**Case 1: Bone growth**

Ali, a 14 year old boy, attended the orthopedic clinic as his parents noticed an unequal length of both lower limbs. Which was more noticeable during the last few months. By discussing his history, The parents confirmed that they didn’t notice this variation except in the last few months. They gave a history of a fracture in the left leg two years earlier. They were advised to have an X-ray which showed a callus of bone tissue near the upper end of the left tibia indicating a healed fracture. The left leg was the shorter one.

1. Mention the type of ossification of long bones and their ossification centers. (Anatomy)

* Membranous ossification: a connective tissue membrane will ossify into bone (e.g.: clavicle).
* Cartilaginous ossification: a membrane will be transformed into cartilage model which will ossify into bone (e.g.: all bones of the limbs except clavicle).
* Before birth, the shaft is transformed into bone, it begins by a primary center of ossification.
* After birth, each end is transformed into bone, it begins by a secondary center of ossification.

1. Describe the structure of a growing long bone.(Anatomy)

* During development of long bones, it is formed of a membranous model, which mostly changes to cartilage.
* Before birth, the shaft is transformed into bone, it begins by a primary center of ossification. • After birth, each end is transformed into bone, it begins by a secondary center of ossification.
* A disc of cartilage persists between the shaft and each end; it is called epiphyseal plate of cartilage.
* The epiphyseal plate of cartilage adds new cells to the shaft, this will increase bone length.
* The newly formed part of the shaft (near epiphyseal plate of cartilage) is called metaphysis.
* Later, the epiphyseal plate of cartilage ossifies, this will stop bone lengthening.
* Usually, the 2 epiphyseal plates of the same bone do not ossify at the same time. One (non-growing) end ossifies around the age of 19 years in males (17 years in females). The other (growing) end will ossify around the age of 21 years in males (19 years in females) with variations.
* The bone is covered by a periosteum. The periosteum adds new cells deep to it, causing an increase in bone width.
* The bone shows a cavity. This cavity is lined with endosteum and contains bone marrow, which is responsible for formation of blood cells.

1. Explain the discrepancy in the length of both limbs.(Anatomy)

* Due to fracture of the epiphyseal plate which is responsible for the increase of long bone length



**Photo of a child with a limb length discrepancy due to growth plate injury.**



X-ray of a leg and a bone

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**Case 2: Immotile cilia syndrome**

A 27-year-old woman arrived at the infertility clinic, claiming to have been unable to conceive for two years. She has a history of tubal pregnancy, recurrent chest infection and chronic sinusitis. The initial assessment of infertility revealed normal hormone levels and normal pelvic ultrasound findings, The doctor suspected there may be an underlying genetic disorder influencing cilia function. Immotile cilia syndrome is confirmed by genetic testing.

1. Describe the anatomy of the fallopian tube. (Anatomy)

* It is about 10 cm.
* It receives the ovum from the ovary, the ovum remains for 1 day for fertilization.
* If fertilization occurs, the cilia in the fallopian tube move the fertilized ovum to the uterus.
* Parts: Infundibulum: guiding the ova and showing fimbriae (finger like processes). Ampulla: dilated part. It is the site of fertilization. Isthmus: narrow part. Intrauterine part: narrowest part.

1. Explain how the above-mentioned syndrome can result in the case of infertility or tubal pregnancy. (Anatomy)

In women, reduced function of motile cilia lining the fallopian tubes may be the cause of reduced fertility due to impaired oocyte transport leading to increased risk of ectopic pregnancies.

1. Enumerate the types of cell apical modification with examples. (Histology)

***Apical Modifications***

1**- Microvilli:**

* Finger like projections from the cell Membrane.
* L.M: apical brush border.
* EM: have a core of actin filaments which maintain its shape & help shortening & elongation of microvilli.
* Site & function: Increase the apical surface area for absorption e.g., in small intestine

**2- Stereocilia: (solid= non- motile):**

* Not true cilia but long microvilli.
* L.M: hairlike processes from the free surface of some cells.
* E.M: Have a core of actin filaments.
* Function & Site: help absorption e.g. epididymis.

