Dynamic nature of cell. They:

1. grow
2. reproduce
3. become specialized
4. respond to stimuli
5. adapt to environment

Example processes:

- anabolism: synthesis
- mitosis
- differentiation
- homeostasis, chemotaxis
- enzyme and gene regulation

Cell biology formed by convergence of:

1. cytology
2. genetics
3. biochemistry

HISTORY OF CYTOLOGY:

First descriptive then investigative. Dependant on new technology: microscope.

DESCRIBITIVE

Robert Hooke 1665, Curator of Instruments for Royal Society, viewed thin slices of cork under 30x lens, saw tiny compartments, he called cellulae (They were empty, he had not idea of significance)

Antonie van Leeuwenhoek 1673 cloth merchant, developed improved simple microscope (300x), examined everything, illustrated, communicated to Royal Society, last quarter of 17th C.

INVESTIGATIVE:

Robert Brown 1833 English botanist, using improved lenses, noted that every orchid epidermis cell had a round central structure he termed nucleus (“little nut”)

Matthias Schleiden 1838 German botanist, concluded all plant tissues are composed of cells
Also, he noted that the embryonic plant arose from a single cell.

Theodor Schwann 1839 German zoologist, examined cartilage which has good cellular definition concluded: all animal tissues are composed of cells

He proposed two cell theory tenets, became unified cell theory:

UNIFIED CELL THEORY (three tenets):

1) all organisms made of cells
2) cell is the basic unit of structure
3) cells arise only from preexisting cells.

TECHNOLOGICAL DEVELOPMENTS OF CYTOLOGY:

(cytos = Gk, hollow vessel)
concerned with cell structure, depended initially on light microscope

- microtome [“tiny-cut”] invented in 1870, allowed analysis of tissue structure (thin sections)
- dyes developed in Germany 2nd half 19th C. They specifically stain particular components
- optics improvements pushed to limit of resolution which depends on wavelength:
  - wavelength = \( \lambda \) = ‘lambda’ (micrometer = micron = 10^{-6} m; [nanometer = 10^{-9} m])
  - \( \lambda/2 \) = theoretical resolution limit. therefore mag = 1000-1500x Thus 400-700 nm lambda resolves 200-350 nm.

Cells often 20-40 microns, organelles, 0.2-2 microns.

Electron microscope invented in Germany, 1932.

- Palade, Sjostrand and Porter used in early 1950s. limit of resol for electron 0.1-0.2 nm Magnification up to 100,000x.

- Scanning tunneling microscope able to resolve general shape of DNA.