Mathematical Analysis of Melanocyte Patterns on Danio rerio

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In the past two decades, zebrafish stripes have been immensely studied and their formation continues to lend itself to a better understanding of pigmentation patterns as a whole (Smith, 2015). Leopard zebrafish spots however are a controversial topic. Photographs were taken to observe the development of leopard zebrafish spots and wild type zebrafish stripes, specifically of melanocytes—black pigment cells. To determine whether the leopard zebrafish spot pattern was random, or if the spots were essentially dashed stripes, photographs of one adult development stage (six photos) were used to analyze melanocyte patterns. Transparent grids were created that mimicked the size of a spot of melanocytes. The grids were then placed on top of the printed photograph and the location of significant melanocytes clusters was recorded. Following, data was collected from the grids to identify what surrounded each melanocyte cluster using a directional format (North, Northwest, West, etc). A computer program was then used to scan the photographs, setting a threshold that matched the shade of the black melanocytes; the program created a grid of the fish melanocyte patterns, similar to the previous but by pixels creating roughly 1,000,000 data points per fish versus about 800. Python was used to analyze pixel data with the same method as was done by hand. ANOVA statistical analysis was applied to the pixel data, comparing the spotted versus striped patterns melanocyte locations. The analysis displayed that the spotted and striped melanocyte patterns were significantly similar and not random as suggested by current research.

Awards Won:

University of Arizona: Tuition Scholarship Award