B2.3

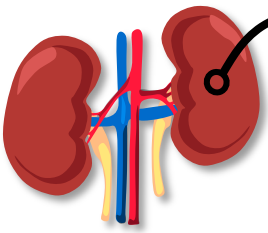
Cell Specialization (HL)

We explore how some cells specialized in order to become more efficient at their task;

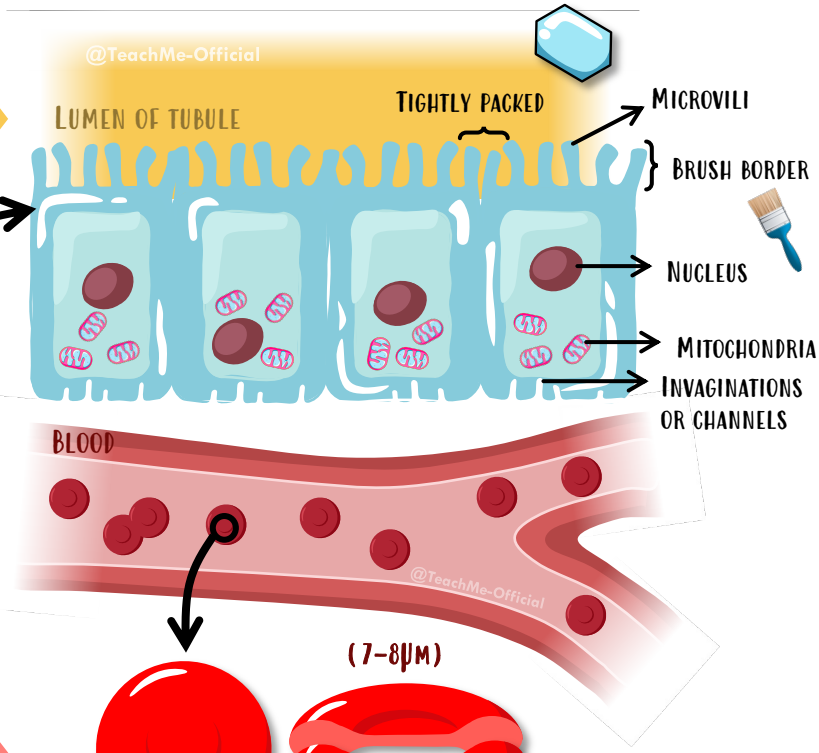
1 – KIDNEY – (PROXIMAL CONVOLUTED TUBULES)

Closely stacked cube-shaped cells (space efficient)

Tiny projections called **MICROVILLI** (brush border) protrude into lumen of tubules in which fluid flows. Increase surface area of the cell for better absorption.

