Molecular Approach to Visual Impairment and Intracranial Pressure (VIIP)

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Molecular Biology
Current Work

- Cell and Molecular Biology major
- I work in a nutritional ecology lab at Auburn University
Hopeful Future

- I hope to attend medical school
- I’m currently interested in internal medicine specializing in Endocrinology or Rheumatology
- However, I really enjoy conducting research
Visual Impairment & Intracranial Pressure (VIIP)

- Changes in astronaut vision after space flight
  - Globe flattening
    - Torsion in the optic nerve
  - Concerns for the astronauts well being
Theories on VIIP

- Several Proposed Theories
  - Fluid Shift
  - Increased CO$_2$ exposure
  - Diet
  - Exercise- ARED
    - Mostly discounted now
  - Molecular Mechanisms
Molecular Genetics

Cell signaling and molecular pathways are fascinating

Stimulation through many mechanisms

» Environment
  Diet, sleep, stress, etc.
  Physiological changes and imbalances
  Such as fluid shifts in microgravity

» Endocrine system regulation
Early Growth Response Protein-1 (EGR1)

- EGR1 is a transcription factor

  Described as stretch and pressure activated

  » Ex. mechanical stretch in muscle induces EGR1 expression
Proposed Theory

Microgravity → Cephalad Fluid Shift → Upregulation of EGR1

Vision Deterioration → Ocular Changes
Determination of Upregulation
RNA Quality

- Agilent RNA 6000 Pico kit
qPCR

 Amplification

<table>
<thead>
<tr>
<th>RLU</th>
<th>0</th>
<th>500</th>
<th>1000</th>
<th>1500</th>
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| Cycles | 0  | 10  | 20   | 30   | 40   |

Quantitation by Real-Time qPCR

\[ 2^{\Delta \Delta Ct} = 2^{(C_{T treated} - C_{T control})_{treated}} - (C_{T treated} - C_{T control})_{control} \]

Fluorescence

Control \( C_{T 0 \%} \)
Treated \( C_{T 0 \%} \)

Crossing Threshold

Cycle

Control, Control Gene (CG)
Treated, Control Gene
Control, Target Gene (TG)
Treated, Target Gene
Future Work

- Finish analyzing data generated
  Propose where to move from this point
- Collaborate with other departments and integrate findings for a more complete picture of the causes of VIIP
- Eventually treat or implement counter measures to the problem
Thank You

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