Yeast Cell Cycle and Metabolism can be Coupled in Nontrivial Ways.

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Abstract:
Synchrony, the phenomenon where components of a system experience events in unison, seems to be common in biological systems. Relatedly, Temporal Clustering or Phase Synchrony, is where sub-groups (or cohorts) of components synchronize among themselves, but are out of phase with other cohorts.

In bioreactor experiments on yeast metabolic oscillations we discovered a case where a culture of yeast exhibits temporal clustering in which two groups progress through their cell cycles in anti-phase. In these experiments the cell cycle clusters and oscillations in the metabolism are seen to be tightly linked.

The discovery raises a number of mathematical questions such as: 'What accounts for the difference between a system that synchronizes and one that forms clusters?', 'What determines the number of clusters that appear?', and 'How do individual cells distribute among clusters?'. In this talk we will discuss how questions such as these can be studied mathematically using biologically motivated non-linear models and in many cases answers can be found. Biologically, we propose a possible coupling mechanism between the cell cycle and metabolism that relies on the fact that in the experiments the bioreactor is operating near carrying capacity.