W33: Implantable Material Design And Engineering Considerations

Workshop Chair: Shayanti Mukherjee, Australia

Start	End	Topic	Speakers
		Advancing Women's Urogynaecological Health with Micro/Nano Design Strategies	Shayanti Mukherjee
		Elastin Biomaterials	Anthony Weiss
		Biomimetic implants for pelvic floor repair	Jan Paul Roovers
		Bioengineering Functional Tissues	Sean Murphy
		Questions	All

Aims of Workshop

This workshop aims to bring prominent research scientists who have set a new paradigm with their innovative research in biomaterials and tissue engineering while actively engaging in patient care and clinical translation. The workshop will provide the audience with an overview of how engineering principles can be applied to improve the biocompatibility of implantable devices. The presentations will enlighten the audience with exciting lab based cross disciplinary research and the key considerations for its success at the pre-clinical and clinical translational level.

Learning Objectives

Overview of Design Techniques and Material Fabrication Methods

Target Audience

Urology, Urogynaecology and Female & Functional Urology, Basic Science

Advanced/Basic

Basic

Suggested Learning before Workshop Attendance

Paul, K.; Darzi, S.; Werkmeister, J.A.; Gargett, C.E.; Mukherjee, S. Emerging Nano/Micro-Structured Degradable Polymeric Meshes for Pelvic Floor Reconstruction. Nanomaterials 2020, 10, 1120. (https://doi.org/10.3390/nano10061120)
Free Article Link: https://www.mdpi.com/2079-4991/10/6/1120/htm

Colaco M, Igel DA, Atala A. The potential of 3D printing in urological research and patient care. Nat Rev Urol. 2018 04; 15(4):213-221. PMID: 29405206.
Atala A. Regenerative Medicine: Progressing Toward Cures. Stem Cells Transl Med. 2018 01; 7(1):1-2. PMID: 29283516.

Anthony Weiss
Elastin Biomaterials

Elastic tissue does not typically regenerate in adults, so there is demand for ways to restore these tissues following damage. This relies on the exogenous supply of elastin's primary building block, tropoelastin. We have developed ways to use tropoelastin to 3D print and build a range of elastic repair materials. To our surprise, tropoelastin also promotes broader tissue repair. Powerfully, the use of tropoelastin promotes healing following surgery, including degradable mesh for pelvic organ prolapse and the recovery of wounds.
An emerging model for tropoelastin is that it delivers this potency by emulating extracellular matrix interactions including those through development and repair. This paradigm for enhanced tissue repair encompasses a novel, pure, synthetic material that promotes the repair and fixation of soft tissues. Tropoelastin-based materials leverage the ability to promote new blood vessel formation and cell recruiting properties to accelerate healing on applied tissues. Understanding these mechanisms has led to the realization of a range of promising biomaterials with tunable mechanical and self-assembly properties.

Jan-Paul Roovers
Biomimetic implants for pelvic floor repair

In the surgical treatment of stress urinary incontinence and pelvic organ prolapse, polypropylene implants have proven to be beneficial with respect to efficacy. However, these implants have been associated with severe adverse events that can result in irreversible morbidity. Research groups have searched for alternative biomaterials, that are capable of inducing a foreign body response to realize load bearing tissues, absorb over time and reduce morbidity. Such material needs to be available, technical applicable, consistent and predictive with respect to surgical outcome, and result in load bearing tissues after complete resorption. The university of Amsterdam and the Pelvic Floro foundation of south africa have researched over the last years P4HB as candidate material for pelvic floor reconstruction. The ambition of the group is to develop this material from bench to bed and in this workshop data of in vitro studies, animal experiments and a first in human clinical study are shared. Also some side steps will be made to other tissue-engineered solutions that may have value in the field of pelvic floor reconstruction.