Engineering Organs and Body Parts

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Abstract

The demographics of the Western world population are shifting towards an increasing elderly population, placing extraordinary demands on our healthcare system. Aging results in failing of different organ, including the heart, brain, spinal cord, etc. In addition, as the number of patient's suffering of cancer increases, there is a growing need for reconstruction surgeries. These shortfalls motivated the development of the tissue engineering concept. In this approach, 3-dimensional (3D) biomaterials serve as extracellular matrix-like scaffolds to the cells, enabling the cells to assemble into effective tissue substitutes, that may restore tissue or organ function. After transplantation the scaffolds either degrade or metabolize, eventually leaving a vital tissue instead of the defected tissue. In this talk I will discuss the recent advancements in the field of tissue engineering. I will describe cutting-edge technologies for engineering functional cardiac, spinal cord and cortical implants, focusing on the design of new biomaterials mimicking the natural microenvironment of tissues, or releasing biofactors to promote physiological processes. In addition, I will discuss the development of patient-specific materials and 3D-printing of personalized and vascularized implants, and even whole organs. Finally, I will show a new direction in tissue engineering, where, micro and nanoelectronics are integrated within engineered tissues to form cyborg tissues and organs.