MAR14-2013-000436

Abstract for an Invited Paper
for the MAR14 Meeting of
the American Physical Society

Reliable cell cycle commitment in budding yeast is ensured by signal integration

CHAO TANG, Peking University

Cells have to make reliable decisions in response to external and/or internal signals that can be noisy and varying. For budding yeast *Saccharomyces cerevisiae*, cells decide whether and when to commit to cell division at the Start checkpoint. The decision is irreversible and has the physiological significance for coordinating cell growth with cell division. The trigger of the Start, the G1 cyclin Cln3 is a dynamic sensor of the nutrient and cellular conditions with low copy number and rapid turnover time. Here we quantitatively investigate how cells process the information from Cln3 to make the Start decision. By using an inducible Cln3 and monitoring the time cell waits before Start transition (G1 length), we find that G1 length is inversely proportional to Cln3 concentration, which implies that Start is triggered when the integration of Cln3 concentration over time exceeds certain threshold. We identify the Start repressor, Whi5 as the integrator. The instantaneous kinase activity of Cln3-Cdk1 is recorded over time on the phosphorylated Whi5, and the decision is made only when the phosphorylation level of Whi5 reaches a threshold. Furthermore, we find that Whi5 plays an important role for coordinating growth and division – cells modulate Whi5 level in different nutrient conditions to adjust the Start threshold. The strategy of signal integration, which reduces noise and minimizes error and uncertainty, has been found in decision-making behaviors of animals. Our work shows that it is adopted at the cellular level, suggesting a general design principle that may be widely implemented in decision-making and signaling systems.