

1  **ANAT3231 - Cell Biology**

Lecture 1

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3  **Lecture 1 - Introduction to Cell Biology**

- Course overview
- Online materials
- Historic background
- Key concepts

4  **Handout #1**

- Course Overview
- Timetable
- Structure
- Assessment
- Textbook
- Websites
- ASCB booklet “Exploring the Cell”

5  **UNSW Cell Biology**

6  **UNSW Cell Biology - Science**

7  **Textbooks**

8  **Journals**

9  **Lecture Overview**

- Cells
 - What is a cell?
 - What do they look like?
 - What do cells do?
- History/Technology
 - Microscopes onward
- Background to Cell Biology
 - The sciences that merged

10  **Robert Hooke (1635-1703)**

11  **Schwann’s Cell Theory**

- All organisms consist of one or more cells
- The cell is the basic unit of structure for all cells


- All cells arise only from preexisting cells

12  **Cell Sizes**

13  **Cell Sizes**

14  **Visible by Electron Microscope**

15  **Visible by Eye**

16  **Visible by Microscope**

17  **Visible by Electron Microscope**

18  **Visible by Electron Microscope**

19  **Modern Cell Biology**

- Arose from 3 separate fields becoming interwoven over the last 50 years
 - Cytology
 - Biochemistry
 - Genetics

20  **Cytology**

- Oldest branch
- Dependent on “optical” techniques
 - 1870 invention of microtome for sectioning biological specimens
- Light Microscope
 - Bright Field, Fluorescence, Phase Contrast, Dark Field, Differential Interference, Digital Video Microscopy, Confocal
- Electron Microscope
 - Transmission, scanning, scanning tunneling
- Magnetic Resonance Imaging

21  **Biochemistry**

22  **Biochemistry**

- 1828 Freidrich Wohler showed urea synthesis from ammonium and cyanate.
 - organic compounds can be synthesized from inorganic compounds.
 - biological chemistry (biochemistry) was the same as all other chemistry.
- 1868 Louis Pasteur shows yeast cells needed for fermentation of sugar into alcohol.
 - living organisms for specific chemical processes.
- 1897 Hans Buchner shows that extract from yeast cells also works
 - enzymes

23  **Biochemistry**

- 1920's-30's Biochemical pathways
 - glycolysis
 - Krebs cycle (TCA)
 - ATP for energy

24  **Genetics**

25  **Genetics**

- 1866 Gregor Mendel
 - hereditary factors (genes) and segregation.
 - took 35 years before work recognised

- 1876 Walther Flemming
 - identified chromosomes
- 1900 Walter Sutton
 - chromosome theory of inheritance.
- 1944 Avery et al.
 - genetic transformation in Bacteria
- 1953 James Watson & Francis Crick
 - double helix model

26 📄 Cell Biology

27 📄 Cell Sizes

28 📄 Plant Cell

29 📄 Mammalian Cell

30 📄 Component sizes

31 📄 Cell Shapes

32 📄 Cell Shapes

33 📄 Cell Motility

34 📄 Cell Environment

35 📄 Differentiation

- Developing and adult cells
- Undifferentiated cells
 - can be “reprogrammed”
- Differentiated cells
 - remember their essential characteristics even in a novel environment
 - environment can modulate cell differentiation

36 📄 References MBOC

- Table 4-1. Some Important Discoveries in the History of Light Microscopy
 - <http://www.ncbi.nlm.nih.gov:80/entrez/query.fcgi?XX&rid=cell.table.576>

37 📄 History of Microscopy

- 1611 **Kepler** suggested a way of making a compound microscope.
- 1655 **Hooke** used a compound microscope to describe small pores in sections of cork that he called “cells”.
- 1674 **Leeuwenhoek** reported his discovery of protozoa. He saw bacteria for the first time nine years later.
- 1833 **Brown** published his microscopic observations of orchids, clearly describing the cell nucleus.
- 1838 **Schleiden** and **Schwann** proposed the cell theory, stating that the nucleated cell is the unit of structure and function in plants and animals.
- 1857 **Kölliker** described mitochondria in muscle cells.
- 1876 **Abbé** analyzed the effects of diffraction on image formation in the microscope and showed how to optimize microscope design.
- 1879 **Flemming** described with great clarity chromosome behavior during mitosis in animal cells.
- 1881 **Retzius** described many animal tissues with a detail that has not been surpassed by any other light microscopist. In the next two decades he, **Cajal**, and other histologists developed staining methods and laid the foundations of microscopic anatomy.
- 1882 **Koch** used aniline dyes to stain microorganisms and identified the bacteria that cause tuberculosis and cholera. In the following two decades other bacteriologists, such as **Klebs** and **Pasteur** identified the causative agents of many other diseases by examining stained preparations under the microscope.
- 1886 **Zeiss** made a series of lenses, to the design of **Abbé**, that enabled microscopists to resolve structures at the theoretical limits of visible light.
- 1898 **Golgi** first saw and described the Golgi apparatus by staining cells with silver nitrate.
- 1924 **Lacassagne** and collaborators developed the first autoradiographic method to localize radioactive polonium in biological specimens.
- 1930 **Lebedeff** designed and built the first interference microscope.
- 1932 **Zernicke** invented the phase-contrast microscope. These two developments allowed unstained living cells to be seen in detail for the first time.
- 1941 **Coons** used antibodies coupled to fluorescent dyes to detect cellular antigens.
- 1952 **Nomarski** revised and patented the system of differential interference contrast for the light microscope that still bears his name.
- 1981 **Allen** and **Inoué** perfected video-enhanced-contrast light microscopy.
- 1988 Commercial confocal scanning microscopes came into widespread use.

38 📄 Prokaryote sizes

39  **Early Cell Biology History**

- 1700's Robert Hooke observed cork slices and saw small compartments which he called *cellulae*
 - Latin for little rooms
- Late 1700's Antony van Leeuwenhoek first microscope descriptive observation
- 1825 Robert Brown identified Nuclei in plant cells
- 1837 Theodor Schwann (animals) & '38 Matthias Schleiden (plants) described how each consisted of cells and were therefore structurally similar

40  **Recent Nobel Prizes**

41  **Magnetic Resonance Imaging**

42  **UNSW Cell Biology**

43  **Resolving Power**