



# Guiding Spiral

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## The research story

This image was generated when we studied how complex spatial patterns can result from the cell motion of *Dictyostelium discoideum* or Dd. Dd are amoeboid cells which when starved aggregate to form a mass of cells. In the process of aggregating, they typically form beautiful streaming patterns as they move up chemical gradients of cAMP, the chemical which guides the cells. We developed a mathematical model of this process using a system of coupled differential equations [1].

## The image

This image is a visualization of a computer simulation of the solution to the equations. It shows the cell density in space with the guiding wave of cAMP superimposed. The distinctly white spiral wave is the region where the concentration of cAMP is above a threshold level. Regions where cell densities are high are shown as level sets in a rainbow-color scheme. Regions void of cells are shown in dark burgundy. A key feature required for the system to create these patterns is that the cells produce (or alter the concentration of) cAMP. This is why the spiral is rough – regions devoid of cells are not producing the chemical. The two typical patterns observed are spiral waves or concentric circles. Here cells are migrating towards the center of a spiral wave of cAMP.

## Reference

- [1] Dallon JC, Othmer HG, A discrete cell model with adaptive signalling for aggregation of *Dictyostelium discoideum*, *Phil. Trans. R. Soc. Lond. B* 352, 391–417, 1997.



