

 FUNGAL PHYSIOLOGY

Radiation junkies

DOI:

10.1038/nrmicro1694

URLs

Cryptococcus neoformans
http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=genome_prj&cmd=Retrieve&dopt=Overview&list_uids=9581

Melanins are complex biological pigments produced by numerous microbial species. Evidence indicates that the presence of melanin within the walls of fungal cells provides these organisms with a survival advantage in hostile environments, including conditions of high UV and solar radiation. A study recently reported in *PLoS One* now shows that exposure of melanized fungal cells to ionizing radiation alters the electronic properties of melanin and actually enhances fungal growth.

Many fungi constitutively synthesize melanin for the purpose of environmental protection, and one component of this role is the ability to absorb a broad range of the electromagnetic spectrum and prevent radiation-induced damage. This characteristic, as well as the observation that melanized fungal cells can successfully colonize radionuclide-contaminated environments, led a team headed by Ekaterina Dadachova and Arturo Casadevall to propose that exposure to ionizing radiation could alter the physical properties of melanin and boost fungal growth. To investigate this hypothesis, the authors assessed the effects of ionizing radiation on the electronic properties of melanin, and were able to show that the electron spin resonance of the molecule was altered, indicating that

radiation can interact with melanin to alter its electronic structure. In addition, it was shown that the electron transfer properties of melanin in a NADH oxidation/reduction reaction increased fourfold following irradiation.

To investigate the effects of radiation on fungal cell growth, the authors exposed melanized *Wangiella dermatitidis* and *Cryptococcus neoformans* to high levels of ionizing radiation and observed that both organisms grew significantly faster as indicated by higher CFUs, increased dry weight mass and a threefold greater uptake of ^{14}C -acetate. The authors also showed that exposure of melanized *Cladosporium sphaerospermum* cells to radiation increased

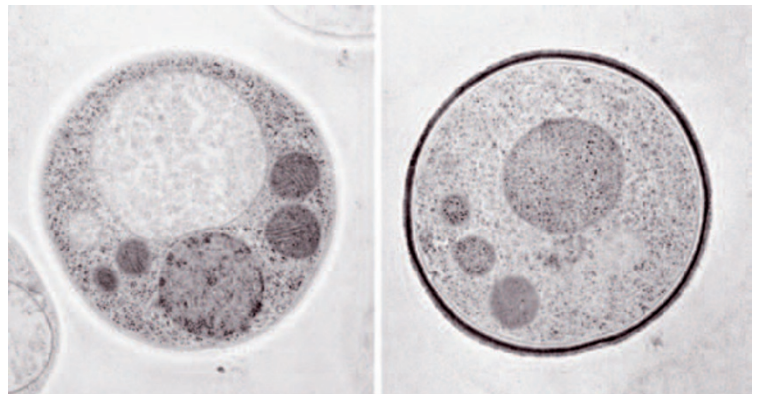
growth under limited nutrient conditions, thus extending the observation of radiation-enhanced growth to three, genetically diverse fungal species.

Collectively, these results raise the intriguing possibility that the ability of melanin to capture electromagnetic radiation represents a source of metabolic energy for melanized microorganisms. Future work will focus on unravelling the mechanism underpinning this phenomenon.

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ORIGINAL RESEARCH PAPER

Dadachova, E. et al. Ionizing radiation changes the electronic properties of melanin and enhances the growth of melanized fungi. *PLoS One* **2**, e457 (2007)



Transmission electron micrograph showing non-melanized (left) and melanized (right) *Cryptococcus neoformans* cells. Image courtesy of J. Nosanchuk, Albert Einstein College of Medicine, New York, USA.