Gravity has been a constant force throughout evolutionary history on Earth. Thus, it is one of the fundamental biological questions, if and how life on Earth requires and responds to gravity at the functional cellular and molecular level. Sensitivity of cells of the human immune system to reduced gravity has been supposed since the first Apollo missions and was demonstrated during several space missions in the past. Thus, serious concerns arose whether spaceflight-associated immune system weakening ultimately precludes the expansion of human presence beyond Earth’s orbit. Due to the fact that cells of the immune system are obviously influenced by altered gravity, its gravi-sensitive nature render these cells also an ideal biological model to understand how gravity influences the cellular life.

In our previous studies, we investigated the effect of microgravity on key functions in cells of the immune system, and especially on gene expression, in a sequence of coordinated projects on parabolic, suborbital and orbital flights. Our results suggest that sensitivity of gene expression to altered gravity is a fundamental biological principle and that the gravity conditions on Earth could represent an important requirement for the homeostasis of gene expression regulation in mammalian cells. During the TEXUS-51 mission, we will conduct a systematic analysis of gene expression in human T lymphocytes, the key control cell of the specific immune system. In our experiment, the influence of gravity on gene expression will be investigated in the entire human lymphocytes genome.

**Project Leadership and Contacts / Projektleitung und Kontakte**

Prof. Dr. Dr. Oliver Ullrich (Project Leader)

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