Photoenzymatic Repair Capability in the Freshwater Cladoceran Genus *Scapholeberis*

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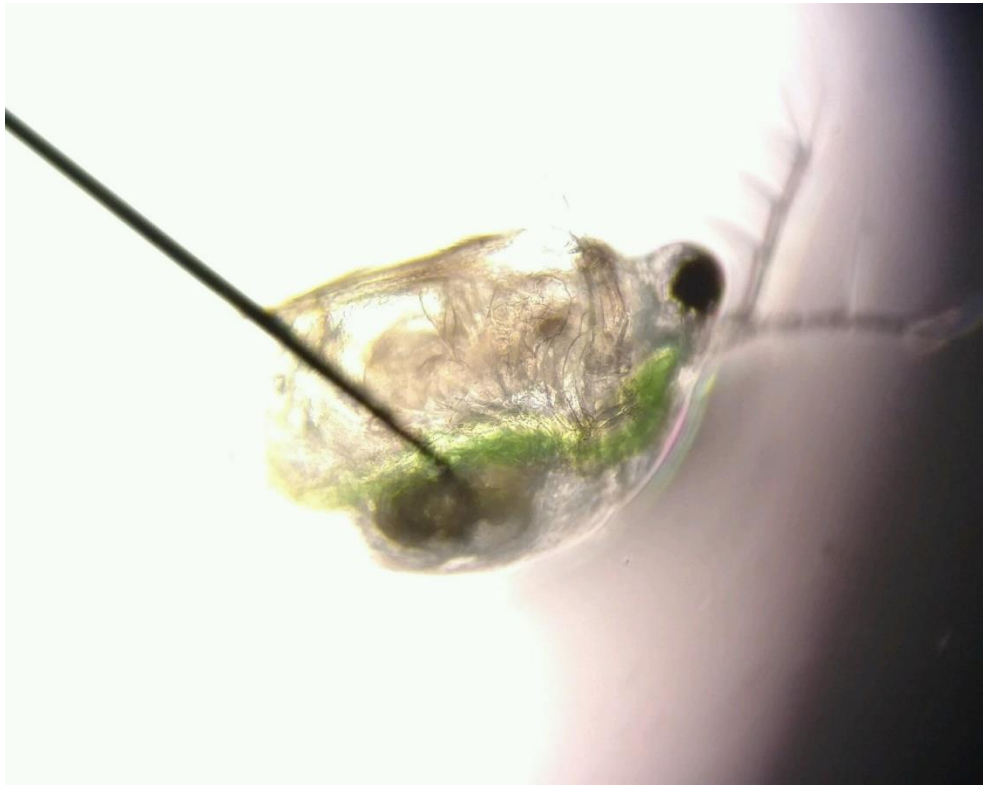
Species of Study

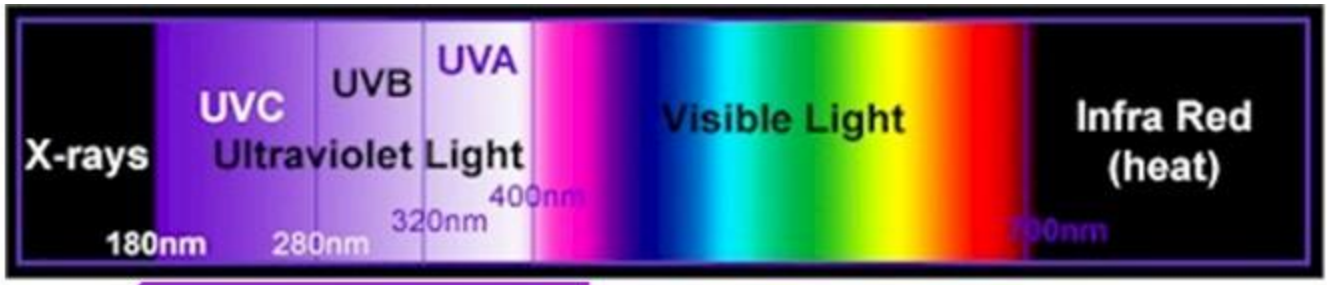
Scapholeberis mucronata

- Cladoceran zooplankton
- Lives in northern hemisphere, temperate freshwater environments
- Littoral taxon
- 0.4-1.2 mm long
- Photoprotective capabilities studied, but not photoenzymatic repair



http://people.cst.cmich.edu/mcnau1as/zooplankton%20web/scapholeberis/scapholeberis.htm

