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Modelling Ultradian Oscillations and Segmentation

MOGENS JENSEN, Niels Bohr Institute

We model ultradian oscillations in four different eucaryotic systems: Hes1, p53-mdm2, NF-kB and Wnt-Notch. In each of the systems we identify the feed-back loops for the genetic regulations. Oscillations are possible when time delays are present, either by directly introducing a delay, by many steps in the loops or by saturated degradation. The oscillations are important for apoptosis and control of inflammation. The Wnt-Notch system is essential in embryo segmentation and we introduce a model in which the Wnt oscillates by itself but drives the Notch cycle out of phase with the Wnt cycle, in good agreement with experimental observations.