Abstract zum Seminarvortrag am 12.08.2015

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The Helmholtz Space Life Sciences Research School (SpaceLife): Two Generations of Doctoral Candidates

Training young researchers in the field of space life sciences is essential to vitalize the future of spaceflight. In 2009, the DLR Institute of Aerospace Medicine established the Helmholtz Space Life Sciences Research School (SpaceLife) in cooperation with several universities, starting with 22 doctoral candidates. SpaceLife offers an intensive three-year training program for early-stage researchers from different fields (biology, biomedicine, biomedical engineering, physics, sports, nutrition, plant and space sciences). The candidates pass a multistep selection procedure with a written application, a self-presentation to a selection committee, and an interview with the prospective supervisors. The selected candidates from Germany as well as from abroad attend a curriculum taught in English. An overview of space life sciences is given in a workshop with introductory lectures on space radiation biology and dosimetry, space physiology, gravitational biology and astrobiology. The yearly doctoral students' workshops are also interdisciplinary. During the first doctoral students' workshop, every candidate presents his/her research topic including hypothesis and methods to be applied. The progress report is due after ~ 1.5 years and a final report after ~ 3 years. The candidates specialize in their subfield in advanced lectures, journal clubs, practical trainings, lab exchanges and elective courses. The students attend at least one transferable skills course per year, starting with a research skills development course in the first year, a presentation and writing skills course in the second year, and a career and leadership course in the third year. The whole program encompasses 303 hours and is complemented by active conference participation.

The doctoral theses cover different topics from the fields of space physiology, radiation measurements and radiation protection, radiation and gravitational biology, and astrobiology. Students are in involved in data analysis of radiation measurements performed on Mars using the Radiation Assessment Detector (RAD) on the Mars Science Laboratory (MSL). Understanding of the cellular response to space radiation might enable development of pharmacological countermeasures and help to reduce the uncertainty in risk assessment. In gravitational biology, students use microgravity for tissue engineering of cartilage, they study possible components of food production systems for space missions such as algae, freshwater plankton, and plants, and determine the effects of altered gravity on the immune system. To control the microbial flora on spaceships, the bacterial resistance towards antibacterial surfaces is analyzed. In astrobiology, the tolerance of microorganisms against extreme physical and chemical environmental parameters is investigated. Training and immobilization studies will reveal muscle, bone, and cerebral and ocular fluid balance alterations, including ultrastructural and molecular changes. Modeling of the responses in bone and in the cardiovascular system complements the studies.

Acknowledgements:

SpaceLife was funded by the Helmholtz Association (Helmholtz-Gemeinschaft) over a period of six years and received additional funds from the DLR. The German universities of Aachen, Bayreuth, Bonn, Düsseldorf, Erlangen-Nürnberg, Frankfurt, Hohenheim, Kiel, Köln, Magdeburg, Marburg, Münster, Regensburg, the Free University Berlin, the Bonn-Rhine-Sieg University of Applied Sciences, the University of Zurich, Aarhus University, the King's College London, the Beihang University in Beijing and the German Sports

University Cologne are SpaceLife partners.