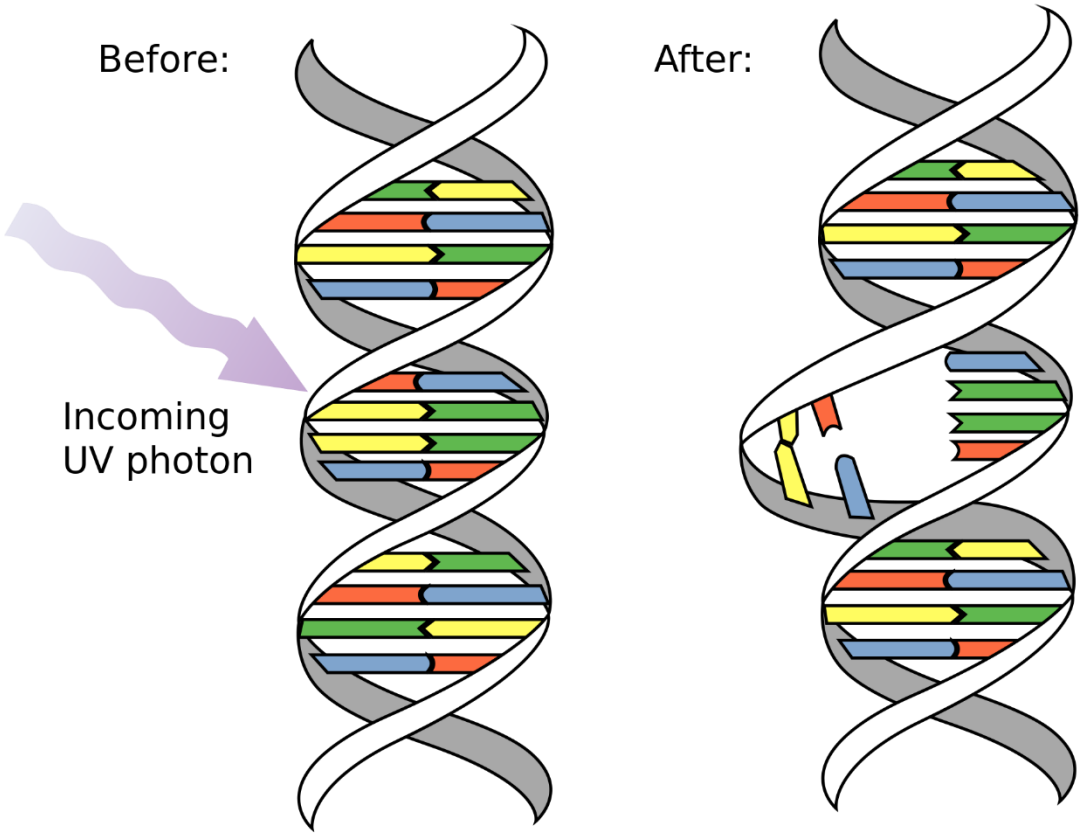
The Ultraviolet Light Spectrum



UV Band	Wavelength Range
UV-A	400nm - 320nm
UV-B	320nm - 280nm
UV-C	280nm - 180nm