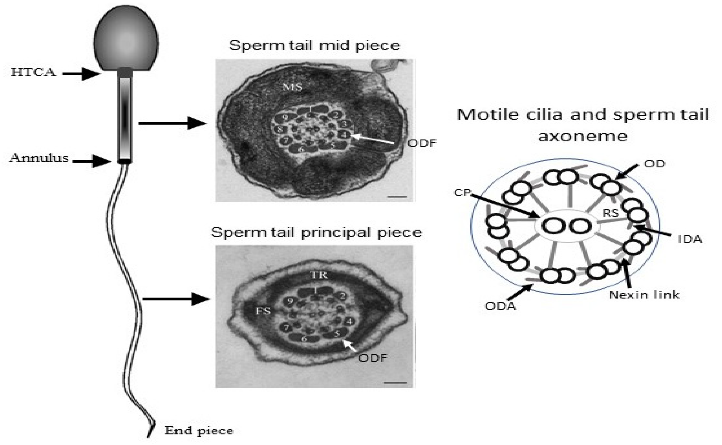
**3- Cilia**:

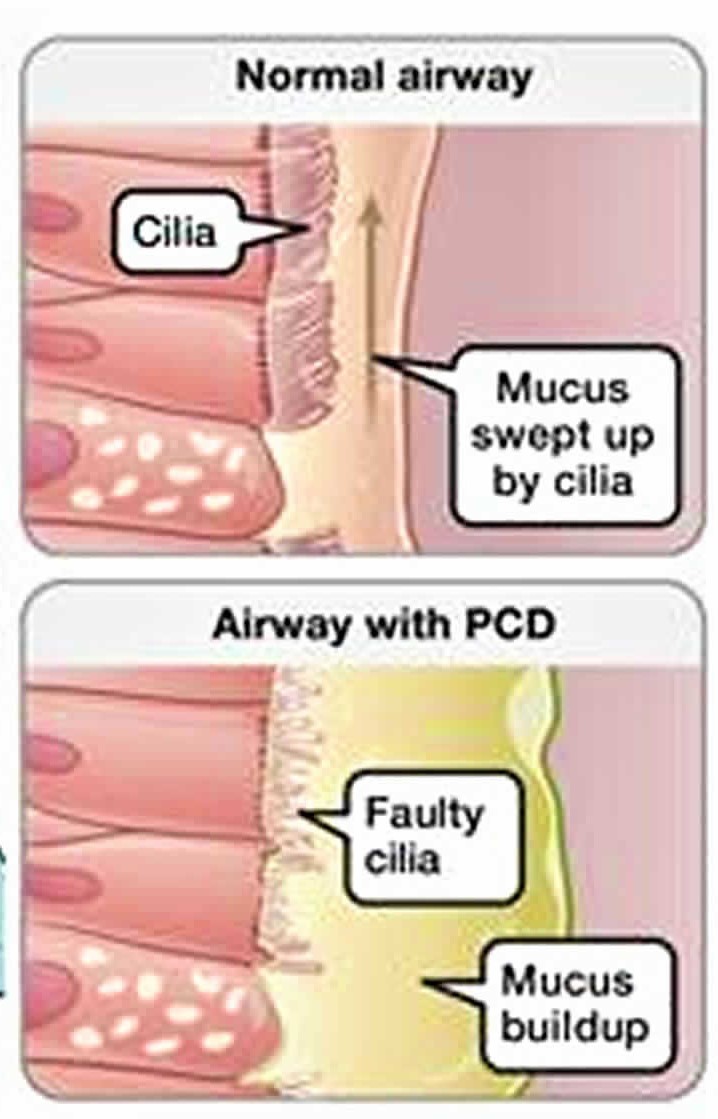
* L.M: hairlike processes which arise from the free surface of some cells.
* E.M: have a core of 20 microtubules arranged as 9 peripheral doublets & 2 central singlets covered with cell membrane.
* Function & sites: Their rhythmic beating propels fluids or particles in one direction e.g. trachea, bronchi & Fallopian tube.

