Fission and Fusion Behavior of Mitochondria Organelles in the Presence of Varying Oleic Acid Levels

Angeline Aguinaldo

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ECES690: Cell Tissue Image Analysis
Final Presentation

Course Professor: Dr. Andrew Cohen
Course Teaching Assistant: Eric Wait
Motivation

**Ground Truth** [1],[2]:

- Mitochondria-dependent cell death $\rightarrow$ fission
- Maintenance of mitochondria DNA $\rightarrow$ fusion

**Objective:** Observe the rate of fusion and fission of mitochondria under varying levels of oleic acid

**Result:** Determine the relationship between oleic acid levels and the rate of cell apoptosis or homeostatic behavior.

Parameter:

Number of Mitochondria Necks

Counting the Necks

1) For each component, the boundary pixel locations were collected.

2) The Euclidean distance between every pair of pixels was calculated \[2\].

3) A 5x5 Guassian filter was applied to the pair distance matrix.

4) The minimum pair distance was determined.

5) The number of pairs that match this minimum distance indicates the number of necks (branch points).

Results

Table 1. Linear Regression and $R^2$ for Number of Necks at Different Oleic Acid Levels

<table>
<thead>
<tr>
<th>Oleic Acid Level</th>
<th>Regression Equation</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Oleic Acid</td>
<td>$y = 0.032x + 192.53$, $R^2 = 0.000$</td>
<td></td>
</tr>
<tr>
<td>Normal Oleic Acid</td>
<td>$y = 0.164x + 215.75$, $R^2 = 0.003$</td>
<td></td>
</tr>
<tr>
<td>Low Oleic Acid</td>
<td>$y = 0.893x + 255.10$, $R^2 = 0.012$</td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Linear Regression and $R^2$ for Number of Objects at Different Oleic Acid Levels

<table>
<thead>
<tr>
<th>Oleic Acid Level</th>
<th>Regression Equation</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Oleic Acid</td>
<td>$y = -0.254x + 75.63$, $R^2 = 0.077$</td>
<td></td>
</tr>
<tr>
<td>Normal Oleic Acid</td>
<td>$y = -0.347x + 90.37$, $R^2 = 0.098$</td>
<td></td>
</tr>
<tr>
<td>Low Oleic Acid</td>
<td>$y = -0.631x + 103.71$, $R^2 = 0.101$</td>
<td></td>
</tr>
</tbody>
</table>
Conclusion

Decreasing oleic acid levels will increase the rate in which mitochondria are fusing together.

AND

Increasing oleic acid levels will decrease the rate in which mitochondria are fusing together.
Thank you for listening!
Questions?

Angeline Aguinaldo

Drexel University
B.S. Biomedical Engineering/M.S. Electrical Engineering
Class of 2017