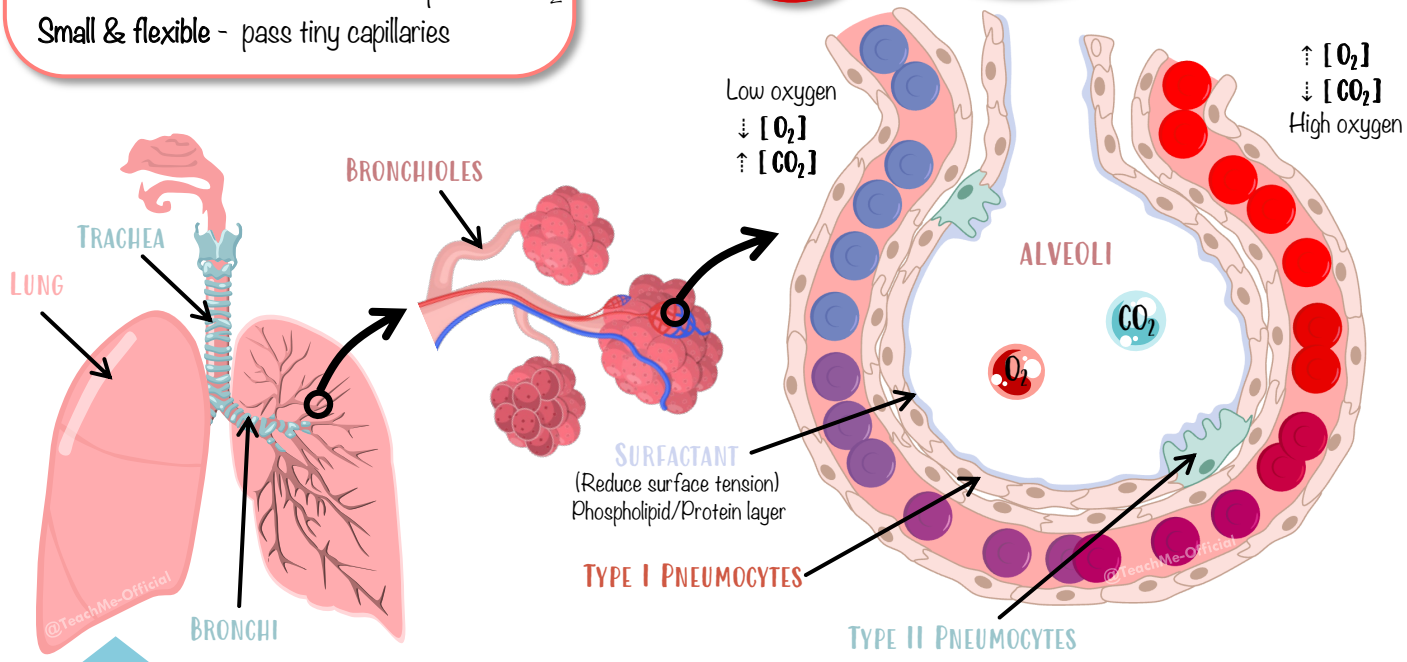


Large numbers of mitochondria. Allows **ACTIVE TRANSPORT** of ions and other substances.



2 ERYTHROCYTE (RBC)

Hemoglobin – to carry oxygen
Biconcave shape – efficient for gas exchange
No mitochondria or nucleus - more space (for O_2)
Small & flexible - pass tiny capillaries



3 – LUNGS – ALVEOLAR CELLS

Thin walls – small diffusion distance
Blood supply – efficient collection
Surface area – maximum diffusion
Tightly joint cells - prevent fluid enter

TYPE I	TYPE 2
Majority (95%)	Minority (5%)
Smaller (flat) - Small diffusion distance	Larger (cube) - More space for organelles such as secretory vesicles
Gas exchange	Secretes surfactant
Can't divide	Can divide to replace type I

Microvilli orientated to inside of alveoli. Larger surface area.

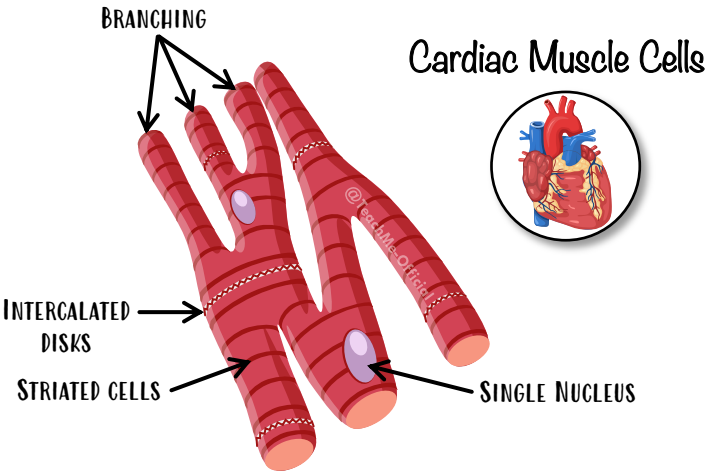
Cell Specialization (HL)

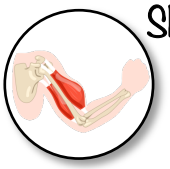
4 – Muscle Fibers (cells) – Cardiac, Skeletal and Smooth

Cardiac Muscle Cells – occur in the heart, are involuntary (you don't control them).

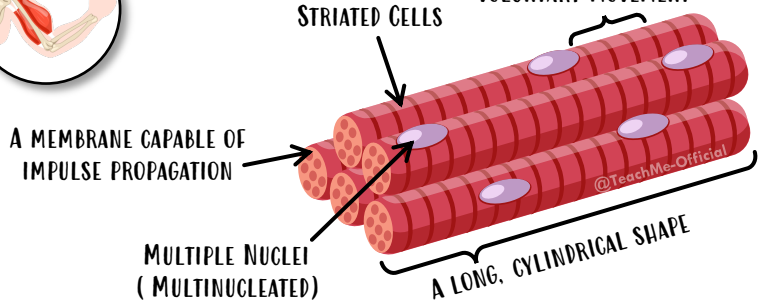
Skeletal Muscle Cells – occur on the skeleton, are voluntary (you have control over them).

Smooth Muscle Cells – occur in some organs and vessels, are involuntary.





