Investigation of Link Between Zebrafish Cataract Formation from Exposure to Galactic Cosmic Radiation and $^{137}$Cs Gamma-Rays

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Astronauts are more likely to have cataracts\textsuperscript{1}

Exposure to GCR and amount of exposure also effects cataract occurrence\textsuperscript{1,2}
What is a cataract?

Clouding of the lens of the eye

Tissues within the lens break down and clump together

Moderate nuclear cataract in rainbow trout

Severe cataract in lens of rainbow trout
Why Zebrafish?

- More individuals
- Well understood vertebrate model
- More replicates
- Similar eye proteins to humans
Galactic-Cosmic Radiation

- Nuclei of atoms, no electrons
- High ionizing
- Pass through spacecraft and astronauts easily
Methods

- AB wild-type and albino zebrafish
- 2-5 months of age
- Shipped to Brookhaven National Lab and back for radiation treatments
- Monitored and kept at the Aquatic Animal Health Lab
Brookhaven National Laboratory (BNL)

- August 2018 (Gamma), November 2018 (Gamma), April 2019 (Gamma + GCR)

Gamma Treatment Groups:
- 8 Gy gamma
- 10 Gy gamma
- 20 Gy gamma
- No radiation
Galactic Cosmic Ray exposure

Treatment Groups:
- 0.75 Gy GCR
- 0.75 Gy GCR + 10 Gy Gamma
- 0.75 Gy GCR + 20 Gy Gamma
- No radiation

NASA Space Radiation Laboratory
Researchers here are working to understand and reduce the risks astronauts will face on future long-term space missions to Mars and beyond. The National Aeronautic and Space Administration (NASA) and the DOE Office of Science partnered to build this unique facility.
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<th>Ion Species</th>
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<tr>
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System
Eye exams
Preliminary Results

- 6-9 months post Gamma
- 6.5 months post Gamma +GCR

- Only small cortical and central cataracts
- None visible to naked eye
- In both control and irradiated fish
UV Exposure

- 5 ABwt zebrafish
- 4.5 J/cm² UVA
- 3.7 J/cm² UVB
- No cataracts
Implications

Zebrafish are highly regenerative

Stem cell research potential in lens regeneration
Works cited


