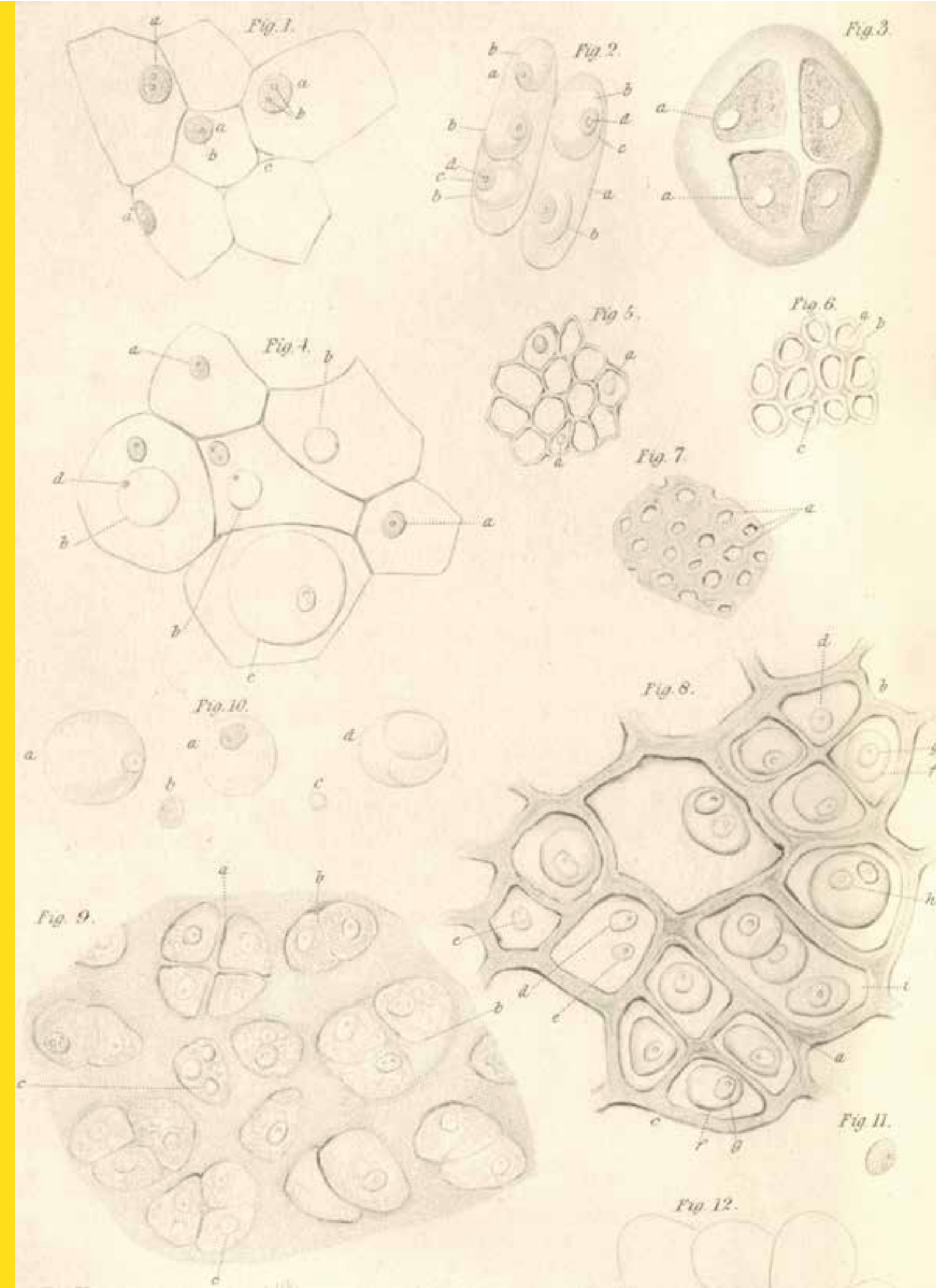


THEORY OF CELLS AS BASIC UNITS OF LIFE

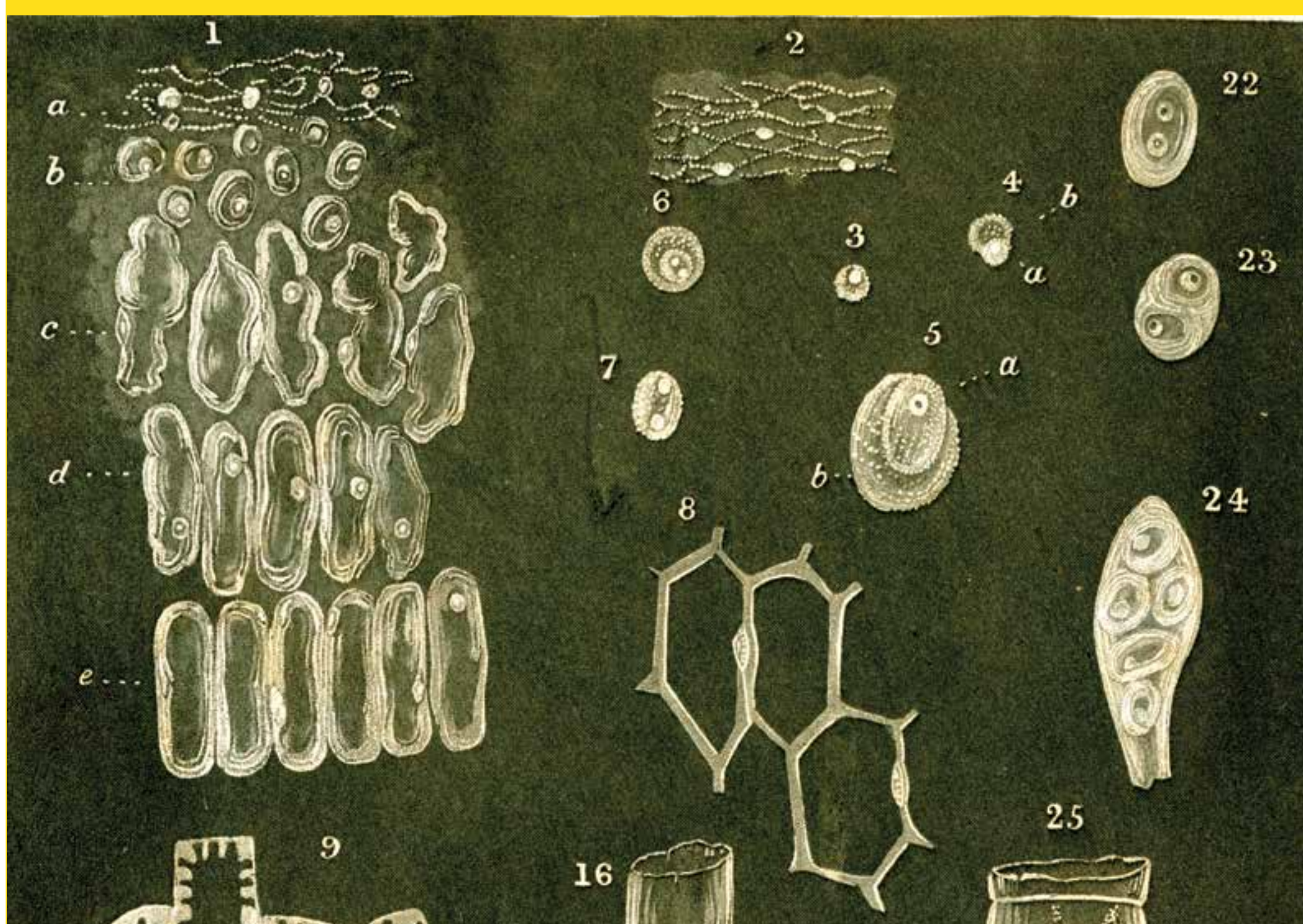
Better microscopes allowed observations and drawings that led to a Cell Theory for all of life, though the idea was not accepted immediately.

