Topic 1

Cell diversity

THE UNIVERSITY OF SYDNEY

Cell Theory

What are the three parts to Theodor Schwann's cell theory?

1. **Organisms <- cells**
2. **Cells = basic units of life**
3. **Cells <- other cells**

Cell Theory

What are the two major classes of cells?

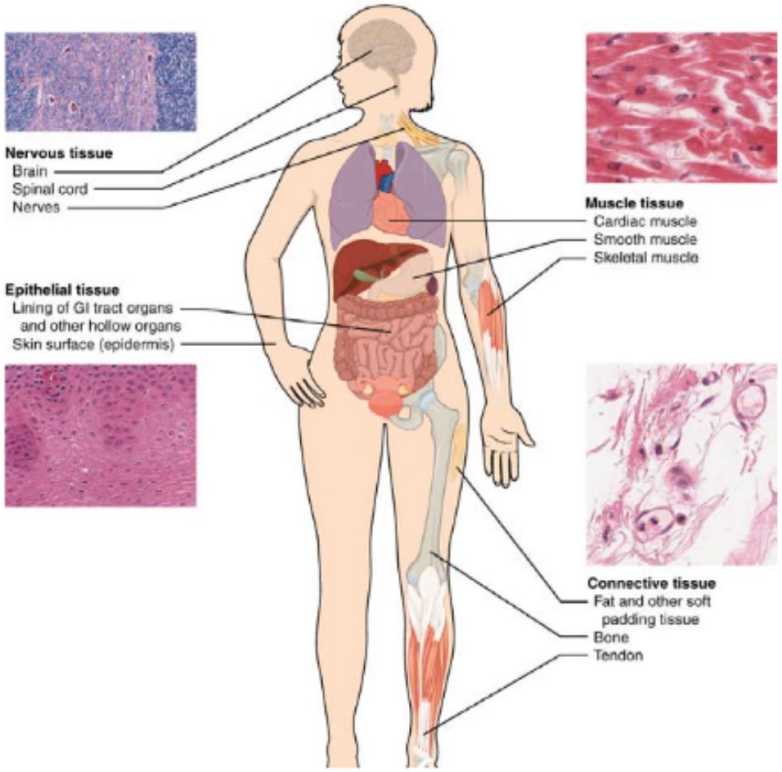
1. **Prokaryotes**
   - 'single celled organism'
   - Weird looking things that live on their own
2. **Eukaryotes**
   - 'multicellular organism'
   - Typically more complex (which needs more organization)

Characteristic	Prokaryote	Eukaryote
Nucleus	Absent	Present
Diameter of a typical cell	≈1μm	10–100 μm
Cytoskeleton	Absent	Present
Cytoplasmic organelles	Absent	Present
DNA content (base pairs)	1×10^6 to 5×10^6	1.5×10^7 to 5×10^9
Chromosomes	Single circular DNA molecule	Multiple linear DNA molecules

Name 5 types of tissues

- Epithelial tissue
- Connective tissue
- Muscle tissue
- Nervous tissue
- Adipose tissue

Lecture 1: Types of tissues



1. **Identify the three types of muscle tissue**
    1. What muscle tissues are under 'voluntary' control
    2. What muscle tissues are under 'involuntary' control
    3. What is responsible for 'involuntary' control of muscles?
2. **This type of cell lines the GIT as well as the skin. What type of tissue is this?**
    1. What is the name of the cell type that lines the inside of your blood vessels?
    2. Blood vessels can contract and relax – this is called vasocontraction and vasoconstriction. What does that imply about the cell-type composition of blood vessels?

