FREE NOTES · NCERT + NEET LEVEL

Excretory Products & Elimination

Ammonotelism, ureotelism, uricotelism, human excretory system, nephron, urine banna, counter-current mechanism, regulation (ADH, RAAS, ANF), micturition, doosre organs ka role aur bimariyan.

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02 Human excretory system aur nephron
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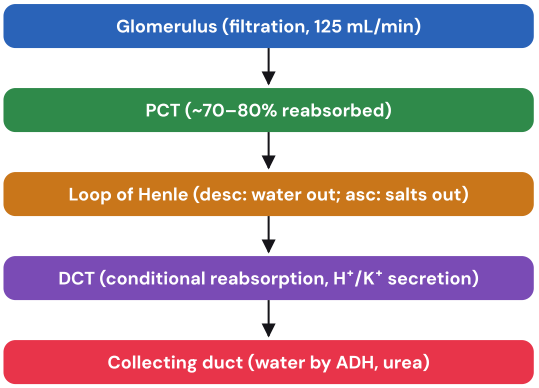
01 Excretion ke tareeke

Mode	Product	Zehar / paani	Examples
Ammonotelic	Ammonia	Sabse zehreela; zyada paani	Bony fishes, paani wale amphibians, aquatic insects
Ureotelic	Urea (liver me ornithine cycle)	Kam zehreela	Mammals, zameeni amphibians, samundari machhli
Uricotelic	Uric acid (pellet/paste)	Sabse kam zehreela, kam paani	Reptiles, birds, land snails, insects

Excretory structures: protonephridia/flame cells (Platyhelminthes, rotifers, kuch annelids, *Amphioxus*), nephridia (annelids), Malpighian tubules (insects), antennal/green glands (prawn jaise crustaceans), kidneys (vertebrates).

02 Human excretory system aur nephron

- Do kidneys (10–12 cm × 5–7 cm × 2–3 cm, 120–170 g) aakhri thoracic aur teesre lumbar vertebra ke beech; ureters, urinary bladder, urethra.
- Hilum (ureter, vessels, nerves), renal pelvis, calyces; bahar cortex, andar medulla pyramids ke saath; **columns of Bertini** = pyramids ke beech cortex.
- Har kidney me ~10 lakh **nephrons**. Nephron: glomerulus + Bowman's capsule (= renal corpuscle), PCT, Henle's loop, DCT, collecting duct.
- Afferent arteriole (chauda) → glomerulus → efferent arteriole → peritubular capillaries; **vasa recta** Henle ke loop ke saath (cortical nephrons me kam).
- **Cortical** nephrons: chhota loop; **juxtamedullary**: lamba loop medulla me gehra.



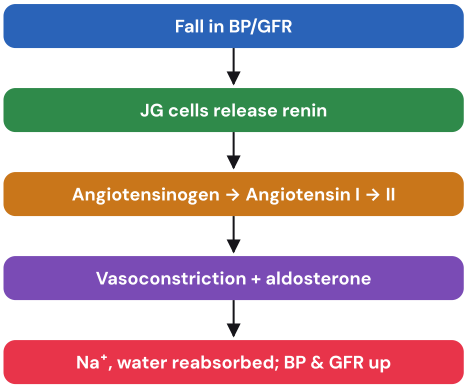
Nephron ka har part kya karta

03 Urine banna

- **Glomerular filtration** (ultrafiltration): endothelium, basement membrane, podocyte slits se; proteins ke alawa plasma ka sab. Kidneys 1100–1200 mL blood/min filter (cardiac output ka ~1/5). **GFR** ≈ 125 mL/min = 180 L/din.
- **Reabsorption**: filtrate ka ~99% wapas; sirf ~1.5 L urine/din. Active (glucose, amino acids, Na^+) aur passive (nitrogenous wastes, paani).
- **Secretion**: H^+, K^+, ammonia filtrate me; ionic aur acid-base balance.
- PCT: brush border wala simple cuboidal epithelium; lagbhag saare nutrients aur 70–80% electrolytes aur paani wapas; HCO_3^- wapas.
- Henle's loop: **descending limb sirf paani ke liye permeable**; **ascending limb paani ke liye impermeable**, electrolytes ke liye permeable. DCT: conditional Na^+ aur paani wapas.