http://www.eyesolarlux.com/light-technology/uv/

The Danger of UV-B Radiation



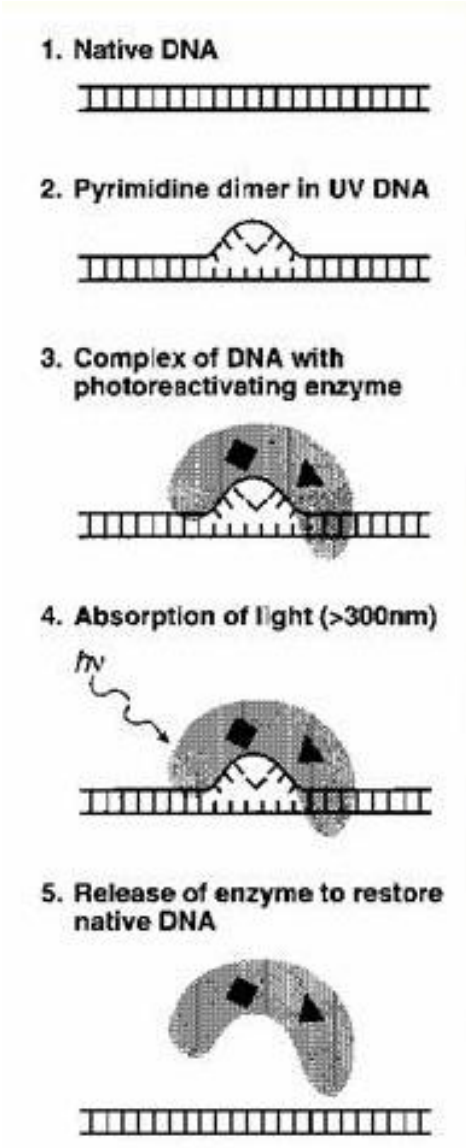
https://en.wikipedia.org/wiki/Pyrimidine_dimer

https://en.wikipedia.org/wiki/Melanoma

Coping Mechanisms

- Avoidance behavior
- Photoprotective compounds
- Repair damages

- Connelly et al. 2009 vs optimal enzyme temperature



Source: Hansson, Lars-Anders, and Samuel Hylander. "Effects of ultraviolet radiation on pigmentation, photoenzymatic repair, behavior, and community ecology of zooplankton." *Photochemical & Photobiological Sciences* 8.9 (2009): 1266-1275.

http://www.orgs.miamioh.edu/uvlakes/UVecology/DNA/DNAfigs/Slide4.jpg

Term Definitions

- PER—Photoenzymatic Repair. The mechanism used by *S. mucronata* which utilizes UV-A radiation and visible light to repair damages done by UV-B radiation.
- PRR—Photorepair radiation. UV-A radiation that helps the specimen heal itself using PER.
  - In –PRR, the absence of UV-A radiation, the specimen will attempt to heal using dark repair, a less effective method.

Ecological Relevance and Research Questions

- Zooplankton are affected by UV radiation to varying degrees
- Zooplankton are an important part of the food web
- How well can *S. mucronata* use PER to cope with radiation?
- Does PER usage vary with temperature?

Sampling Location

High Point City Lake Park, Jamestown, NC

http://www.yelp.com/biz_photos/high-point-city-lake-park-jamestown

PER Experimental Procedure

- Filled exam dishes with pond water and six specimens each
- Three treatments: **+PRR, -PRR, Control**
- Four replicates per treatment
- Monitored survival rates
- Examined at 10°C, 15°C, 20°C, 25°C, 30°C

