ORGAN PRINTING

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PRE-REQUISITES : Knowledge on Biomaterials and Human Anatomy and Physiology

INTENDED AUDIENCE : Students from Bioengineering/Biomedical Engineering/Biotechnology programs

INDUSTRY SUPPORT : Relevant Industries of Biotechnology/Biomaterials/Tissue Engineering

COURSE OUTLINE :

Printing of tissue analogs recapitulating the structure and function of native tissues are beneficial for many applications like tissue engineering, in vitro tissue modeling, cancer modeling, and for studying tissue/organ development process. Organ printing or 3D bioprinting uses a layer-by-layer manufacturing process with all the components of a tissue like cells, matrix materials and bioactive factors to produce artificial tissues. Various aspects of this technology will be described in this course starting from the fundamental of 3D Bioprinting, process parameters, bioinks used to organ-specific strategies for tissue printing. Moreover, the applications of this technology will be described with examples from recent literatures and reports.

ABOUT INSTRUCTOR :

Prof. Falguni Pati is an Associate Professor in the Biomedical Engineering Department at IIT Hyderabad (IITH). He completed his Ph.D. from IIT Kharagpur and had Postdoctoral appointments in POSTECH, South Korea, and KTH, Sweden prior to joining IITH in 2015. His lab at IITH, Biofabrication and Tissue Engineering Lab (BioFabTE Lab) focuses on developing innovative tissue-engineered products and in vitro tissue/organ models with 3D bioprinting technology. His research interests include developing novel bioinks, bioprinting methods and protocol to produce tissue analogs-on-demand, and in vitro tissue/organ models. Dr. Pati designed and developed a course on Biofabrication for the postgraduate students at IITH, which is the first of its kind in India.

COURSE PLAN :

Week 1: Introduction to Bioprinting; different types of bioprinting techniques and their advantages and disadvantages
Week 2: 3D tissue designing and 3D tissue/organ printing; various process parameters and their role in bioprinting
Week 3: Introduction to bioinks; biomaterials used for bioink development with their merits and demerits
Week 4: Critical parameters of bioink formulations for bioprinting, modulation of bioink properties to control different processing conditions
Week 5: 3D bioprinted in vitro, in vivo, and ex vivo research models and techniques; in vitro manipulation of cells and biomaterials with a bioprinter to engineer tissues for regenerative medicine or in vitro tissue/organ models
Week 6: In situ bioprinting and 4D bioprinting with examples from recent literature
Week 7: Biofabrication-based strategies from bench-to-bed to address specific clinical problems
Week 8: Next step in bioprinting (challenges and future direction); ethical issues related to bioprinting