

Keynote Symposium

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NASA Space Based Research: Challenges and Benefits for Tissue Engineering. DAVID A. WOLF. National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, TX 77058. Email: david.a.wolf@nasa.gov

In addition to the inspiration and sense of pride that our country derives from our National Space Program, a wide range of more tangible benefits are produced as a result of specifically targeted research as well as useful spin-off technology. Cell biology and tissue culture technology are areas in which NASA has applied multidisciplinary teams, unique assets, and significant resource. In vitro cell and tissue based research has been important to ruling out significant direct gravitational affects to individual cells which would adversely affect Astronaut well being. More importantly, for Earth based applications, are the ability to assemble cells into ordered tissue constructs which well represent the in vivo conditions through the use of specialized rotating bioreactors which emulate some of the physical conditions obtainable in reduced gravity. This unique variable has elucidated principles important to tissue engineering as well as providing useful Earth based in vitro culture technology and technique. These have been successfully applied to a wide range of in vitro techniques including tumor biology, infectious disease propagation, genetics, molecule production, toxicity analysis, and organ regeneration. The NASA rotating bioreactors are able to produce conditions of simultaneous low fluid mechanical stress, 3-dimensional spatial freedom, and co-spatial location of particles with different sedimentation rates. The importance of these variables to permitting tissue self-assembly, differentiation, and ordered growth is then appreciated by the freedom to adjust these variables without the limitations introduced by conventional Earth based techniques. Methods and orbiting laboratory platforms for actual microgravity research are discussed.