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Monomer exchange and the hourglass model of protein-based oscillators

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Circadian rhythms in photosynthetic cyanobacteria are under the control of a three protein biochemical network that generates oscillations in the phosphorylation level of one of the proteins. This oscillatory signal has a period of roughly 24 hours and regulates many biological processes in the bacteria to the day and night cycle. The molecular view of the phosphorylation process is that one of the proteins forms a hexameric complex whose phosphorylation levels rise and fall based on the activity of the other two proteins. Each hexameric complex thus functions as an independent molecular clock. However the bacteria contains many such clocks and so how do they interact to generate a coherent oscillating signal? In this talk I will discuss a model that suggests that monomer exchange between hexamers helps to synchronize the population of clocks during the daylight portion of the oscillation. Other synchronizing mechanisms will be highlighted for the other portion of the cycle. Recent experiments will be discussed in light of the exchange model.