Experimental Design

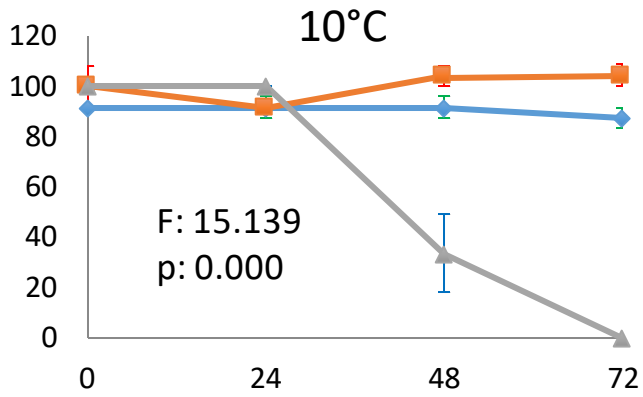
+PRR -PRR control

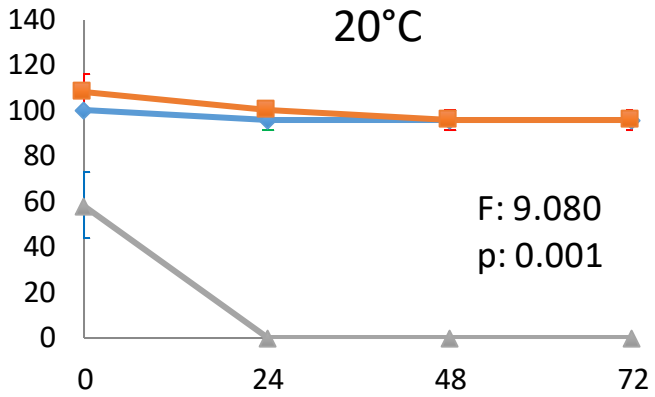
15 minutes of UV-B exposure | 15 minutes of darkness

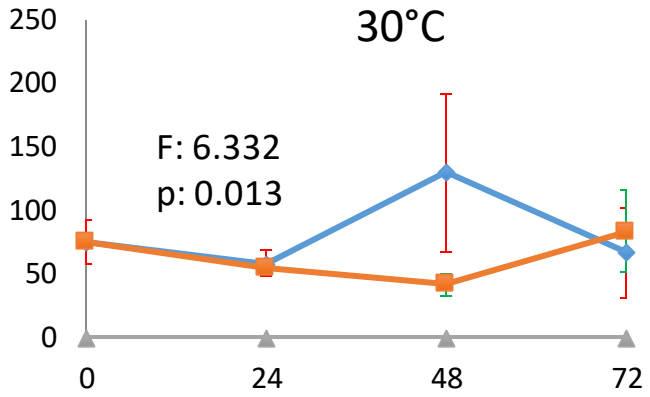
24 hours of UV-A exposure | 24 hours of darkness

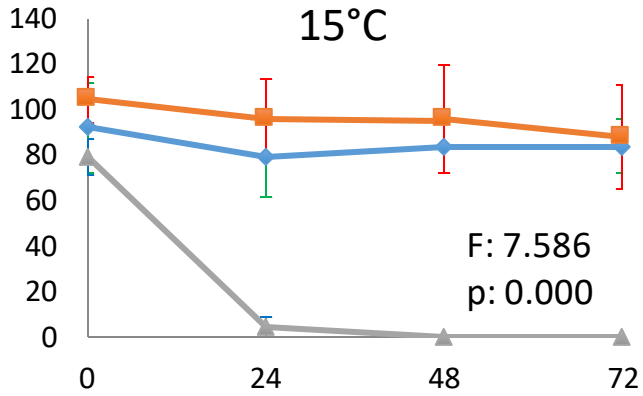
Monitor survival every 24 hours for 72 hours

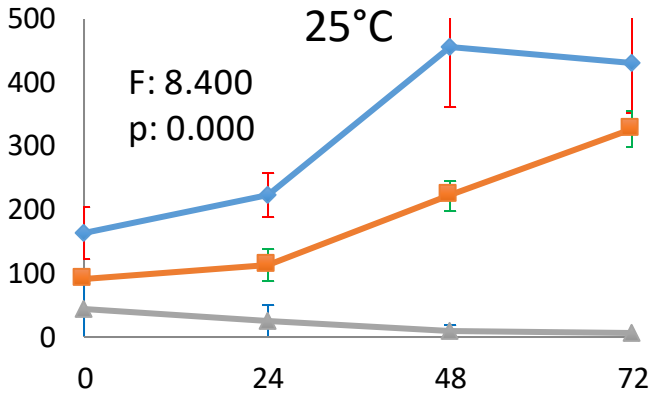
PER Experimental Results











Legend:

