Switching between oscillations and homeostasis in competing negative and positive feedback motifs

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We analyze a class of network motifs in which a short, two-node positive feed- back motif is inserted in a three-node negative feedback loop. We demonstrate that such networks can undergo a bifurcation to a state where a stable fixed point and a stable limit cycle coexist. At the bifurcation point the period of the oscillations diverges. Further, intrinsic noise can make the system switch between oscillatory state and the stationary state spontaneously. We find that this switching also occurs in previous models of circadian clocks that use this combination of positive and negative feedback. Our results suggest that real- life circadian systems may need specific regulation to prevent or minimize such switching events.

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