Skeletal Muscle Cells



Smooth Muscle Cells

5 – Sperm Cell – (Spermatozoa)

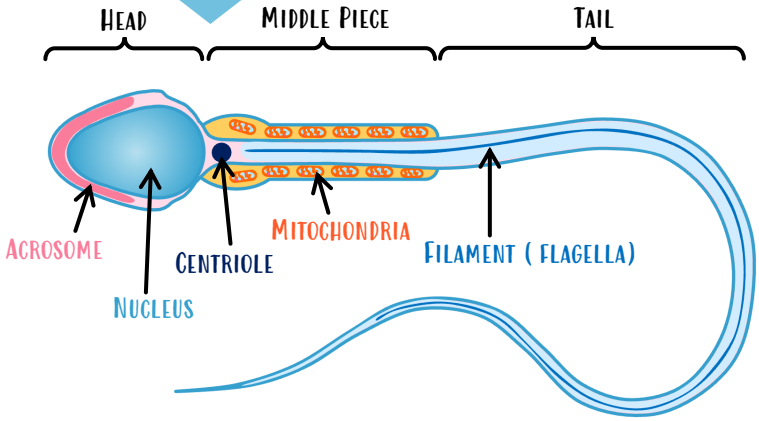
Acrosome – a vacuole that contains enzymes useful in destroying the egg membrane - to allow the sperm to penetrate the egg.

Nucleus - contains the DNA of the cell but only contains half the number of DNA (haploid, n).

Centriole – (1) Used in cell division (mitosis/meiosis). (2) Links the head to the tail and controls its beating (swimming). (3) Plays a role in forming the zygote cell structure (cytoskeleton).

Mitochondria – makes the ATP (energy). Many are present ("swimming" takes a lot of energy).

Filament – allows the swimming to happen (like the fins of a fish).



6 – Egg Cell – (Ovum / Oocyte)

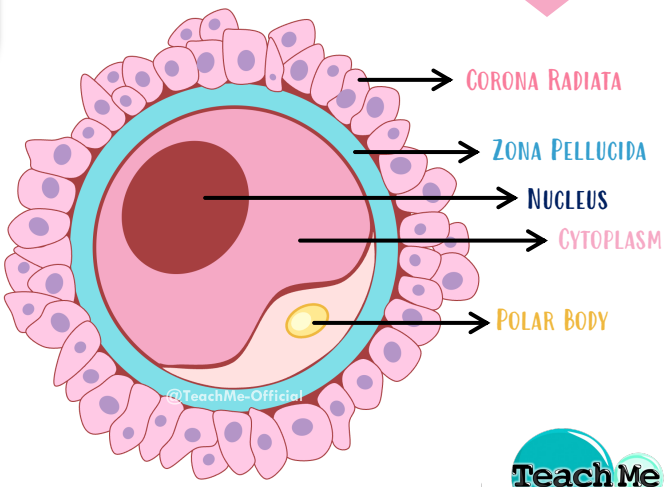
Corona Radiata – protective layer of cells surrounding the egg to supply it with nutrients.

Zona Pellucida – layer which prevents polyspermy and only allows species-specific fertilization.

Nucleus - contains the DNA of the cell but only contains half the number of DNA (haploid, n).

Polar Body - a cell that separates from an oocyte during meiosis, it contains a nucleus produced in the first or second meiotic division and very little cytoplasm.

Cytoplasm - the jelly-like liquid in which everything is floating.



Cell Specialization (HL)

Some differences between the two types of gametes; sperm cells and egg cells

– Sperm Cell – (Spermatozoa)	– Egg Cell – (Ovum / Oocyte)
One of the **SMALLEST** human cells 3μm in width, 50μm in length	One of the **LARGEST** human cells 120μm
Streamlined body with flagellum (for motility) Mitochondria located near the flagellum to supply energy for movement	Shape is spherical (not streamlined)
Very few cytoplasmic organelles	Most cytoplasmic organelles are present plus specialized storage structure for initial embryo development
Continually produced in vast numbers throughout the life of a a male	All the early gamete-forming cells are present before birth. No new egg-forming cells are produced after birth
Head has a specialized secretory vesicle called the acrosomal vesicle that helps the sperm penetrate the egg's outer coat	Has special secretory vesicles just under the plasma membrane that release their contents after one sperm penetrates the egg to prevent other sperm from entering (polyspermy)
Contains a haploid (n) nucleus	Contains a haploid (n) nucleus

notes