In the 1830s, the Germans Matthias Schleiden (with plants) and Theodor Schwann (with animals) declared that plants and animals are all made of cells. They argued that each cell begins with a nucleus, and the cell develops around that nucleus. Cells then join together to make up complex organisms like us.

They argued about whether cells arise by crystallization from surrounding material, through spontaneous generation, by cell division, or some other process.

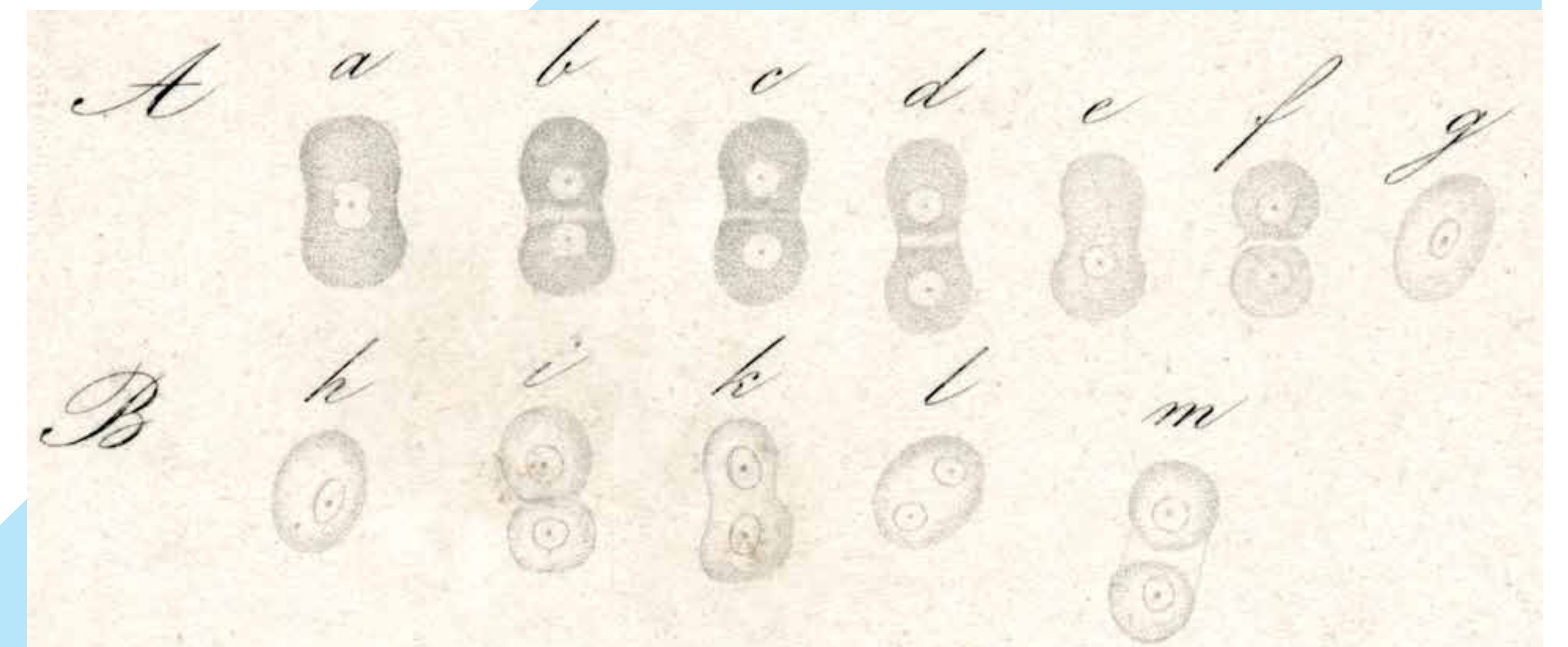


Animal cells Schwann 1838



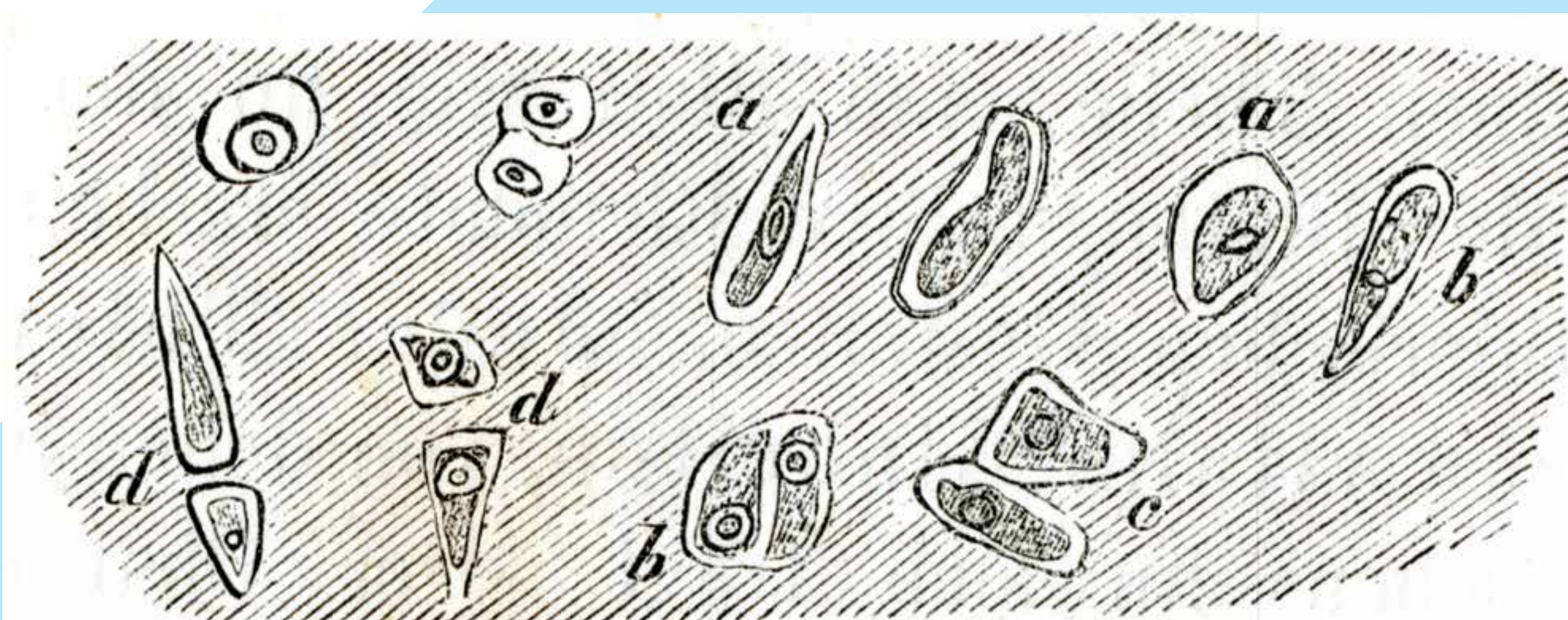
Plant cells Schleiden 1838

Cells dividing Remak 1855



In the 1850s, the Polish-German Robert Remak showed that cells arise by division of other cells, then German pathologist Rudolf Virchow popularized the idea. Though science does not progress through instant agreement with new ideas, this assumption became part of what was accepted by 1900 as the cell theory. The ability to observe cell division and represent it in images eventually persuaded others.

Cells dividing Virchow 1858



The cell theory established that cells are the fundamental units of living organisms, which arise through cell division, and that cells each have a nucleus and also material called protoplasm. But what is protoplasm and what is its role in life?