
Conductor's baton: The meaning of the cell cycle for development, inheritance and evolution

Sebastian Gaub*¹

¹Technical University Kaiserslautern – Germany

Abstract

The cell cycle represents the fundamental rhythm of the cell. On the one side the cell cycle oscillates by means of rhythmic activity of various cyclins and dependent kinases. On the other side the cell cycle has a strong impact on a lot of cell cycle controlled genes (CCGs). Checkpoints divide the cell cycle in different phases: growth, synthesis, mitosis and rest phase. Recent findings give evidence that cell cycle regulators play a dual role in proliferation and metabolic control. Also epigenetic oscillations of DNA methylation, chromatin state and microRNA levels show coupling to the cell cycle.

The importance of the cell cycle for the molecular dynamics deserves closer attention by theoretical biology. I made first steps of conceptualising the system features of the cell cycle as (i) a circular flow of information, (ii) the division and control of different cellular phases and (iii) the continuing orchestration of genomic expression, molecular networks and biochemistry of the cell. These systemic features are not determined genetically (ab ovo), but continuously (in medias res). So, biological polymers as DNA, RNA or AA can only "make a difference" with regard to the temporal context. Additionally, the epigenetic reprogramming of oscillating genes opens windows of opportunity for transgenerational inheritance at early stages of development.

In summary, the cell cycle reflects the temporal order of the cell and is a molecular prerequisite of inheritance systems and multicellular evolution. Therefore, I argue that we should pay more attention to the rhythmical nature of molecular ("self"-)organization.

*Speaker