BioMed Research International

Special Issue on
How Microgravity Affects the Biology of Living Systems

Call for Papers

Gravity has constantly influenced both physical and biological phenomena throughout all the Earth's history. The gravitational field has probably played a major role in shaping evolution when life moved from water to land, even if, for a while, it has been generally deemed to influence natural selection only by limiting the range of acceptable body sizes, according to Galilei's principle. Indeed, to counteract gravity, living organisms would need to develop systems to provide cell membrane rigidity, fluid flow regulation, and appropriate structural support and locomotion. However, gravity may influence in a more deep and subtle fashion the way the cells behave and build themselves. Gravity, indeed, represents an 'inescapable' constraint that obliges living beings to adopt only a few configurations among many others. By 'removing' the gravitational field, living structures will be free to recover more degrees of freedom, thus acquiring new phenotypes and new functions/properties. That statement raises several crucial questions. Some of these entail fundamentals of theoretical biology, as they question the gene- centered paradigm, according to which biological behavior can be explained by solely genetic mechanisms. Indeed, influence of physical cues in biology (and, in particular, on gene expression) is still now largely overlooked. This is why it has been argued that the ultimate reason for human space exploration is precisely to enable us to discover ourselves. Undoubtedly, the microgravitational-space field presents an unlimited horizon for investigation and discovery. Controlled studies conducted in microgravity can advance our knowledge, providing amazing insights into the biological mechanism underlying physiology as well as many relevant diseases, like cancer. Thereby, space-based investigations may serve as a novel paradigm for innovation in basic and applied science. Potential topics include, but not limited to:

- Direct and indirect mechanisms of gravity sensing by cells and tissues
- Shape, Cytoskeletal, and nucleoskeletal changes in microgravity
- Changes in molecular pathways upon microgravity exposure
- How microgravity affects gene expression and gene-regulatory circuits
- Technological devices and flight opportunities in microgravity-based investigations
- Experimental models in microgravity: from 2D to 3D cell cultures

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Manuscript Due	Friday, 4 July 2014
First Round of Reviews	Friday, 26 September 2014
Publication Date	Friday, 21 November 2014

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