**Karen Page**, Department of Mathematics, University College London, UK

Jasmina Panovska-Griffiths, Department of Medical Physics, University College London, UK

James Briscoe, National Institute of Medical Research, London, UK

## The AC-DC motif – a circuit which allows cells to respond to morphogen signaling in the vertebrate neural tube

During the course of embryonic development, an initially homogeneous population of cells organizes into an exquisitely patterned organism, consisting of multiple cell types. How the information encoded in the DNA is interpreted to create this three-dimensional pattern of cell types has intrigued scientists for many years. One strategy for specifying cellular differentiation is the local production and subsequent diffusion of a "morphogen." The signal conferred to cells varies in space and is used by them to decide their fates.

An example morphogen is Sonic Hedgehog, which, in vertebrates, specifies neural progenitor domains. These later develop into different types of neuron. We present a mathematical model of the gene regulatory circuit that interprets the Sonic Hedghog signal at the cellular level. We show that the circuit responds to both the level and duration of the signal and confers properties of hysteresis and robustness on cells. We show that, in addition to switch-like behavior, the circuit can also exhibit oscillations. We therefore term the circuit the "AC-DC motif."

We suggest that through changes in for example a binding affinity, the AC-DC motif could have been re-used during the course of evolution for either switch-like or oscillatory functions, both of which are important in embryonic patterning.