

**DRAFT**  
**CONTRACT**  
**TOPICAL TEAMS**

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of the one part.

and:

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**USE OF ARTIFICIAL GRAVITY TO PREVENT  
METABOLIC DISORDERS INDUCED BY BED REST  
SIMULATED MICROGRAVITY**

Workshop of the Topical Team

DUBLIN CITY UNIVERSITY  
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## Participants and introductions

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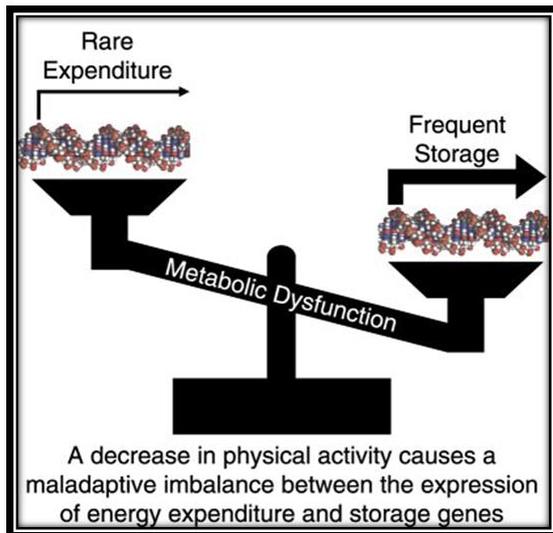
### Purpose of the Workshop:

Assess Art G as comprehensive CM on reduced gravity metabolic changes leading to disorders.

Identify and focus on less studied metabolic changes induced by microgravity and BR

### Metabolic consequences

Two of the major biological consequences of the shift from physical activity to sedentary condition are a rapid expansion of intra-abdominal fat storage and a rapid increase in insulin resistance. Those changes which are regulated not only by classical metabolic signals but also by endocrine signals soon lead to diseases like Type 2 diabetes, obesity, metabolic syndrome, sarcopenia, etc.



### **Objective:**

Determine if replacing G by means of Art G prevents these metabolic changes that underlie the systemic consequences of BR.

### Hypothesis?

Hypothesis: Gravity Deprivation syndrome consists of a comprehensive metabolic distortion to reduced mechanotransduction.

This metabolic distortion underlies altered morphological, physiological and functional changes we have come to associate with space, its simulation by BR, aging and sedentary lifestyles.

So far the study of gravity deprivation has been approached on an individual systems level with CMs developed and tested mostly as system specific.

Metabolic changes have been described on a systems basis as well more as a consequence than a cause.

Hardly any research has approached gravity deprivation from the perspective of an integrated metabolic disorder and almost nothing on Art G as a CM.

Traditional reduced Gravity has been equated to inactivity but replacing activity without increasing gravity does not correct the problem.

There is much more to G than its role as a loading factor and making exercise effective. Therefore it has been impossible as yet to provide an activity replacement countermeasure of ever increasing intensity and duration that was comprehensively and fully effective.

To the extent that the G reduction can be replaced with centrifugation, Art G should logically be such a comprehensive Countermeasure.

The availability of a short-arm human centrifuge provides the opportunity to test this hypothesis.

### **Artificial Gravity - An Integrative Countermeasure**

Artificial gravity represents a different approach because it simply simulates the natural 1-g environment

All physiological systems are affected: muscle and bone, neurovestibular, autonomic nervous system

Artificial gravity seems to be a **general purpose or "integrated" countermeasure as it** produces multi-system effects

### **Key points to work**

Identify and focus on less studied metabolic changes induced by microgravity and BR

Identify early detectable metabolic markers of those changes and

Speculate according to previous experiences the effect of art. Gravity to prevent those.

### Issues discussed during the workshop:

- ✓ Metabolic disorders induced by bed rest, their causes and their relationship to morphological and functional consequences of

space flight and bedrest (each speaker will address his area of expertise)

- ✓ The effect of short radius human centrifuge in preventing these disorders
- ✓ Advantages and disadvantages of hypergravity without or combined with exercise and
- ✓ Biomarkers needed to investigate the metabolic disorders (this will be in collaboration with the TT on biomarkers)

The main objective: *Which modality of g-loading is most effective and efficient and what is the optimal time and duration of exposure to hypergravity in humans to prevent these maladaptations.*