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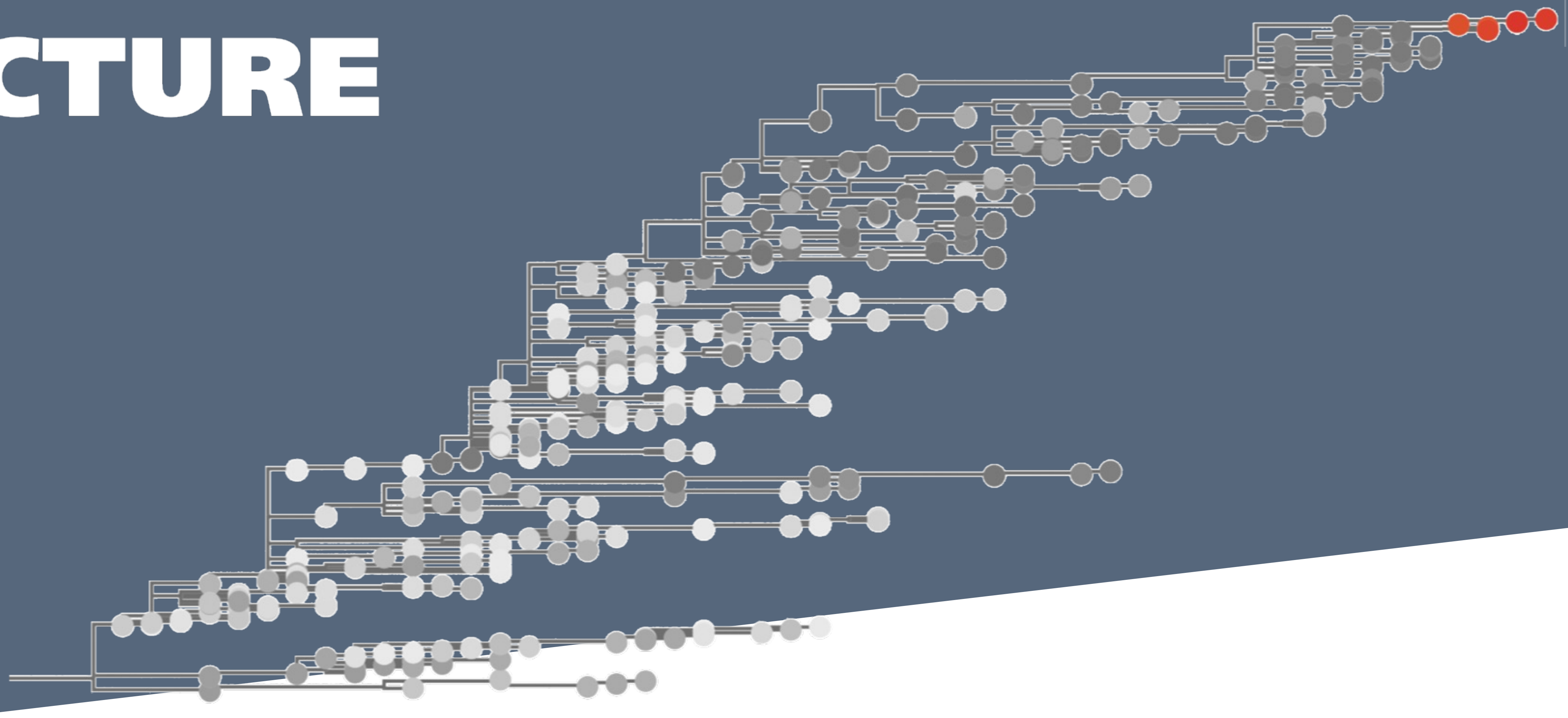

Bacterial growth laws and the origin of dimensional reduction

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Extensive quantitative experiments in the past decades have established simple empirical laws of resource allocation obeyed by exponentially growing bacteria subjected to different environmental or genetic perturbations. Combinations of these laws, together with their kinetic extensions, have led to quantitative account of a number of long-standing phenomena in microbiology. In this talk, I will briefly recount how we embarked on the path of top-down phenomenological studies, exhibit the striking universality of the law of ribosome allocation across diverse bacterial lineages, and describe a recent study establishing how this law is implemented molecularly via simple regulatory processes. The findings provide a rare view of "dimensional reduction" by a living cell, i.e., how a cell manages to collapse the complex, high-dimensional dynamics of metabolic reactions underlying cell growth to quantitatively "perceive" the growth rate, and allocate resources in accordance to the growth rate. Overall, these studies showcase how the basic methodology of classical physics can be used to discover simple organizing principles of living systems and construct quantitative, predictive theories linking molecules to cellular behaviors.

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University of Cologne

Institute for Biological Physics

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Hosted by Leon Seeger and Michael Lässig

CRC 1310 PREDICTABILITY IN EVOLUTION