BIOMEDICAL ENGINEERING STUDENT AFFAIRS
THIRD ANNUAL

VIRTUAL

BESA SYMPOSIUM

FEATURING GUEST SPEAKERS

Jeff Ross, Ph.D.

CEO | Miromatrix

FRIDAY, APRIL 17, 2020

1:30 P.M.

zoom

Jennifer West, Ph.D.

Co-founder | NanoSpectra Biosciences
Professor | Biomedical Engineering, Duke University

FRIDAY, APRIL 24, 2020

1:30 P.M.

zoom

No poster session.

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Bioengineering Transplantable Organs—The Future of Regenerative Medicine

Jeff Ross, Ph.D.
Chief Executive Officer
MiroMatrix

1:30 p.m. | Click here to RSVP

ABSTRACT

Organ failure remains a significant clinical problem, and the only curative solution in many cases is organ transplant. However, there is a chronic shortage of donor organs available to patients on the organ waiting list. In 2008, the development of vascular perfusion decellularization and recellularization technology as a means to engineer whole organs provided a pathway to expanding, and potentially eliminating, the pool of available organs. Progress down the pathway has been hindered by challenges with reestablishing the vasculature of the decellularized organ to allow for long-term patency of clinical scale engineered organs. Our recent work demonstrates that we can reestablishing the vasculature in a decellularized organ with long-term patency in clinically relevant sized organs. With one critical challenge solved, the current focus is on restoring total organ function to engineered organs that can eliminate the organ transplant list.

BIO

Jeff Ross brings more than 20 years of biomedical research, management and regulatory experience in regenerative medicine, biologics, and medical devices including concept development, preclinical, clinical, manufacturing, and commercialization. He has held various technical and management positions at Guidant, Athersys and SurModics and is currently on the Board of Directors for the Alliance of Regenerative Medicine. Since joining Miromatrix in 2010 he has been pivotal in the development, manufacturing and regulatory clearance of the innovative MIROMESH and MIRODERM product lines. He has spearheaded development, global patent strategy, and fundraising for the revolutionary whole organ transplant program and its key decellularization technology. Dr. Ross has over 30 patents along with scientific publications in Nature and other peer reviewed journals. He holds a Master's degree in Biomedical Engineering and a Ph.D. in Molecular, Cellular and Developmental Biology from the University of Minnesota.

Diagnostic and Therapeutic Applications of Nanotechnology: Translating Cutting-Edge Technologies from the Lab to the Clinic

Jennifer L. West, Ph.D.
Fitzpatrick University Professor of Engineering
Departments of Biomedical Engineering and
Mechanical Engineering & Materials Science, Chemistry

1:30 p.m. | Click here to RSVP

ABSTRACT

The increasing capability to manipulate matter at the nanoscale is generating new materials with unique properties that promise to address unmet medical needs for future generations. As an example, metal nanoshells are a relatively new class of nanoparticles with highly tunable optical properties. Metal nanoshells consist of a dielectric core nanoparticle such as silica surrounded by an ultrathin metal shell, usually composed of gold for biomedical applications. Depending on the size and composition of each layer of the nanoshell, particles can be designed to either absorb or scatter light over much of the visible and infrared regions of the electromagnetic spectrum, including the near infrared region where penetration of light through tissue is maximal.

These particles are also easily conjugated to antibodies, aptamers, peptides and other biomolecules for specific targeting. Further, the biocompatibility of these particles is excellent. For photothermal cancer therapy, nanoshells can be fabricated to achieve strong near infrared absorption, injected intravenously to accumulate at tumor sites due to the enhanced permeability and retention (EPR) effect and/or molecular targeting, then generate heat upon illumination with near infrared light, leading to destruction of the tumor. This has shown very promising results in several animal models. For example, in a mouse colon carcinoma model, we demonstrated 100% tumor-free survival of nanoshell treated mice at 1 year. These materials are now in human clinical trials. In a clinical trial of prostate tumor ablation, complete tumor ablation was achieved in 94% of patients with no observed impacts on sexual health.

For use in diagnostics and imaging, nanoshells can be designed to strongly scatter near infrared light. Molecularly targeted nanoshells have been used as optical contrast agents for cancer imaging with sub-cellular resolution. For example, anti-HER2 conjugated nanoshells allow near infrared imaging of HER2+ breast carcinoma cells. Furthermore, integrated imaging and therapy applications have been accomplished with nanoshells designed to provide both absorption and scattering, potentially enabling "see-and-treat" approaches to cancer therapy. Gold nanoshells also provide x-ray contrast due to the electron density of gold and can be conjugated to MR contrast agents such as gadolinium to provide highly mulit-modal imaging capabilities in addition to therapy as well.

BIO

Jennifer West 's research focuses on the development of novel biofunctional materials. Part of her program has developed nanoparticle-based approaches to biophotonics therapeutics and diagnostics. An example of this work is the application of near-infrared absorbing nanoparticles for photothermal tumor ablation. In animal studies, this therapeutic strategy has demonstrated very high efficacy with minimal side effects or damage to surrounding normal tissues. Professor West founded Nanospectra Biosciences, Inc. to commercialize the nanoparticle-assisted photothermal ablation technology, now called AuroLase. Nanospectra Biosciences, Inc., located in Houston, TX, is the recipient of a NIST ATP Award and a grant from the Texas Emerging Technology Fund. Professor West is a director of the company. The company has built manufacturing facilities, and AuroLase cancer therapy is now in human clinical trials.