EFFECT OF OSCILLATORY SHEAR STRESS ON STEM CELL DIFFERENTIATION

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OVERVIEW OF RESEARCH

Stem cells, like all cells, are influenced by their microenvironment, including both chemical and physical cues. In vitro, these cues can serve to influence stem cell fate (e.g., maintain stem cells undifferentiated or promote differentiation along a pathway) and/or to facilitate regenerative medicine applications (e.g., expand stem cells to large numbers or promote uniformly differentiated populations). Until now, chemical cues, such as soluble factors and substrate coatings, have been the primary means by which stem cell self-renewal and differentiation have been influenced. Recent efforts have begun focusing on controlling the cellular microenvironment by applying controlled and well-defined physical forces. This project will investigate the effects of oscillatory shear stress on stem cell differentiation towards an endothelial phenotype.

PROJECT OBJECTIVES

1) Learn to culture and expand mouse embryonic stem cells.
2) Learn to use the bioreactor system to apply oscillatory fluid shear stress.
3) Learn real time PCR to detect changes in mRNA expression (indicative of phenotype).
4) Determine the effect of 2 days of oscillatory shear stress on stem cell differentiation.

At the end of the summer program, the student will be able to culture stem cells, assess for biological markers, and apply mechanical cues to stem cells.

PREREQUISITES

No technical prerequisites, but the student needs to be responsible, meticulous, and scientifically curious.