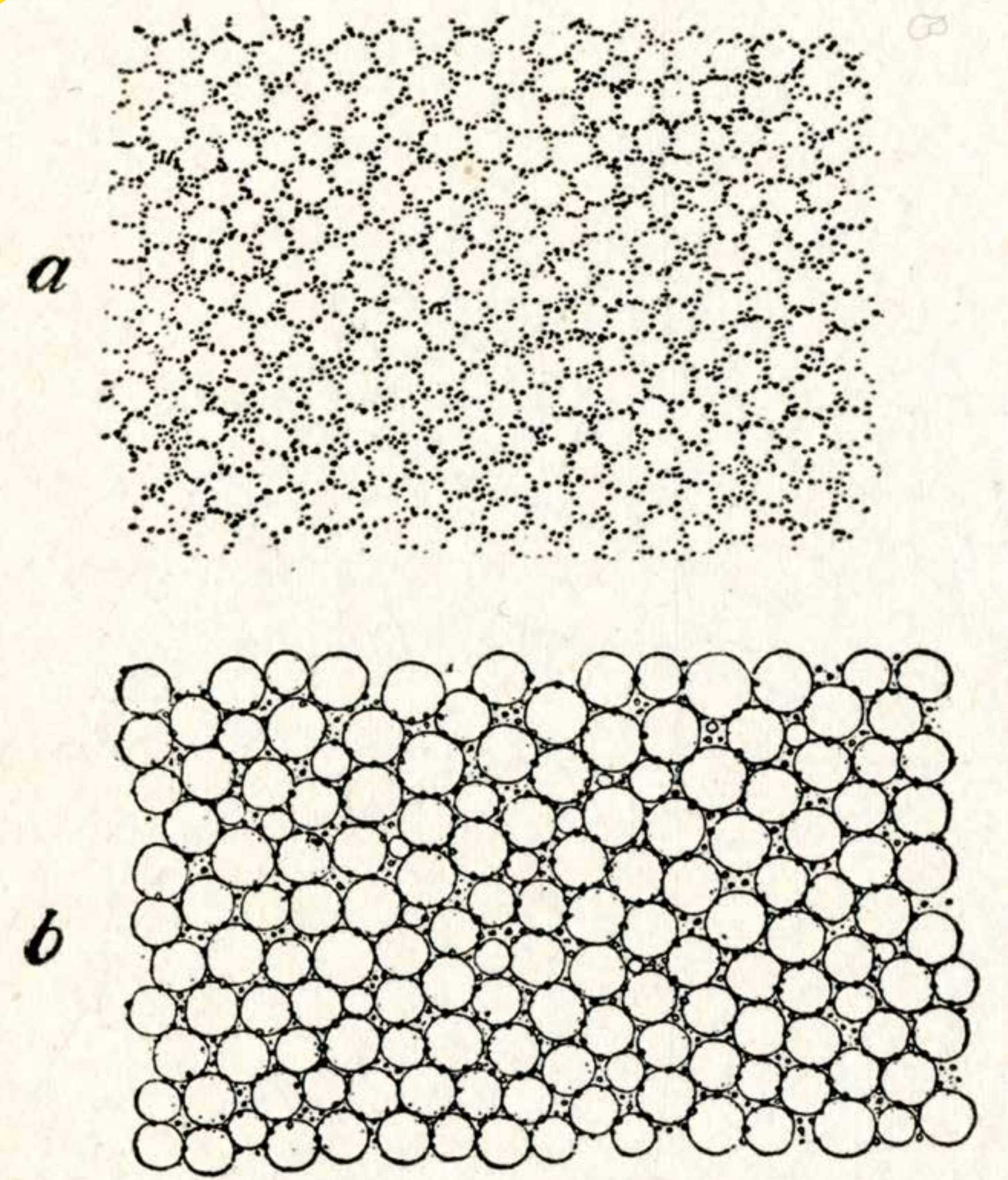


# PROTOPLASM AS THE LIVING STUFF

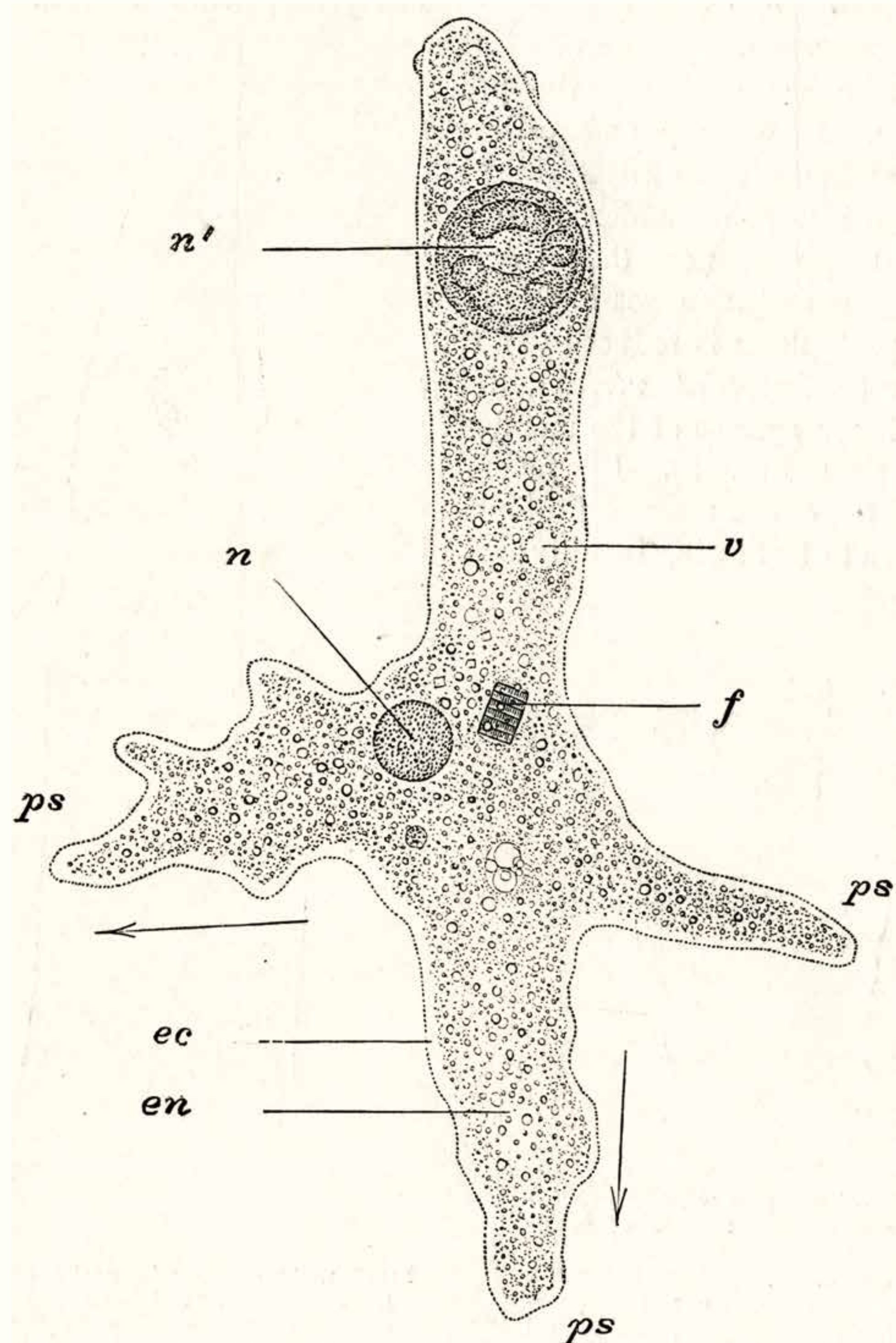
Biologists today focus on DNA and ways that genes influence life. In the 19th century, the nucleus looked relatively stable and separated from the rest of the cell, while the protoplasm seemed to be dynamic. Protoplasm, some leading biologists suggested, must be the stuff of life.

Protoplasm flows and moves, a viscous substance inside cell walls. Apparently constant motion suggested that protoplasm causes cells to move, grow, divide (with help from the nucleus), and interact with each other. Attention shifted to the insides of individual cells, such as white blood cells or amoebae, instead of cell walls or membranes.



