Paper ID: 65133
oral
student

IAF/IAA SPACE LIFE SCIENCES SYMPOSIUM (A1)
Astrobiology and Exploration (6)

Author: Ms. Laura Molares Moncayo
École Normale Supérieure, France

# PUSHING THE LIMITS OF LIFE: WHAT ARE THE PROTEOMETABOLOMIC MECHANISMS USED BY DEINOCOCCUS RADIODURANS TO RESIST THE DAMAGING EFFECTS OF OXIDATIVE STRESS INDUCED BY EXTREME RADIATION DOSES?

**Abstract**

*Deinococcus radiodurans* is an exceptional polyextremophile known for its ability to endure multiple severe environmental stresses, including acute exposure of up to 5000 Gy of $\gamma$-radiation without measurable loss of viability. In comparison, a full-body exposure of only 5 Gy can have lethal effects on a human. Recent research utilising *D. radiodurans* as a model organism has challenged the classical DNA-centric view of radiation toxicity, with a shift of focus towards the effective enzymatic and non-enzymatic mechanisms that prevent radiation- induced oxidative stress on the proteome. Nonetheless, a thorough understanding of how these molecules play a part in the radioresistance of *D. radiodurans* is still missing. Therefore, through a systematic literature review on experimental studies with a proteomic and metabolomic focus, I examined the research that has been done in the past 10 years to analyse the proteometabolome of *D. radiodurans* after exposure to extreme radiation doses. Following an online database search in PubMed, sEURch and Google Scholar, 221 articles were retrieved. These were then reviewed with specific inclusion and exclusion criteria, leading to a final selection of 7 relevant articles. Among their findings, there was an overlap between some of the molecules found to be upregulated after acute irradiation, highlighting their importance for the efficient radioresistance of *D. radiodurans*. These are ROS scavenging mechanisms (catalases, dismutases, peroxidases, carotenoids, and Mn2+ complexes) and cell-cleaning mechanisms (nudix, lon, and clp proteases). The combined action of these molecular mechanisms and their co-evolution help *D. radiodurans* protect its proteome and consequently its genome. This ability has enabled this bacterium to become a highly successful radioresistant organism on Earth, allowing it to survive environments that would not naturally occur on present-day Earth. These findings suggest the ability of other organisms to evolve similar strategies to survive planetary bodies with different levels of radiation.