

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

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ECES690: Cell Tissue Image Analysis

Final Presentation

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Motivation

Ground Truth ^{[1],[2]}:

- Mitochondria-dependent cell death → fission
- Maintenance of mitochondria DNA → fusion

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

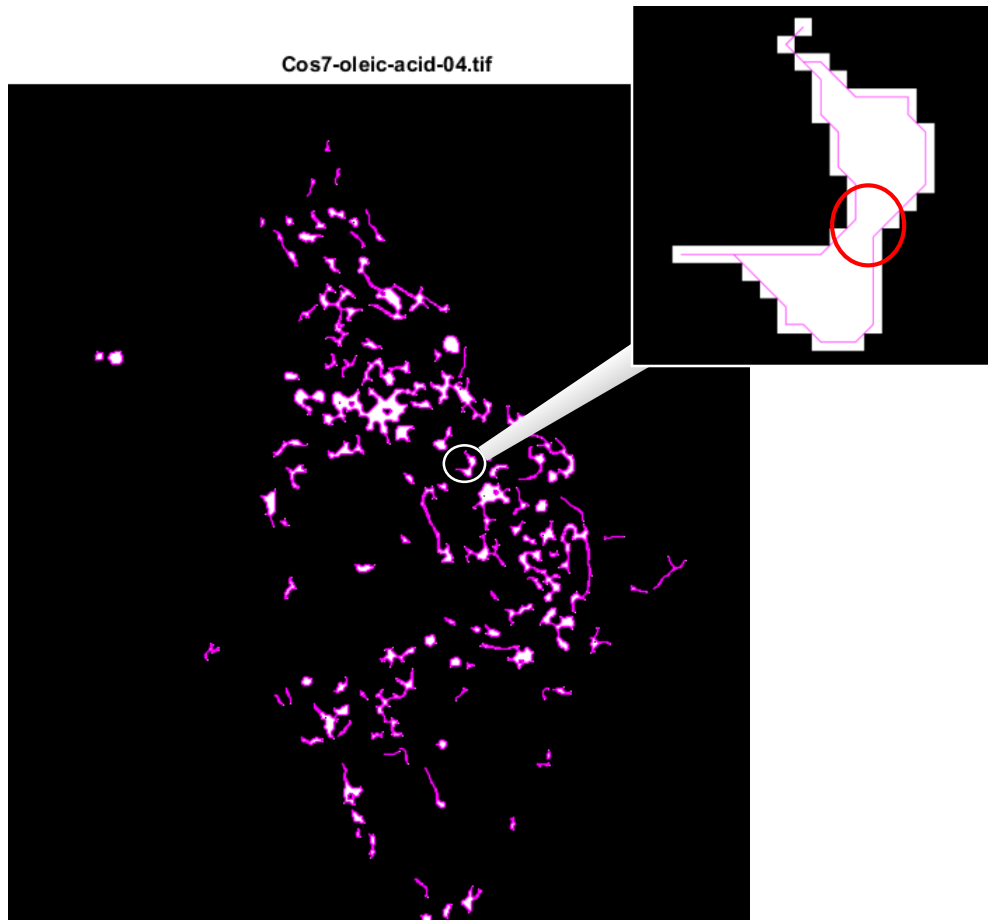
Result: Determine the relationship between oleic acid levels and the rate of cell apoptosis or homeostatic behavior.

[1] Mitra, Kasturi, and Jennifer Lippincott-Schwartz. "Analysis of Mitochondrial Dynamics and Functions Using Imaging Approaches." *Current protocols in cell biology / editorial board, Juan S. Bonifacino ... [et al.]* CHAPTER (2010): Unit-4.2521. PMC. Web. 16 Mar. 2015.

[2] Chen, H., and D. C. Chan. "Mitochondrial Dynamics-fusion, Fission, Movement, and Mitophagy-in Neurodegenerative Diseases." *Human Molecular Genetics* 18.R2 (2009): R169-176. Web.

