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Two Decades of Commercializing Medical Devices Using Nanotechnology

By

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There is an acute shortage of organs due to disease, trauma, congenital defects, and most importantly, age related maladies. The synthetic materials used in tissue engineering applications today are typically composed of millimeter or micron sized particles and/or fiber dimensions. Although human cells are on the micron scale, their individual components, e.g. proteins, are composed of nanometer features. By modifying only the nanofeatures on material surfaces without changing surface chemistry, it is possible to increase tissue growth of any human tissue by controlling the endogenous adsorption of adhesive proteins onto the material surface. In addition, our group has shown that these same nanofeatures and nano-modifications can reduce bacterial growth without using antibiotics, which may further accelerate the growth of antibiotic resistant microbes. Inflammation can also be decreased through the use of nanomaterials. Finally, nanomedicine has been shown to stimulate the growth and differentiation of stem cells, which may someday be used to treat incurable disorders, such as neural damage. This strategy also accelerates FDA approval and commercialization efforts since new chemistries are not proposed, rather chemistries already approved by the FDA with altered nanoscale features. This invited talk will highlight some of the advancements and emphasize current nanomaterials approved by the FDA for human implantation.

BIO: Thomas J. Webster’s (H index: 80, Google Scholar) degrees are in chemical engineering from the University of Pittsburgh (B.S., 1995) and in biomedical engineering from Rensselaer Polytechnic Institute (M.S., 1997; Ph.D., 2000). Prof. Webster is the current director of the Nanomedicine Laboratories (currently at 23 members) and has completed extensive studies on the use of nanophase materials in medicine. He pioneered the use of nanomaterials to increase tissue growth, inhibit infection, and decrease inflammation. He was appointed Department Chair of Chemical Engineering at Northeastern University in 2012 in which the Department recently broke the record for the fastest increase in ranking over a five year period from the U.S. News and World Report. In his 17 years in academics, Prof. Webster has graduated/supervised over 149 visiting faculty, clinical fellows, post-doctoral students, and thesis completing B.S., M.S., and Ph.D. students. To date, his lab group has generated over 13 textbooks, 68 book chapters, 376 invited presentations, at least 503 peer-reviewed literature articles and/or conference proceedings, at least 767 conference presentations, and 42 provisional or full patents. His research has led to the formation of 12 companies with 4 FDA approved nanomedicine products. He is the founding editor-in-chief of the International Journal of Nanomedicine (the first open-access, international journal in nanomedicine which has a 5-year impact factor of 5.03). Prof. Webster currently directs or co-directs several centers in the area of biomaterials: The Center for Natural and Tropical Biomaterials (Medellin, Colombia), The Center for Pico and Nanomedicine (Wenzhou China), and The International Materials Research Center (Soochow, China). He was named the Art Zafiropoulo Chair at Northeastern University for his contributions to nanomedicine in 2013. Prof. Webster has received numerous honors including but not limited to: 2012, Fellow, American Institute for Medical and Biological Engineering (AIMBE, representing the top 2% of all medical and biological engineers); 2013, Fellow, Biomedical Engineering Society; 2015, Wenzhou 580 Award; 2015, Zhejiang 1000 Talent Program; 2016, International Materials Research Chinese Academy of Science Lee-Hsun Lecture Award; 2016, International College of Fellows, Biomaterials Science and Engineering; and 2016, Acta Biomaterialia Silver Award. He also served as the President of the U.S. Society For Biomaterials. He has appeared on BBC, NBC, ABC, Fox News, the Weather Channel, the Discovery Channel, and the recent special ‘Year Million’ TV series on National Geographic talking about the future of medicine and science.

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