Probing Molecular Mechanisms of Radiotropism in Melanized Fungus

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Abstract:

In 1991, researchers discovered extensive colonization of Chernobyl by Wangiella dermatitidis despite an inhospitable environment. Early investigations demonstrated that exposure to comparatively high levels of ionizing radiation induced cell growth at enhanced rates for this melanized fungus. The observance of radiotropism in W. dermatitidis has prompted many questions regarding the molecular origin of this behavior. While a full genome sequence exists for W. dermatitidis, the proteome which gives rise to the observed phenotype remains unexplored. Since proteins are the actors within a cell and radiation induced cell death is due to protein oxidation damage, analyzing proteins present in W. dermatitidis is essential to elucidate radiotropic mechanisms.

Early work by Dadachova theorized the presence of melanin enables radiotropism, but later a transcriptomic study by Robertson showed radiotropism was dictated by other cellular components. An advantage to Wangiella dermatitidis as a model is that deletion of the WdPKS1 gene produces an albino mutant, a strain without melanin. To resolve the contradicting literature conclusions a high-resolution technique capable of probing systems on the molecular levels is needed to investigate radiotropism. With limitations to genomics and transcriptomics in explaining cellular phenomenon, proteomics offers alternative methodology to investigate cellular function. In proteomics, proteins and their modifications are analyzed using a mass spectrometry platform. Using the Thermo Orbitrap Fusion system and powerful bioinformatics workflows, proteomes are deconstructed, and analyzed in detail.

A full proteome analysis of the wild type W. dermatitidis will be compared to the albino mutant to investigate whether the presence of melanin contributes to differing proteomes associated with radioresistance. Environmental strain in the form of ionization radiation will provide further grounds for comparison. Identifying biological signatures indicative of radiation damage at the protein level and exploiting those biological signatures could foster development of a low-cost biosensor where W. dermatitidis magnifies radiological signals.