

IAF MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)  
Science Results from Ground Based Research (4)

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INTRODUCTION TO MICROGRAVITY IN PHYSICAL AND LIFE SCIENCES: MEANS AND  
METHODS**Abstract**

Microgravity is the state that a vehicle experiences when it is in free fall, whether on Earth, in low Earth orbit, or in outer space. Microgravity research has opened up new possibilities for physical and life sciences investigations that are needed to improve our understanding of how physical systems and the human body, from cells to whole body systems, perform, react, and function in microgravity, which will aid in the preparation for human space exploration. This chapter provides an overview of the microgravity environment, which can be achieved on a variety of platforms, including space missions. Microgravity simulations are also employed in research and are presented here. The impacts of microgravity on numerous elements of physical science as well as the human body's adaptability to this altered gravity environment are also discussed in this chapter. If human exploration of space is to continue, a deeper knowledge of the impacts of microgravity on physics and the human body, from cells to body systems, is required. The ability to conduct research in the microgravity environment provided by spaceflight is critical, particularly in light of current plans to expand long-term missions in low Earth orbit and establish commercial space use, as well as the ultimate goals of establishing a human colony on the Moon and sending the first crewed mission to Mars. Nonetheless, there are other constraints that limit the performance of studies in space, such as the high expenses of bringing resources and equipment into orbit, the stringent safety requirements that experimental gadgets must meet, as well as the limited number of astronauts on each voyage. Ground-based research facilities and parabolic flights were established in response to these constraints. Because of the short duration of time spent in microgravity and the hypergravity condition that precedes and follows each parabola, the latter has some restrictions. It is, however, the only source of microgravity, in which human operators and volunteers can conduct research in physics, biology, physiology, and medicine. Although parabolic flights are not a perfect simulation of spaceflight, they remain an important research tool that allows for research and testing as well as a better understanding of the effects of microgravity, assisting academia, the private sector, and governments in better designing future plans for human space exploration.