Research & Reviews: Journal of Pure and Applied Physics

e-ISSN:2320-2459
p-ISSN:2347-2316

Gravity Research-Main Challenges

Scarlett T*

Editorial Office, Pure and Applied Physics, India

Opinion Article

Received date: 17/01/2021
Accepted date: 15/01/2021
Published date: 30/01/2021

***For Correspondence**

Tara Scarlett, Gravity research-Main challenges, Editorial Office, Pure and Applied Physics, India.

E-mail: tara.scarlett@gmail.com

OPINION ARTICLE

"Microgravity" isn't a science, as some presume, but a specific environment where science is often performed. The most reason behind performing basic sciences under such microgravity, free fall, or conditions of near weightlessness is indeed that the load is far away from the mass. This leads to less mechanical stress within a system, less or nearly no convection, reduced pressure differences within a system, etc.

In such an environment, one also can observe phenomena that are otherwise obscured or blurred when studied during a field, like thermo-capillary Bénard-Marangoni convection or surface-tension-dominated Gibbs-Marangoni convections, capillary flows, juncture phenomena, and lots of more related issues in physical sciences and engineering. Items of study include colloids, emulsions, foams, liquid crystals, dusty plasmas, flames/combustion or granular material, and also elementary particle physics, e.g., Bose-Einstein condensates, or more bulk processes, like alloy solidification

Besides basics sciences where we make use of the microgravity environment, we even have the operational sciences where we've to deal with the microgravity environment. In operational sciences, which is usually also mentioned as applied sciences; one must develop and use systems for both physical and life sciences fields that facilitate existence within such an environment. For instance, all fluidic and two-phase systems got to remain functional without the sedimenting force of gravity altogether sorts of fluid-filled systems in space stations but also in fuel tanks for other satellites.

Additionally, humans got to be ready to work also, within the future, within a free-falling system. However, the latter does pose serious problems with reference to human health. Numerous so-called "countermeasures" are developed so as to stop human physiology to travel into a condition. In cosmonauts, astronauts, and taikonauts, we see disorders like osteo- and sarcopenia, cardiovascular deconditioning, impaired cognitive performance, Spaceflight Associated Neuro-ocular Syndrome (SANS), reduced immune sensitivity, renal stones, loss of quality and duration of sleep, lower back pain, post-flight balance and coordination issues, and orthostatic intolerance or spinal compression with intervertebral disc damage.

Some might question if the present lack of proper microgravity therapies is compliant with ethical labor and legal standards. This new journal would even be available to receive manuscripts concerning the event and test of instruments concerning the mitigation or full "recovery" of chronic microgravity and gravity transitions. Besides, for instance, high-impact training or Lower Body Negative Pressure (LBNP) devices we'd explore the appliance of centrifuges to truly generate in-flight artificial gravity. Short arm systems are the foremost obvious ones, although such systems generate a steep body gradient of gravity, and not all organs could also be exposed to a sufficient gravity level. One can also check out rotating the entire spacecraft. In such systems, there's a more evenly distributed gravity level, and therefore the subjects are chronically exposed to the synthetic gravity like on Earth. However, such systems require a far better understanding on long duration rotation for both humans and engineering. Ground-based facilities might be wont to address such in-flight-related questions at an equivalent time as they address the utilization of systems for health care (e.g., aging and obesity) and athletics-related applications.

The impact of gravity on small, low-mass systems remains puzzling. Quite half a century ago, Pollard published a paper indicating that, from a biophysics point of view, weightlessness isn't expected to possess a big effect at the extent of one cell. Possible "gravisensors" during a non-specialized cell could be the mitochondria or the nucleolus. Later, Todd (1989) and Albrecht-

e-ISSN:2320-2459
p-ISSN:2347-2316

Buehler (1991) published interesting papers, which are still quite relevant, addressing a series of forces that are involved at a little scale cellular level and compared them to the force of gravity at that micro scale.

Therefore, although there are numerous experiments in space and on the bottom showing the effect of gravity, or the shortage thereof, on cells, the particular sensing mechanism in non-specialized cells has yet to be described. In an *in-vitro* model monolayer single cell with a diameter of 10 μm, the gravitational energy of a clear weight of 0.5 pN at a mean distance of the radius (5 μm) above rock bottom point of the cell is ~500 kT, where k is Boltzmann's constant, and T is temperature. These are small forces and energies compared to other intra- and extra-cellular forces.

Numerous studies are performed to explore the effect of weight or near weightlessness on cells. These studies are, partially pushed by contemporary techniques, focused on the genetic effects, although this is often moving more and more toward proteomics/metabolomics and therefore the actual physiology, while it's possible that adapted phenotypes or sometimes pathological changes are often noted. Of these findings are within the area of mechano-transduction and mechano-adaptation, while the grail and grand challenge during this field would be to spot a gravisensor (if such a thing exists). Most of the effects reported from altered gravity research in cell biology should start, at some point, with a mechanical, conformational, or frequency change within the system. It’s this gravi- or mechano-sensor that ought to be identified. More advanced in-flight research opportunities and technologies are required for this, which is analogous to what's utilized in the sector of biomechanics, especially in molecular, cellular, and tissue biomechanics, but also on an organ and organism level. Instruments like femtosecond lasers, microscopes with advanced imaging modalities like FLIM or FRET, atomic force microscopes, optical tweezers, or micro-aspiration techniques could have a prominent role within the go after a gravity mechanosensory, especially in non-specialized cells. Systems just like the FLUMIAS, the sunshine Microscopy Module, or the JAXA microscope adapted plate readers or equivalents, which could even be quite illustrative concerning molecular conformational changes or interactions, e.g., with plate readers or the Nano Racks plate reader, micro-NMR systems, or specific *in vivo* probes that reflect biophysical properties in molecules counting on their extra-molecular environment.