URINARY SYSTEM

KIDNEY (REN, NEPHROS)

Facies anterior et **posterior**
Margo lateralis et **medialis (hilum renale - sinus renalis)**
Extremitas superior et **inferior**
Capsula fibrosa
Cortex renalis, **medulla renalis- 6-20 pyramides renales**
Columnae renales, pars radiata corticis
Papilla renalis – ductus papillares – area cribrosa
Lobus renalis s. renculus. - **renculi-marking**
Nephron: corpusculum renale (Malpighi) - glomerulus + Bowman`s capsule, tubulus proximalis, Henle`s loop, **tubulus distalis, tubulus colligens - ductus papillares - foramina papillaria.**
Daily production of primary urine (to the Bowman`s capsule) is 170-200 liters, most of it is reabsorbed in the tubular system so that the definitive amount of urine is 1, 5 liter a day.

Blood supply of kidneys

A. renalis - r. anterior (4 rr. praepelvici) and **posterior (r. retropelvicus)**.
5 vascular segments (**segmentum superius, anterius superius, anterius inferius, inferius and posterius**)
A. renalis accessoria - in 30 %.
Aa. segmentales – aa. lobares - aa. interlobares - aa. arcuatae - aa. interlobulares - vasa afferentia that form the **glomerulus**. **Vasa efferentia** leave the glomerulus and form the plexus around the tubules of the nefron. The plexus give off into the medulla **arteriolae rectae** that participate on the reabsorption of water from the tubules.

Venulae stellatae +venulae rectae - vv. interlobulares, vv. arcuatae and **vv. interlobares.**
V. renalis - v. cava inf.

Position of kidneys

The kidneys are located in the retroperitoneal space at the level of T12-L2-3. The hilum is at the level of the L1. The right kidney is a half vertebra lower than the left one. The left kidney is often slightly longer than the right one. Longitudinal axes of both kidneys diverge caudally. The dorsal surface is in contact with the diaphragm (the upper part) and m. psoas major, m. quadratus lumborum and m. tramsversus abdominis (the lower part). The dorsal side is crossed by the 12^{th} rib. 3 nerves run behind the kidneys parallel to the 12^{th} rib: **n. subcostalis, iliohypogastricus and ilioinguinalis.** They may be irritated during renal pathologic processes. The cranial poles of kidneys are covered by the **glandulae suprarenales**. The anterior surface of the kidney is separated from the organs of the peritoneal cavity by fat. The attachment of the mesocolon transversum divides the surface to the upper and lower parts. The right kidney has a relation to the liver and flexura coli dx. in its upper segment, the hilum is in contact with the descending part of the duodenum, the caudal part of the anterior surface is in relation to the intestinal coils. The left kidney is in contact with the spleen, stomach and flexura coli sin. in its cranial part, the lower part is in contact with the intestinal coils. The middle part of the anterior surface is in contact with the cauda pancreatis.

Coverings of kidneys

Capsula adiposa
Fascia renalis - lamina praerenalis and **lamina retrorenalis** meet each other cranially and laterally.
Corpus adiposum pararenale posteriorly.
Ren migrans x ectopic kidney

GLANDULA SUPRARENALIS

Facies anterior (**hilum), facies posterior** and **facies renalis**
The suprarenal gland is composed of two developmentally different parts. The **cortex** is yellowish, forms most of the gland and produces **steroid** hormones. The **medulla** is grayish, developed from the neural crest and produces **adrenaline** and **noradrenaline** (epinephrine and norepinephrine).

CALICES RENALES, PELVIS RENALIS

Calices renales minores surround apices of each papilla (7-14) - 2-4 **calices renales majores** - **pelvis renalis** (2-5 cm^3).

URETER
Pars abdominalis, pelvina, intramuralis (**ostium ureteris)**. The abdominal part descends ventral to the m. psoas major where it crosses the testicular (ovaric) vessels (anterior to the ureter) and the genitofemoral nerve (posterior to the ureter); the pelvic part crosses the ductus deferens that lies between the bladder and the ureter in male. In female this part crosses the uterine artery lateral to the vagina (lies below the artery). The parietal peritoneum is lifted - **plica ureterica**.
3 physiological constrictions: 1. at its beginning, 2. at the crossing with the iliac vessels, and 3. pars intramuralis. The 2nd point projects to the **Lanz`s point** to the bispinal line in the 1/3 from the right superior anterior iliac spine. The pain in this point may be caused by the stone in the ureter (urolithiasis) or the appendicitis of the appendix in pelvic position. Stones are formed by crystallization of inorganic substances normally present in urine, usually due to metabolic diseases, infections, some uropathies, over-supply of animal proteins and decreased water intake.

The wall – mucosa (transitional epithelium) - longitudinal reserve folds, musculature - inner longitudinal, outer circular (conversely to the digestive tube). The pelvic part has the additional longitudinal superficial layer that is continuous with the musculature of the bladder. This muscular bundles form the **ureteral sheath** the contractions of which prevent the reflux of urine from the bladder into the ureter.

VESICA URINARIA
Fundus vesicae (toward the rectum in male and cervix uteri in female).
Cervix vesicae – around **ostium urethrae internum**.
Corpus vesicae
Apex vesicae ventrocranially - **ligamentum umbilicale medianum**
Mucosa (transitional epithelium) reserve folds
Trigonum vesicae (without folds) – 2 **ostia ureterum** + **ostium urethrae internum**
Plica interureterica, **fossa retrotrigonalis.**

Uvula vesicae
M. sphincter vesicae
M. retractor uvulae
M. trigonalis.
Paracystium

The function
Urine is accumulated in the urinary bladder. The bladder is reflexively emptied when it reaches the physiologic content (250-350 cm3) and the urge to urinate is felt. The content that can be voluntarily retained is 500-700cm3. The micturition is initiated by involuntary opening of the ostium urethrae internum by the **m. retractor uvulae** that pulls the uvula backward. This process is followed by the contraction of all three layers to empty the bladder. This system is called **m. detrusor**. When the micturition is finished **m. sphincter vesicae** closes the internal orifice of the urethra. This way of micturition is typical for infants. A child learns to influence the contractions of the **m. sphincter urethrae** that is striated muscle in the pelvic floor around the urethra and that enables to overcome the urge to urinate and postpone it to more suitable time.

URETHRA FEMININA

Ostium urethrae internum - ostium urehtrae externum (papilla urethralis)
Pars intramuralis, pelvina, membranacea, perinealis.
Mucosa - reserve longitudinal folds (**crista urethralis), lacunae urethrales - glandulae urehtrales**, **ductus paraurehtrales**
M. transversus perinei profundus - m. sphincter urethrae