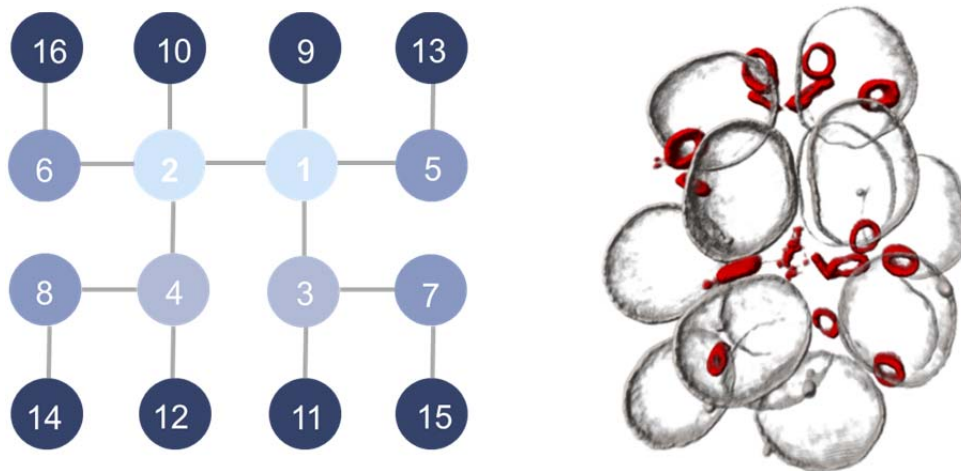


MATHEMATICAL MODELS FOR A MODEL EXPERIMENTAL SYSTEM

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Egg development in the fruit fly *Drosophila melanogaster* has been used for decades as a model system in developmental biology. Studies of this system provided invaluable insights into the general mechanisms that guide the formation of robust multicellular structures. As a rule, the proposed mechanisms rely on multiscale interactions of multiple components, only some of which can be monitored directly. At this level of complexity, mathematical models can play a key role in the rigorous evaluation of candidate mechanisms and design of future experiments. I will present our work on the formulation and analysis of such models. The first model describes how a sheet of identical cells is patterned by a chemical signal. The second model explains how the patterned sheet may be transformed in a glove-like structure. The third model is purely geometrical and is used to describe packing of small cell clusters. For each of these models, I will discuss the key aspects of model formulation, computational analysis, and experimental validation.



Left: A tree-like structure of *Drosophila* germ cells is formed by four sequential divisions of a single germline stem cell (cell #1). Each cell in the tree can be uniquely identified. Right: Three-dimensional packing of the germline cells in the developing egg chamber. Gray – nuclear envelopes of the nurse cells, red – ring canals joining the adjacent cells. Image: Jasmin Imran Alsous (Princeton University).

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