# Kidney organoids

## Cell types

* **Epithelial cells** - Thin, ordered, continuous protective layer of cells around organs and blood vessels in the body. Also, inside some cavities of organs.
  + Modelled as ‘polar cells.’
* **Mesenchyme cells** - Loosely organized undifferentiated cells which gives rise to most tissues, such as skin, blood, and bones etc.
  + Modelled as ‘non-polar cells’
  + **Question:** How dense are the Mesenchyme cells packed compared to the epithelial cells? They seem to be less densely packed than E-cells, which mean the lambda discrepancy makes sense.
* **Somatic cells**: Cells in the body other than sperm and eggs
* **Human pluripotent stem cells** **(hPCs**): Human pluripotent stem cells (hPSCs), which include human embryonic stem cells (hESCs) and human induced pluripotent stem cells (hiPSCs), can self-renew indefinitely in culture while maintaining the ability to become almost any cell type in the human body ([Takahashi et al., 2007](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3557771/#R131))

## Organ stuff explanations:

* **Mesonephric / Wolffian duct:**  Duct that develops early in human embryonic development and connects the early primitive kidney-types to the cloaca. From here the ureteric bud springs, which develops into a conduit for urine drainage.

## 25.2 Microscopic Anatomy of the Kidney: Anatomy of the Nephron – Anatomy & PhysiologyNephrons

* **Function**: Microscopic structural and functional unit of the kidney. It filters blood into pee. A healthy kidney has about a million of these.
* **Components**:
  + **Renal Corpuscle:** Big blob at the end of tube. Consists of capillaries called the **glomerulus** and cup shaped thing called **Bowman’s capsule**.

**Glomerulus:** Blood is filtered as it is passed through the walls of the capillaries here.

* + - **Bowman’s capsule**: Capsule that collects the filtrate from the glomerulus and passes it into the **renal tubule.**
  + **Renal tubule**: Exchanges some components of the tubular fluid from the glomerulus and ultimately produces pee. Consists of 4 main parts:
    - **Proximal convoluted tubule (PCT)**: Tube immediately after the renal corpuscle.
    - **Loop of Henle**: The thin loop
    - **Distal convoluted tubule (DCT)**: Tube after Loop of Henle
    - **Collecting tubule**: Multiple nephrons feed into the same tubule in the end.

## In Vivo Kidney Development

* **Overall kidney development:**
  + **Pronephros:** Pronephros develops in day 22 of gestation. Epithelial in tubuli called nephrotomes, which connects to pronephric duct, (which later develops into the mesonepric duct (Wollfian fuct))
  + **🡪 Mesonephros:** Nephron-like formations on the mesonephric duct, which leads to the cloaca.
  + **🡪 Metanephros:** Permanent kidney in humans
    - 5th week of gestation: Ureteric buds develop on mesonephric duct near its attachment to the cloaca.
    - Ureteric stalk grows long and begins to branch to form the collecting duct system of the kidney.
    - Undifferentiated mesenchyme cells (Mesoderm) come into contact with tips of the branching ureteric buds which induces differentiation in the mesenchyme cells to form renal tubules.
    - Renal tubules grow 🡪 Join with connecting tubules (the branching ureteric bud)

## In Vivo Nephron genesis

## Organoids

* Organoid refers to a “cellular model of an organ” (“What can we learn from kidney organoids)

## Nephrons genesis

* Cells of nephrons all come from the Six2+ nephrogenic mesenchyme *cap mesenchyme.*