

## Observation vs. Empathy

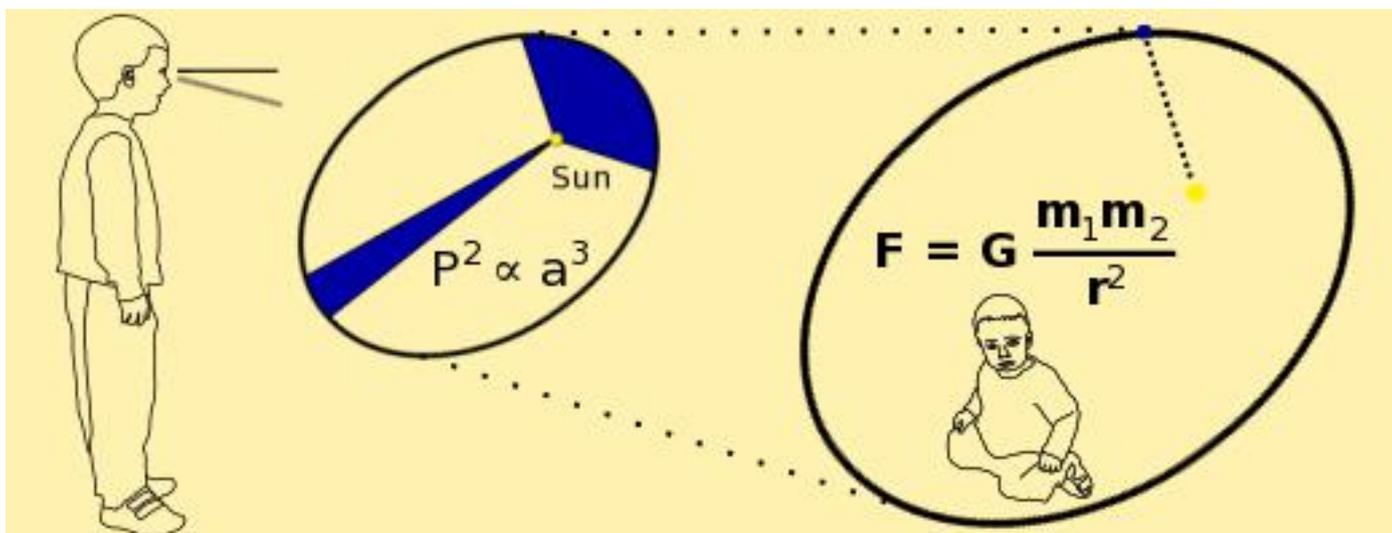
The approach how the biological laws and models are built is crucial. We distinguish so-called "observational" and "empathy" approaches. Although the first one is common in biomedicine world, we chose the second one - the empathy approach. We will show why.

In the figure below you can see the difference between observational and empathic approach. The observer (in the left) can see only outer behavior of the cell (the bubble in the right), but he does not know anything about the inner cell rules and laws. The empather (inside the cell) knows the inner cell rules and does not know anything else. He can see only what the cell sees (e.g. detects by its receptors).



### Analogy of Physics and Biology

You can find analogy of these approaches also in physics. [Johannes Kepler's laws of planetary motion](#) were built on observations. On the other side the [Newton's law of universal gravitation](#) is built on "empathy to mass". The Newton's law can be applied to a movement of a stone or even movements of the planets. Moreover the Kepler's laws can be deduced from the Newton's law of universal gravitation and [Newton's own laws of motion](#). And even more: Newton's model improves Kepler's model to give better fit to the observations.

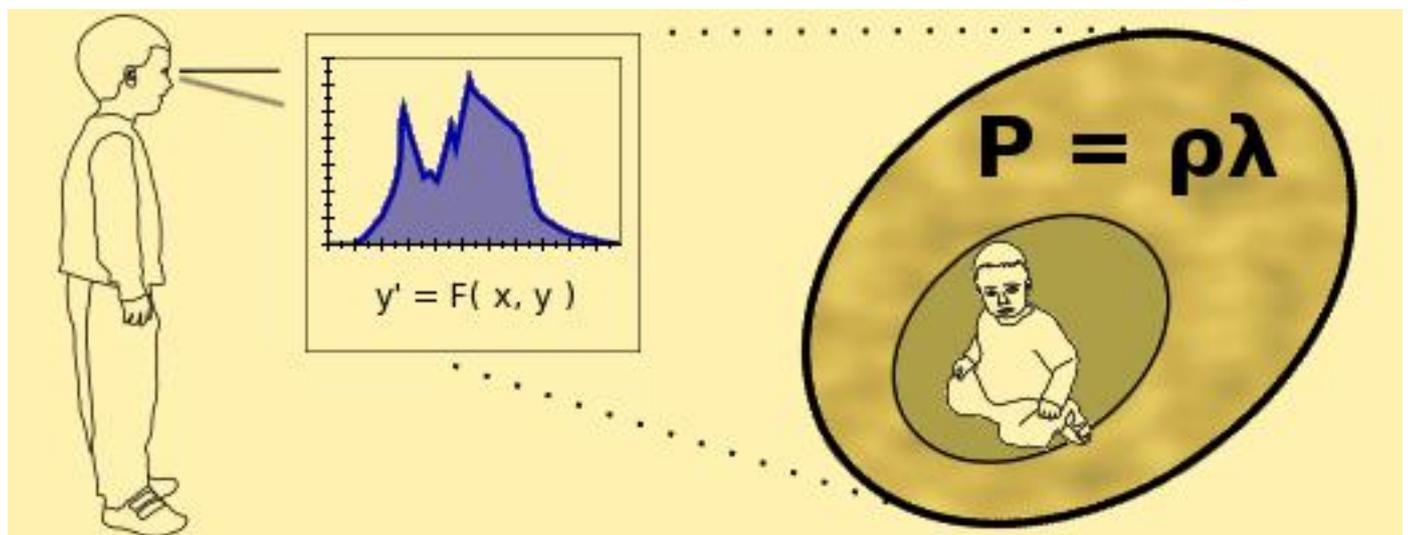


In the figure above you can see that the observer in the left (Kepler's approach) makes the observation model containing the three well-known Kepler's laws (the first two are shown graphically, the third one is presented as the formula).

The empather in the right (Newton's approach) makes the empathy model, which is not limited to the planet movements only, but can be used for all mass objects.

## Application in Biology

If we try to redraw the previous figure for application in biology, we get the following one:



The observer in the left guesses the best observational model, which fits his observations. But the model is not related to the cells at all - it describes only the situation observed on the anthropological level. Unfortunately in most cases the observer must invent a new model/law/equation for each new situation he observes.

The empather tries to find a universal law of cell behavior (He is shown in the right). Such law will be never observed, but the results of models using the law must match the observations. The law is still the same - without aware of cell types or environment.

## The " $\rho\lambda$ " Empathy Approach

We use " $\rho\lambda$ " notion for the cell empathy approach. The " $\rho$ " stands for "receptors" and the " $\lambda$ " stands for "ligands". The notion " $\rho\lambda$ " means that cell's behavior is driven by ligands caught by the cell's receptors.

" $\rho\lambda$ " based models are cell-centric: the basic element of the models is a cell. The types and amounts of the cells' receptors represent the type of cells. This means that we are able to model different types of cells (e.g. immune

cells and neural cells) using the same laws.

For more detail about the cell theory, please continue here: [>>> Digital Biological Cell](#).

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