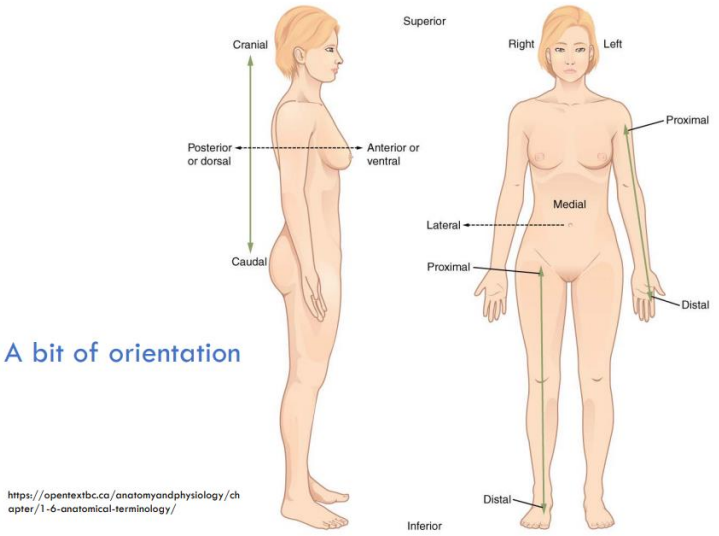
Lecture 1 - Apoptosis

1. **In the figure to the left, the child has Syndactyly - the fusion of digits. In fact, when we are all developing in our mother's wombs, our toes are all joined and webbed together. Explain what apoptosis is and how this sign relates to apoptosis.**

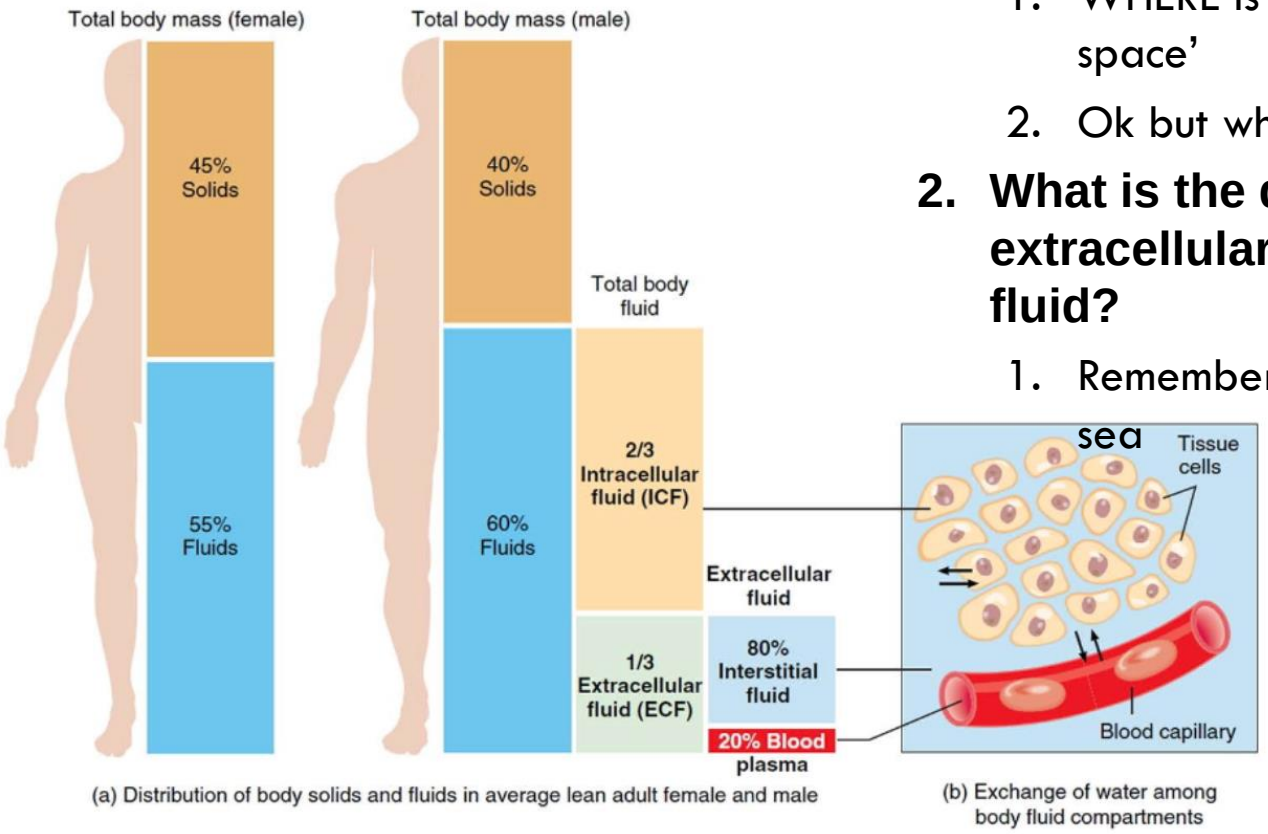
Orient yourself

What is the term for?

