social fabric for the center. In the last year, 28 underrepresented minority students were hosted in the Center labs. During this period, outreach to K-12 students and teachers reached over 347,790 students through visits to center laboratories, workshops, activities in discovery-based labs in local high school science classrooms and via Edheads online nanoscience activities. In advancing student diversity in the past year, 8 summer prospective graduate students (i.e. REU students) from underrepresented groups were hosted by CANPBD faculty in research laboratories. Our goal was to encourage them to choose graduate studies in STEM related areas, and to provide a bridge experience to enhance their chance for success in graduate school.



Popular Edheads nano-activity

Overall, CANPBD has been instrumental in establishing a robust interdisciplinary research program in polymer-based nanoengineering that is geared towards emerging medical and pharmaceutical applications. The Center has also established a nanoactivity hub for outreach and a shared nanofacility at the Ohio State University. In addition, CANPBD has trained teachers, students, and has outreached to the community through exciting hands-on and online activities.

References

[1] For further information about this project visit our website at http://nsec.osu.edu or email lee.31@osu.edu .