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Bioreactors to investigate the mechanotransduction in tissue engineering

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Bioreactor technologies intended for tissue engineering can be used to grow functional cells and tissues for transplantation, and for controlled in vitro studies on the regulation effect of biochemical and biomechanical factors on cell and tissue development. The primary objectives of these systems are to establish spatially uniform cell distributions on three dimensional scaffolds, to maintain desired concentrations of gases and nutrients in the culture medium, and to expose developing tissue to appropriate physical stimuli. Despite the early promise of tissue engineering, researchers have faced challenges in regenerating tissues that serve a predominantly mechanical function. Current approaches investigate the use of bioactive or bioresorbable matrices, which rely on the appropriate cellular response in vivo, with the intention of developing biological and physical functionality after implantation. A limitation of this approach is the variability of the patient response in terms of resorption, recellularisation and regeneration, which can result in development of inappropriate implant properties. The success of this approach is also limited since cell differentiation and tissue remodelling do not progress physiologically. Studies have produced considerable evidence suggesting that physical stimuli may affect gene expression and significantly increase the biosynthetic activity in a range of different cells. The fact that physical stimuli can modulate cell function has motivated the development of functional simulations systems to recellularise tissues in vitro by exposing them to physical stimuli. The development of such technologies will not only provide tissue engineering solutions, but will also provide important in vitro model systems for the enhancement of understanding into mechanotransduction. This paper focuses on how mechanotransduction dictates cell function, as well as on the bioreactor systems that have been developed to investigate this phenomenon.

Biography

K. Narasimhulu has 12 years of teaching experience and 4 years of research experience. He is working as Asst. Professor in the department of Biotechnology, National Institute of Technology Warangal, India. He has published more than 15 papers in reputed journals and serving as a reviewer for various journals.

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