1. **Towards the centre of your body?**
2. **Towards the sides of your body?**
3. **Towards the top of your body?**
4. **Towards the bottom of your body?**
5. **CLOSER towards the centre of your body**
6. **FURTHER from the centre of your body**
7. **The front of your body**
8. **The back of your body**
9. **Towards the top**
10. **Towards the bottom**



Lecture 1 – Fluid distribution

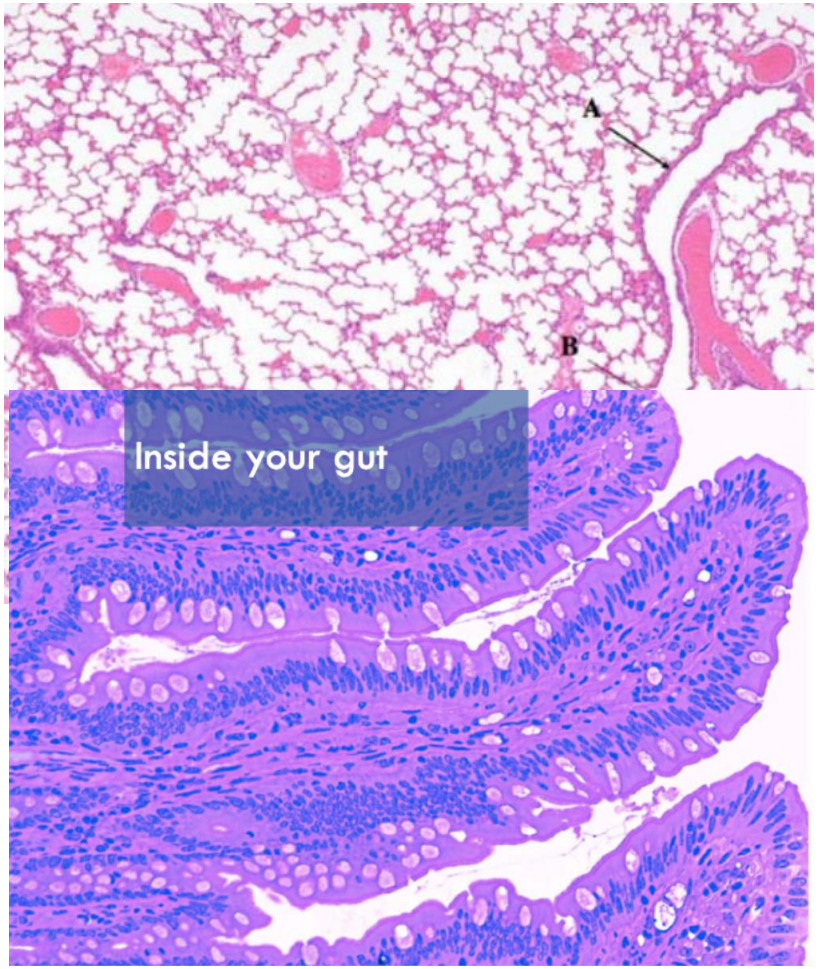


(a) Distribution of body solids and fluids in average lean adult female and male

(b) Exchange of water among body fluid compartments

1. **Describe how much of our mass (as humans) is fluid, how much is intracellular and how much is extracellular**
    1. WHERE is this 'extracellular space'
    2. Ok but where is it really?
2. **What is the difference between extracellular and intracellular fluid?**
    1. Remember: The cell floats inside a sea

Lecture 1 – High surface area ratios



1. **What structure in the lung is responsible for the massive surface area allowing for diffusion of O2 into and CO2 out of the blood?**
2. **What is the structure in the gastrointestinal tract (mainly in small intestine) which allows for absorption of nutrients from digested food?**
    1. What is the structure made up of cells
    2. What is the structure incorporated in the cell?

https://www.gastrojournal.org/article/S0016-5085(05)00177-0/fulltext

Clinical correlation – Coeliac disease

Coeliac disease is an intolerance towards glutin-based compounds in food. On consumption, the gastrointestinal tract of a patient with Coeliac's will undergo total villous atrophy. On microscopy, you will see a loss of villi (diagnostic).