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 Gaussian 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

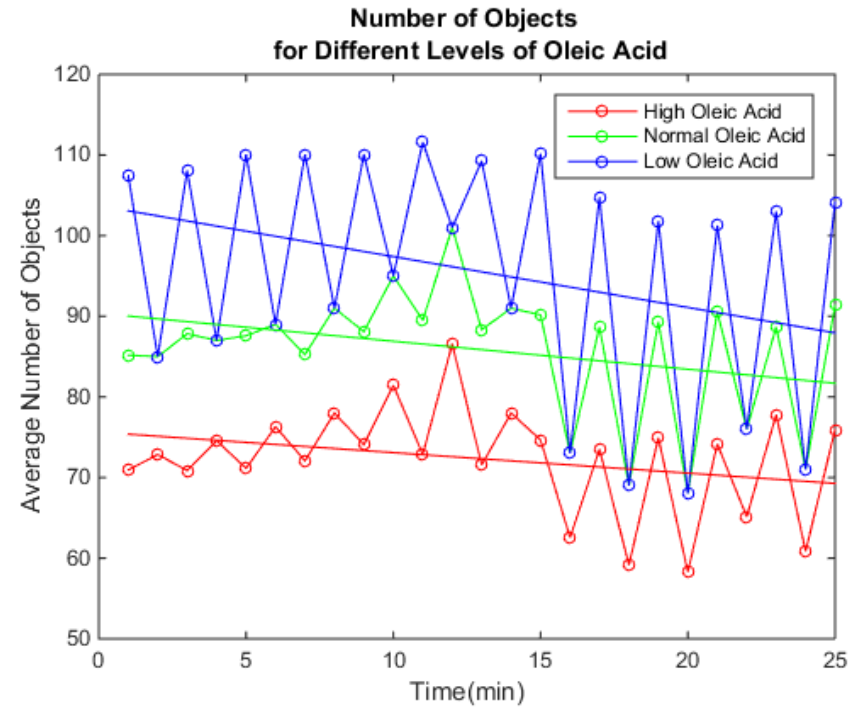
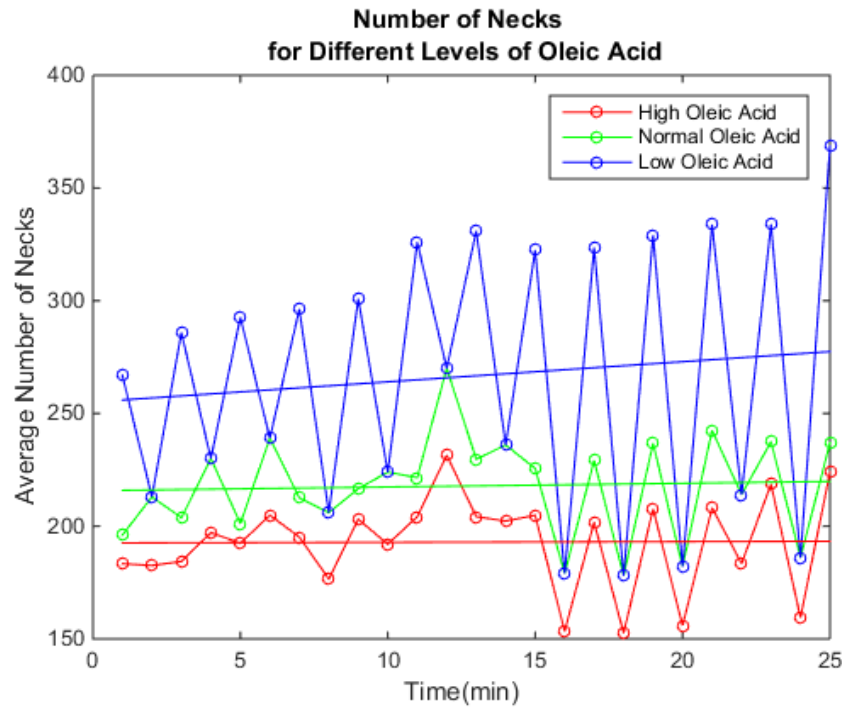


Table 1. Linear Regression and R^2 for Number of Necks at Different Oleic Acid Levels

High Oleic Acid	$y = 0.032x + 192.53$, $R^2 = 0.000$
Normal Oleic Acid	$y = 0.164x + 215.75$, $R^2 = 0.003$
Low Oleic Acid	$y = 0.893x + 255.10$, $R^2 = 0.012$

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

High Oleic Acid	$y = -0.254x + 75.63$, $R^2 = 0.077$
Normal Oleic Acid	$y = -0.347x + 90.37$, $R^2 = 0.098$
Low Oleic Acid	$y = -0.631x + 103.71$, $R^2 = 0.101$

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?

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