- Dark control
- + repair radiation
- - repair radiation

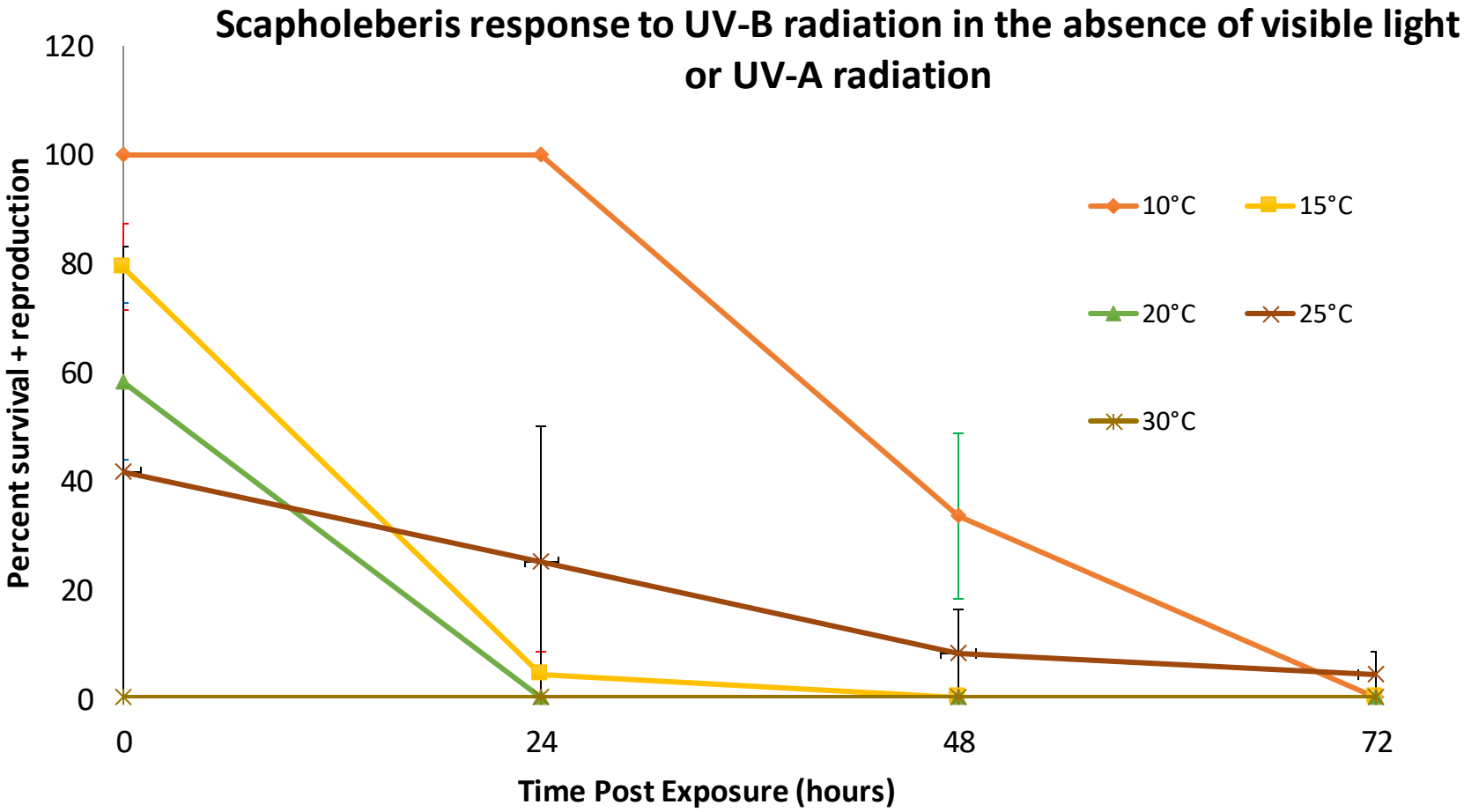
x-axis: hours post-exposure
y-axis: percent survival

*10 and 20 only used PAR, not UV-A

*all F and p values are time by treatment interactions except 30.

*egg-bearing individuals

Intriguing Dark Repair Findings



Conclusions

- *Scapholeberis mucronata* uses photoenzymatic repair
- Successful PER usage leads to survival rates comparable to control groups
- Temperature seems to make little difference in control and +PRR survival
- In -PRR (dark repair), initial survival rates decrease with increasing temperature

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