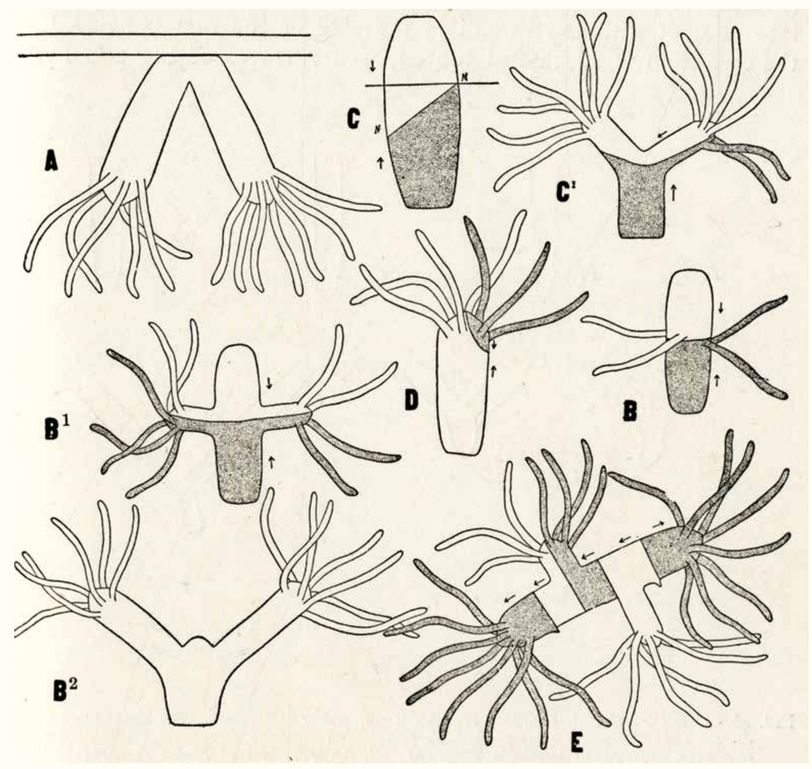
EXPERIMENTAL MANIPULATIONS

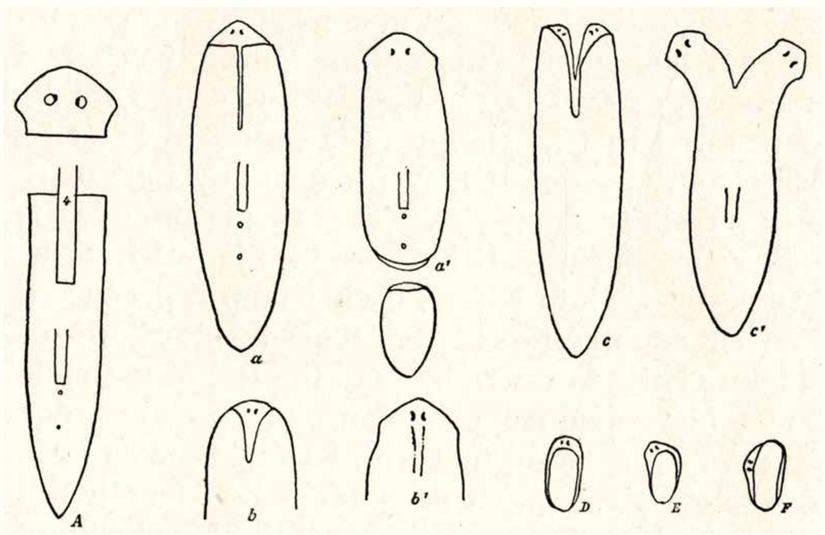
In the 1890s, German biologist Wilhelm Roux argued that just observing what happens in nature is not enough to understand life. Biological research must become experimental. The MBL community took up this call.

In order to understand the role of cells in regeneration, for example, Thomas Hunt Morgan experimented with planarians and hydras, cutting them into bits and observing what happened next.



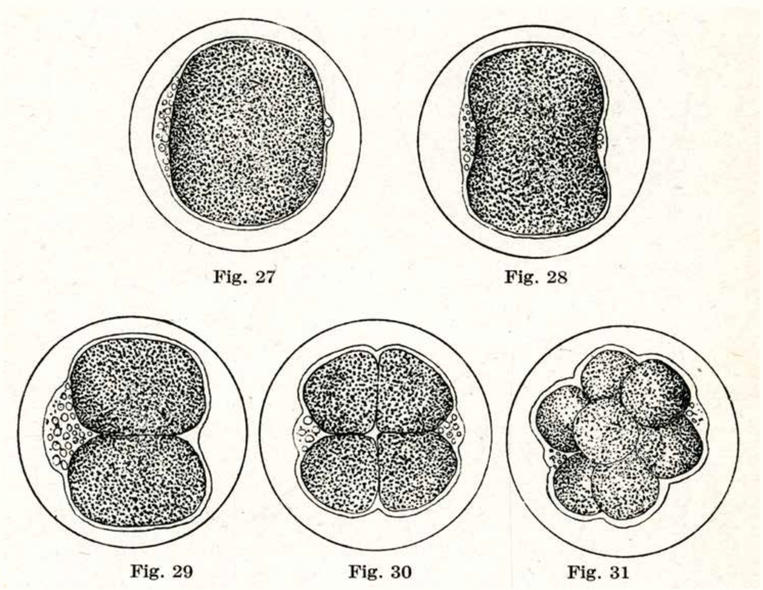
Regeneration of hydra *Morgan 1899*

Regeneration of planarians (flatworms) *Morgan 1899*



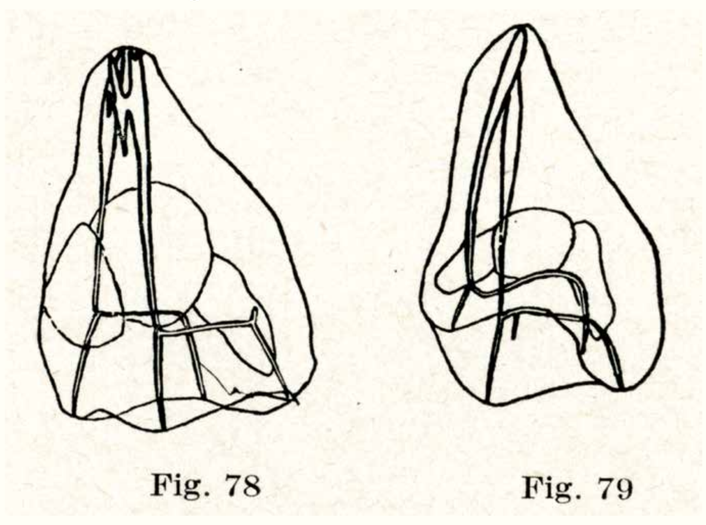
As whole organisms regenerated from the pieces, he asked whether the remaining cells had been transformed to take up different functions, or whether new cells had filled the void. He urged others to join him in testing interpretations.

Jacques Loeb took up the call and experimented with sea urchin egg cells by placing them in different concentrations of salt water. In the right conditions, egg cells began to divide, even without fertilization by sperm, a process called parthenogenesis.



Organisms developed from unfertilized eggs *Loeb 1900*

Cells dividing without fertilization *Loeb 1900*



Loeb also asked how he could manipulate environmental conditions, both inside and outside organisms, to learn how they affect cells and their functions.

As experimental biologists asked new questions, using the new methods, they generated observations that raised more questions. In particular: what is going on inside cells?