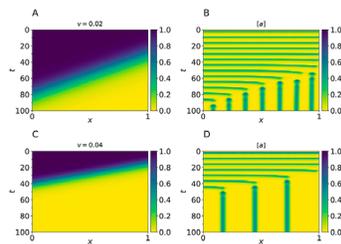


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## Hybrid model combines genetic clocks and signaling proteins to explain somitogenesis

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Theory demonstrates compatibility between the two leading models for understanding the formation of key building blocks during the development of embryos.



The formation of somites, blocks of early tissue that form along the axis in the development of most vertebrates, is essential to embryonic growth. One prevailing theory for how this occurs suggests the process is driven by genetic clocks inside embryonic cells interacting with a traveling hormone gradient, while another focuses on the role of diffusing signaling proteins.

Pantoja-Hernandez et al. couples the clock-and-wavefront model with the Meinhardt-progressive oscillatory reaction-diffusion (PORD) model to describe the process of somitogenesis.

“In our work, we introduced a hybrid model that incorporated elements from both paradigms and is capable of explaining more features of somitogenesis than any of the original paradigms separately,” said author Moises Santillan. “I believe that our study’s principal virtue is showing that the two existing paradigms are not necessarily antagonistic.”

Theories have proposed cells acquire positional values in a coordinate system as development occurs. Cellular interpretation of such positional information gives rise to spatial patterns of cells and tissue structure.

The clock-and-wavefront model suggests a network of genes oscillates its expression in a clock-like fashion and interacts with a differentiation wavefront to trigger a wave of changes along the organism. The Meinhardt-PORD model proposes oscillation arrest is caused by a spatial instability from the diffusion of one of the proteins encoded by the oscillatory gene network.

The hybrid model allows for reaction-diffusion and positional information to coordinate with oscillating gene expression. The theory accounts for experimental findings, such as the appearance of somites in the absence of an external wavefront.

Santillan hopes the paper inspires other researchers to assemble multidisciplinary groups to investigate complex biological systems further.

**Source:** “Hybrid reaction-diffusion and clock-and-wavefront model for the arrest of oscillations in the somitogenesis segmentation clock,” by Jesus Pantoja-Hernandez, Victor F. Brena-Medina, and Moises Santillan, *Chaos* (2021). The article can be accessed at <https://doi.org/10.1063/5.0045460>.

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