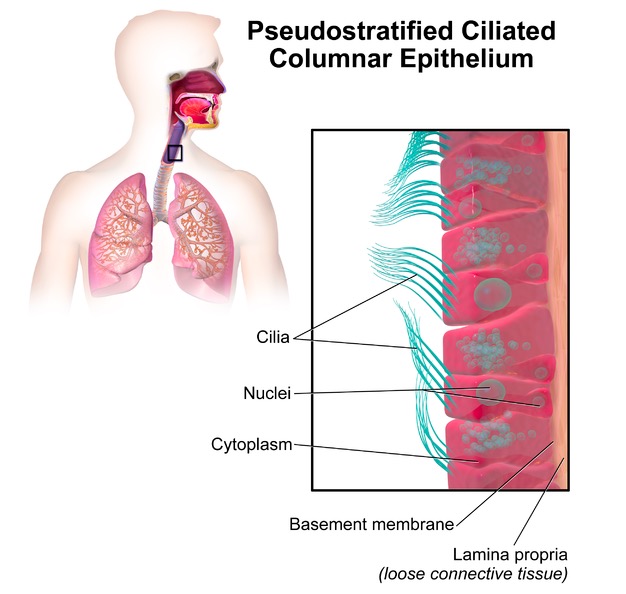
4**- Flagella**: is an extra-long cilium that forms the tail of sperm & helps its movements.

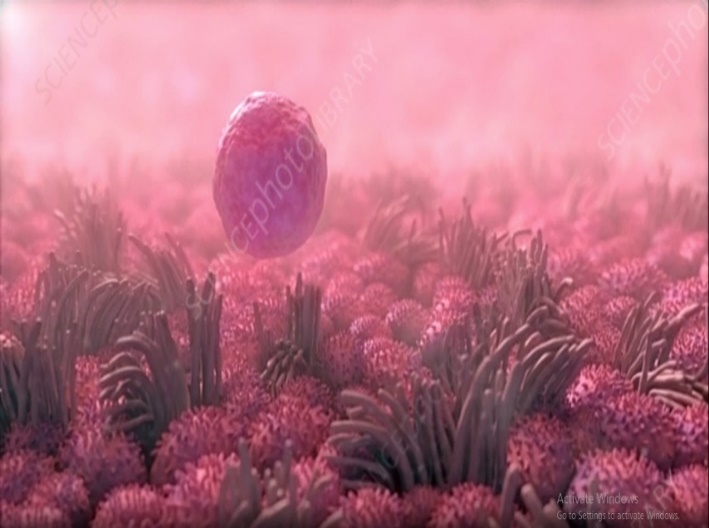
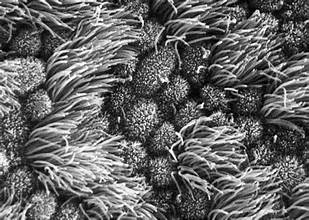
1. In cases of male patients, how this syndrome affect fertility? .(Histology)

Sperm flagella share similar axonemal structures with motile cilia, with mutations leading to sperm dysmotility or morphological abnormalities of sperm.

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**Cilia within the fallopian tubes**

**Case 3: Umbilical cord abnormalities**

A 28-year-old woman, 34 weeks gestational age, presents to the prenatal clinic for routine ultrasound examination. The obstetrician noticed an umbilical cord localized thickening around the umbilical vein. However, healthy fetal heart sounds and normal blood flow within the umbilical cord assured him that there is nothing to worry about.

1. What is the name of this condition? (Anatomy)

False umbilical cord knots due to localized collections of Wharton’s jelly within the umbilical cord.

1. Enumerate the contents of umbilical cord. (Anatomy)

**Contents:**

1) Warton’s jelly: the EEM of the connecting stalk.

2) Umbilical vessels: a) Two (Rt & Lt) umbilical arteries: carries non oxygenated blood from the fetus to the placenta. b) Two (Rt & Lt) umbilical veins: the Rt rapidly disappears. The Lt vein carries oxygenated blood from the placenta to the fetus.

3) Vitelline duct: which connects the midgut to the definitive yolk sac. Later this duct disappears.

4) Urachus (distal part of allantois).

1. Mention the congenital anomalies of umbilical cord. (Anatomy)

Anomalies of umbilical cord:

1) Very long cord: may wind around the neck of the fetus causing hypoxia and may cause true knots.

2) Very short cord: may cause early separation of the placenta.

3) Knots of the cord:

4) Abnormal attachment of the cord to the placenta (battledore placenta and velamentous attachment of umbilical cord)

1. Describe in detail the type of connective tissue in the umbilical cord. (Histology)

* ***Type of C.T is Mucoid connective tissue***
* **Structure**: formed of
* Mesenchymal cells & fibroblasts that communicate with their processes.
* Jelly like ground substance huge in amount, rich in mucus, hyaluronic acid and glycoprotein called Wharton's jelly.
* **Other Sites:** • Pulp of growing tooth. • Vitreous humor of eye.
* **Function**: protects nearby structures from pressure.

A close-up of a knot

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