04 Urine gaadha karna aur regulation

- **Counter-current mechanism**: Henle ke loop ke do limbs aur vasa recta me ulti disha flow; NaCl aur urea medulla ko hyperosmotic rakhte: cortex 300 mOsmol/L → andar ki medulla **1200 mOsmol/L**. Urine filtrate se ~4 guna gaadha.
- **ADH** (vasopressin) posterior pituitary se: paani kam hone pe osmoreceptors ADH chhudwate ⇒ DCT aur collecting duct se zyada paani wapas; vessels bhi sikudte.
- **RAAS** (daayein). **ANF** (atrial natriuretic factor) BP badhne pe atria se: vasodilation, BP kam; RAAS ko rokta.



Renin–angiotensin–aldosterone system

05 Micturition aur doosre excretory organs

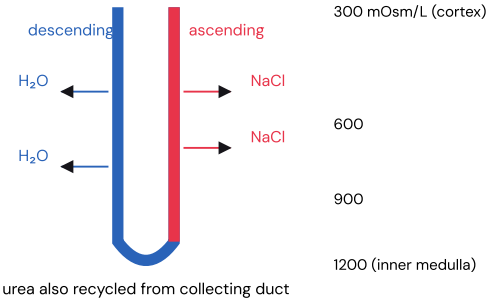
- Urine bladder me; stretch receptors CNS ko signal; motor messages se bladder muscles sikudte aur urethral sphincter dheela: **micturition reflex**.
- Adult 1–1.5 L urine/din, thoda acidic (pH 6.0), ~25–30 g urea/din. Urine me glucose = **glycosuria**, ketone bodies = **ketonuria** (diabetes mellitus ka sanket).
- Lungs CO_2 (~200 mL/min) aur paani nikalte. Liver bile me bilirubin, biliverdin, cholesterol, steroid hormones ke tukde, vitamins, drugs. Skin: paseena (NaCl, thoda urea, lactic acid; mainly thanda karna) aur sebum (sterols, hydrocarbons, waxes). Saliva thode nitrogenous wastes.

06 Bimariyan

Bimari	Kya hota / ilaaj
Uraemia	Blood me urea jamta; nuksaan; **haemodialysis** (artificial kidney: heparin wala blood cellophane tube se dialysing fluid me jisme nitrogenous wastes nahi; phir anti-heparin)
Kidney transplant	Acute renal failure ka aakhri ilaaj; donor kareebi rishtedaar behtar, rejection kam
Renal calculi	Kidney me namak (oxalates) ke pathar
Glomerulonephritis	Glomeruli me sujan

07 Extra + tricks

- **Renal failure**: kidneys filter karna band; dialysis ya transplant. **Nephritis** (glomerulonephritis): glomeruli me sujan.
- **Diabetes insipidus**: ADH kam ⇒ bahut patla urine (polyuria), pyaas.
- Normal urine: ~1–1.5 L/din, pH ~6, urea 25–30 g/din; rang urochrome se.
- Trick: **"Descending paani peeta, ascending namak deta"**: descending limb se paani, ascending se namak nikalta.
- Juxtaglomerular apparatus (JGA) = afferent arteriole ke JG cells + DCT ka macula densa; BP/GFR mehsoos karta.



Henle's loop me counter-current mechanism

08 Important Q&A

Q1. Henle ka descending limb filtrate gaadha kyun karta?

Paani ke liye permeable par electrolytes ke liye nahi, isliye paani hyperosmotic medulla me nikalta.

Q2. GFR 125 mL/min se din ka filtrate?

125 × 60 × 24 = 1,80,000 mL = 180 L/din.

Q3. ANF ka role?

BP badhne pe atria se; vasodilation, BP kam, RAAS ko rokta.

09 Common mistakes

- Ascending limb ko paani ke liye permeable kehna (impermeable).
- Birds ko ureotelic likhna (uricotelic).
- ADH ko anterior pituitary se sochna (posterior).
- Bhoolna ki columns of Bertini cortex ka tissue.

10 Practice (NEET style)

1. Normal GFR?
2. Insects ki excretory structure?
3. JG cells kya chhodte?
4. Andar ki medulla ki max osmolarity?
5. Urine me glucose ko kya kehte?

ANSWERS

1) 125 mL/min · 2) Malpighian tubules · 3) Renin · 4) 1200 mOsmol/L · 5) Glycosuria

11 Quick revision: exam se 5 minute pehle

MODES

- Ammonia: machhli
- Urea: mammals
- Uric acid: birds, reptiles

NEPHRON

- GFR 125 mL/min, 180 L/din
- PCT max reabsorption
- Desc paani, asc salts

REGULATION

- ADH: paani wapas
- RAAS: BP upar
- ANF: BP neeche

DISORDERS

- Uraemia → dialysis
- Calculi, glomerulonephritis

Koi doubt? padhaiadda.netlify.app pe AI Doubt Solver se poocho, ya is chapter ka mock test do.