Microscopic view of protoplasm Wilson 1896

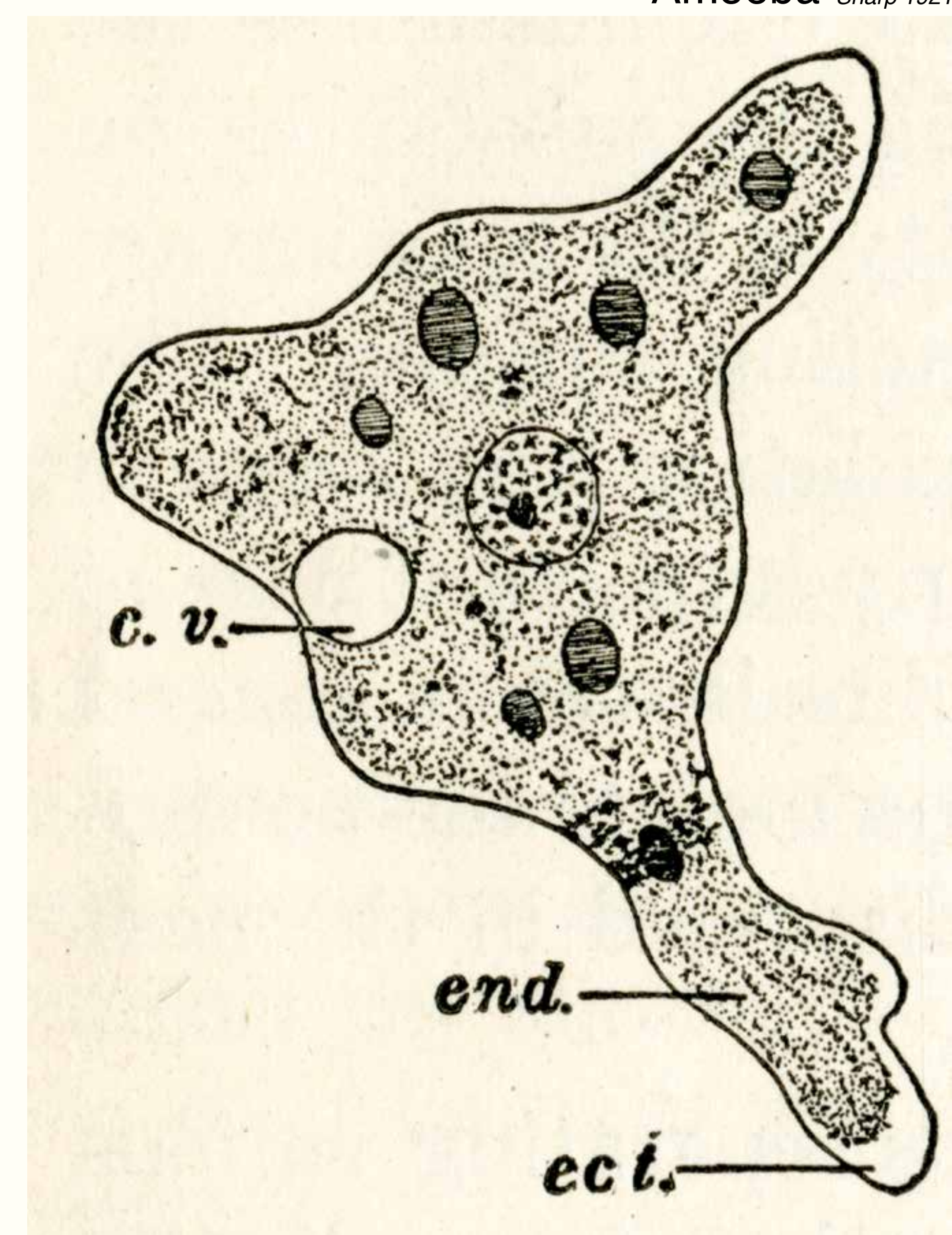
Amoeba Sedgwick and Wilson 1886



An amoeba consists of a single cell and offers an ideal way to study the roles different cell parts play. An amoeba seen through the 19th century microscope looked like a migrating blob of protoplasm with a nucleus, lacking a rigid cell wall.

Ideas about what made up a "cell" changed from focusing on the wall that Hooke had emphasized to the moving substance inside the cell. An amoeba, with protoplasm as its dominant feature, could be seen as an ideal "minimal cell."

Amoeba Sharp 1921



Yet biologists soon realized that most cells are different from this minimal version. They have varied internal structures and function in diverse ways as parts of organisms. Cells are differentiated and specialized, but how?