# Lecture 5

Gidon Rosalki

2025-11-02

Wow, this is a little light on content. This was a very biological lesson, with all the concepts in Hebrew. I spent most of it a little lost.

## 1 Basic concepts

### 1.1 Biological systems

What is a system? A system is a group of joined components, working together to a common goal. A *dynamic* system is a system that changes with time. An example of a dynamic system is Conway's Game of Life, where each cell is not particularly interesting in and of itself, but together create a much larger and more interesting system.

A dynamic *biological* system has various requirements to be considered such. It is a collection of parts that operate together to enable the requirements for life:

- To collect information / energy / construction material
- To make choices
- To run plans
- To make adjustments
- To grow / reproduce
- To be protected from the surroundings

Models can strengthen, and explain known, and unknown properties. They can also decide unknown hypotheses, and provide control over properties of the system, providing the ability to change them according to our needs. Finally, it can help identify missing knowledge, which we can then measure in an experiment.

## 2 Integrated models of dynamic biological systems

To model is the process of creating new knowledge, from old knowledge. This can be a continuous process, where this new knowledge is then fed back into creating a new model. Let us consider a cell filter, size on the order of $0.1\mu m$. This allows through passive diffusion the entry of small inert macromolecules, ions, and water to diffuse passively through it into the cell, but blocks the large, inert macromolecules. This is incredibly impressive, such a small filter, with so much capability. The question is though, how does this work? Since we do not have a camera that can tell us, we need to create an integrative model. Firstly, we collect information about the system, through things like experiments, physics, intuition, statistics, and so on. Next we create a computerised mathematical model of the system, as we understand it right now. Next we find a good model of the system, and finally measure the correctness, and usefulness of this model. This is then fed back into the first step to try and create a more accurate model.