

GOODBYE HOSPITALS AND HELLO IMPLANTABLE SENSORS

THOMAS J. WEBSTER*

DEPARTMENT OF CHEMICAL ENGINEERING,
NORTHEASTERN UNIVERSITY, BOSTON, MA USA 02115

*E-MAIL: TH.WEBSTER@NEU.EDU

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Introduction

There is an acute shortage of organs due to disease, trauma, congenital defects, and most importantly, age related maladies. While tissue engineering (and nanotechnology) has made great strides towards improving tissue growth, infection control has been largely forgotten. Critically, as a consequence, the Centers for Disease Control in the U.S. have predicted more deaths from antibiotic-resistant bacteria than all cancers combined by 2050, culminating into a prediction of 3 deaths every second. Moreover, there has been a lack of translation to real commercial products. This talk will summarize how nanotechnology with FDA approval can be used to increase tissue growth and decrease implant infection without using antibiotics. Studies will also be highlighted using nano sensors (while getting regulatory approval).

Methods

We have grown nanoparticles and induced nanoscale surface features on numerous implants inserted today. We have further grown sensors off of currently implanted biomaterials. Lastly, we have fabricated a wide range of self-assembled materials using them to both increase tissue growth and reduce infection. This talk will emphasize both in vitro and in vivo studies.

Results and Discussion

Our group has shown that nanofeatures, nanomodifications, nanoparticles, and most importantly, nanosensors can reduce bacterial growth without using antibiotics. This talk will summarize techniques and efforts to create nanosensors for a wide range of medical and tissue engineering applications, particularly those that have received FDA approval and are currently being implanted in humans. Moreover, our nanosensors can communicate to hand held devices cellular events at the surface of the implant and, in turn, such sensors can communicate back to release molecules that reduce infection, inhibit inflammation, and/or increase tissue growth.

Conclusions

Nanotechnology has proven to be a technology that can be approved by the FDA to improve tissue growth, limit infection, and inhibit inflammation without the use of drugs. Further nanosensors can be implanted with biomaterials to determine their fate and even control cellular events to promote success. In this manner, nanotechnology is revolutionizing healthcare.