

“Mechanical Wavefronts in Developing Embryos”

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In order to transmit signals across many cells, biological systems often exploit the physical phenomenon of nonlinear wavefront propagation. For example, when the slime mold *Dictyostelium* begins to aggregate to form a fruiting body, the chemical cAMP serves as an intercellular signal. Although cAMP itself spreads diffusively, wavefronts of cAMP propagate across the amoeba colony with a well-defined speed because the colony is chemically excitable: when the local concentration of cAMP exceeds a threshold, further local release of the species is triggered. The early embryos of many species, including *Drosophila*, exhibit metachronous mitosis, in which mitosis progresses as a wavefront across the embryo. Here we suggest that the mitotic wavefront relies on mechanical, rather than chemical, signalling as it propagates through a mechanically excitable medium, the syncytial *Drosophila* embryo. We consider a theoretical model in which stress, rather than a chemical agent such as cAMP or calcium, serves as the intercellular signal. Nuclei can be triggered into metaphase when the local stress exceeds a threshold value, thereby releasing additional stress that diffuses through the embryo to trigger neighboring nuclei. We show that this model is quantitatively consistent with image analysis of confocal microscopy videos of mitotic wavefronts in early *Drosophila* embryos. Finally, I will discuss the application of similar ideas to beating in the heart tube of the early chick embryo.