

Bulletin of the American Physical Society

2024 APS March Meeting

Monday–Friday, March 4–8, 2024; Minneapolis & Virtual

Session D61: Undergrad Research III

3:00 PM–5:24 PM, Monday, March 4, 2024

Room: 208AB

Sponsoring Unit: APS/SPS

Chair: Md. Shafayat Hossain, Princeton University

Abstract: D61.00003 : Pigmentation Pattern Recreation in Reaction-Diffusion Systems using Realistic Bounds*

3:24 PM–3:36 PM

← Abstract →

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Research into the application of reaction-diffusion models to understand natural systems has uncovered its novel capability to mechanistically recreate realistic animal pigmentation patterns. Reaction-diffusion systems, first proposed by Alan Turing in 1952, describe the rate of change of the concentrations of substances by their interactions and diffusions in space. The complex spatial periodic patterns created by the model develop autonomously through the random perturbations of an initially homogeneous equilibrium state, and have been found to correspond to numerous natural phenomena, including animal pigmentation. With the implementation of a reparameterized version of the system, we use silhouettes of various species as spatial bounds to create GPU simulations of the development of their pigmentation patterns in their natural shape. We study the relationship between the features of an animal's surface and its developed pigmentation pattern complexity. We also analyze variations in the parameters, which produce a wide range of pigmentation patterns associated with different species of animal. Our analysis allows for biological and mathematical insight into the core mechanisms of general animal pattern development.

*National Science Foundation REU Grant #2244423