# Between Phenomenon and Mechanism: Diagrams as Vehicles of Intermediate Explanatory Reasoning

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**Abstract**

Session: Reasoning with Diagrams in Biology (Daniel C. Burnston, Benjamin Sheredos, Laura Perini)
Philosophers of science in the new-mechanistic tradition have characterized mechanistic research as progressing by first delineating a phenomenon, then explaining it by discovering the parts and operations of the responsible mechanism. I argue, drawing on diagrammatic representations in mammalian chronobiology, that this bifurcated account of practice misses a key process that mediates between the two recognized stages. In *intermediate explanatory reasoning* (IER), researchers seek to uncover *spatio-temporal dependencies*-precise, quantitative relationships involving known elements of a complex system. The method involves generating data regarding how temporal and spatial patterns in the properties of system elements (e.g., oscillatory patterns of gene transcripts or protein quantities in distinct cells or organs) covary, with the goal of uncovering the aspects of system organization that are vital to produce the phenomenon. While spatio-temporal dependencies are important in developing mechanistic explanations, they do not themselves posit specific operations that causally link parts of the system. Thus, IER is a qualitatively distinct aspect of explanatory reasoning, not yet addressed by mechanists.

A variety of *graphical practices* play vital roles in elucidating spatio-temporal dependencies in the system by conveying the results of key manipulations or recordings. For example, line graphs often are used to show how certain gene knockouts/knockdowns affect the behavior of the system or some of its parts; raster plots convey detailed information about circadian periodicity from individual cells. I show how analysis of these types of diagrams can yield important insights into practice.

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