Explain why a patient with coeliac's disease is at risk of experiencing malnutrition.

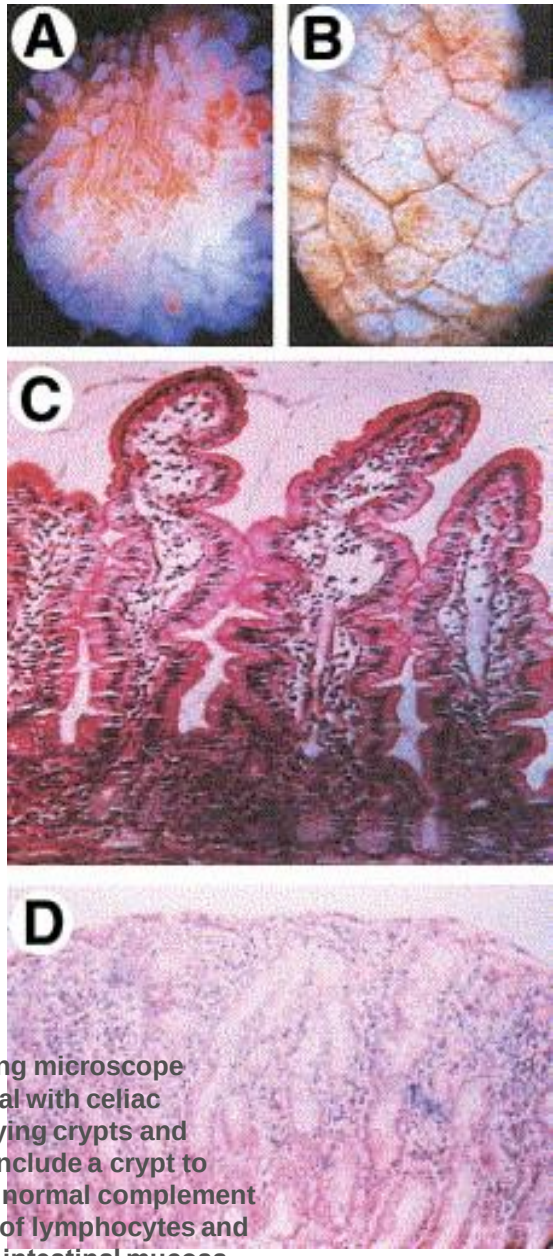


Figure 1 **Small intestinal mucosal biopsy. Small intestinal mucosal biopsy viewed through a dissecting microscope (*A* and *B*). The normal biopsy (*A*) shows numerous surface villi, whereas a biopsy from an individual with celiac disease and total villous atrophy shows, in place of the villi, numerous surface openings to underlying crypts and surface ridges (*B*). (*C*) H&E-stained section of a normal small intestinal mucosal biopsy. Features include a crypt to villous ratio of approximately 4–5:1, columnar villous epithelial cells with basally oriented nuclei, a normal complement of intraepithelial lymphocytes (approximately 1 per 6–10 enterocytes) and a normal representation of lymphocytes and plasma cells in the lamina propria characteristic of the "physiologic" inflammation in normal small intestinal mucosa. (*D*) A small intestinal mucosal biopsy from an individual with celiac disease and total villous atrophy. Note the abnormal surface epithelial cells that are flattened rather than columnar, the complete loss of villi, marked lenghtening of the crypt compartment, the increase in intraepithelial lymphocytes, lymphocytes, and plasma cells in the lamina propria, and increased crypt miltoses.**