Molecular mechanisms of kidney development

The differentiation of the kidney is conditioned by the **interaction** of the epithelium of the ureteral bud and the mesenchyme of the metanephrogenic blastema.

Mesenchyme action of metanephrogenic blastema

The mesenchyme, which also forms the cap above the peripheral end of the ureteral bud, expresses the transcription factor **WT1** (protein with a zinc finger motif), which allows the metanephrogenic tissue to respond to the inductive influence of the ureteral bud epithelium. At the same time, WT1 influences the production of **glial neutrophil factor (GDNF)** and **hepatocyte growth factor (HGF)**. These 2 growth factors are responsible for stimulating growth and branching of the ureteric bud.

The mesenchyme of the metanephrogenic blastema will later become the basis of the nephron. Its transformation into nephron epithelium is caused both by the expression of **PAX2** and **WNT4**, which is conditioned by the expression of **WNT6** and **WNT9b** in the ureteral bud, and by a change the composition of the **extracellular matrix**, which is also affected by the ureteral bud and where fibronectin, collagen 1 and 3 are replaced by collagen 4 and laminin. The synthesis of **CAMs (Cell Adhesion Molecules)** is also necessary for the transformation of mesenchyme into epithelium.

Action of the epithelium of the ureteral bud

The epithelium of the ureteral bud originates from the **mesonephros**. It arises from the **ductus mesonephricus** and sinks into the tissue of the metanephros. It synthesizes 2 tyrosine kinase receptors that participate in the signaling pathway between the ureteral bud and the mesenchyme of the metanephrogenic blastema.

- **RET** for **GDNF**,
- **MET** for **HGF**.

The epithelium of the ureteral bud, in addition to the above WNT6 and WNT9b, expresses 2 other growth factors:

- **Fibroblast growth factor 2 (FGF2)**,
- **Bone morphogenetic protein 7 (BMP7)**.

Both FG2 and BMP7 promote proliferation of the metanephros mesenchyme, thereby maintaining WT1 production.

Links

Related articles

- Development of the genitourinary system

Used literature

- SADLER, Thomas, W. – SINHA, M.D.. *Langmanova lékařská embryologie.* 1.. edition. Grada, 2011. 414 pp. ISBN 978-80-247-2640-3.
- MOORE, Keith L. – PERSAUD, T. V. N.. *Zrození člověka : Embryologie s klinickým zaměřením.* 1. edition. ISV, 2002. 564 pp. ISBN 80-85866-94-3.