GLOMERULAR FILTRATION

Learning Outcomes

At the end of the session you will be able to:

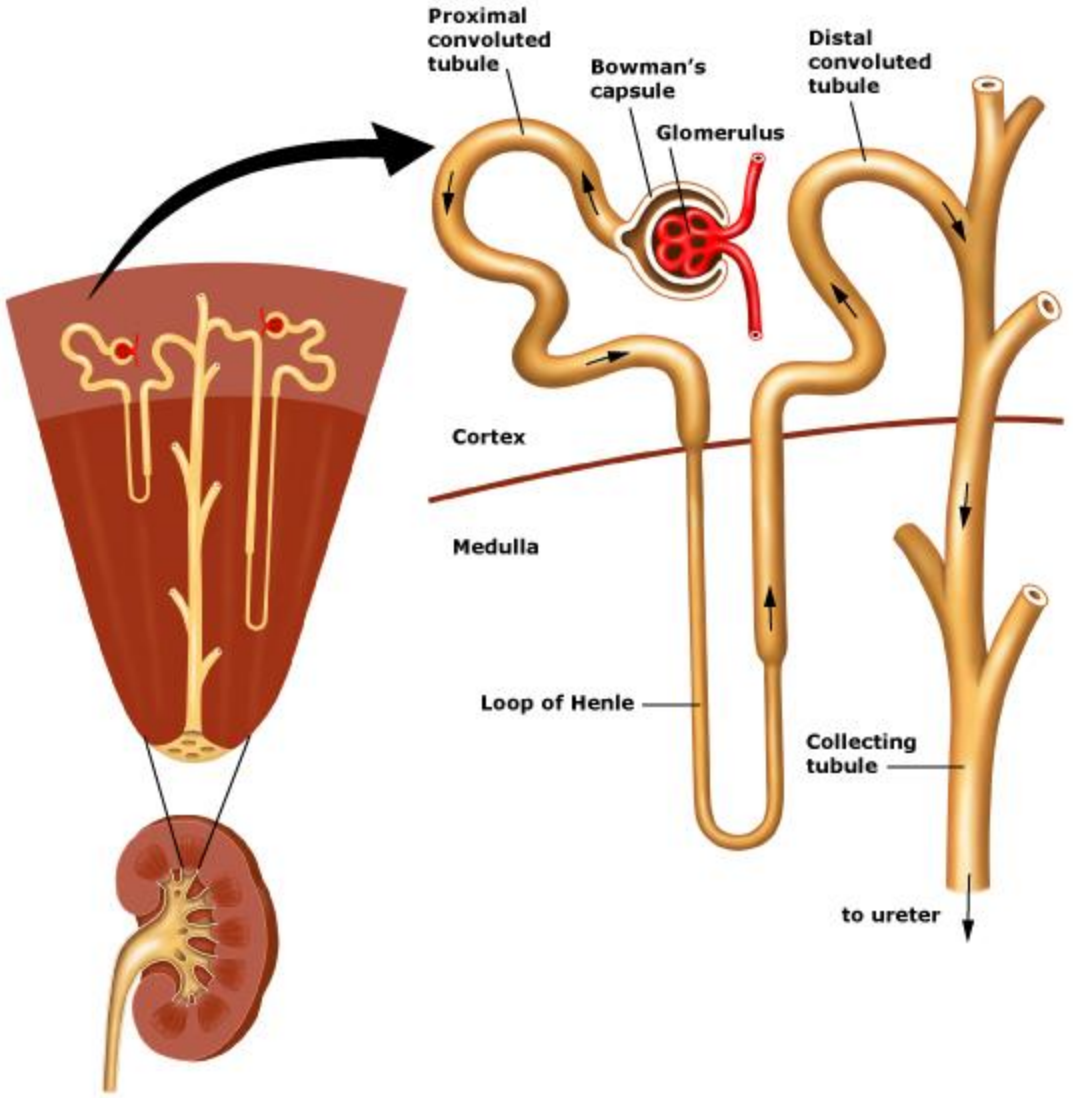
- Define Glomerular Filtration
- Describe structure and function of the Glomerular apparatus
- Discuss the factors affecting and regulating GFR
- Relate common pathologies with GFR

Significance of Glomerular Filtration:

- ECF homeostasis
- Electrolyte Composition
- Osmolality
- Excretion of toxins

- **Compensates easily for excess then loss??**

- 500 ml needs to be eliminated at all cost to get rid of the toxins



Nephron

- 1 million
- Each nephron has 2 components
- Vascular and tubular
- Vascular is Glomerulus

Glomerulus:

- Tuft of capillaries

- Filtered fluid is ALMOST identical to plasma?? What's the difference and why?

Guyton and Hall Physiology

Arterial blood both ends. Why??

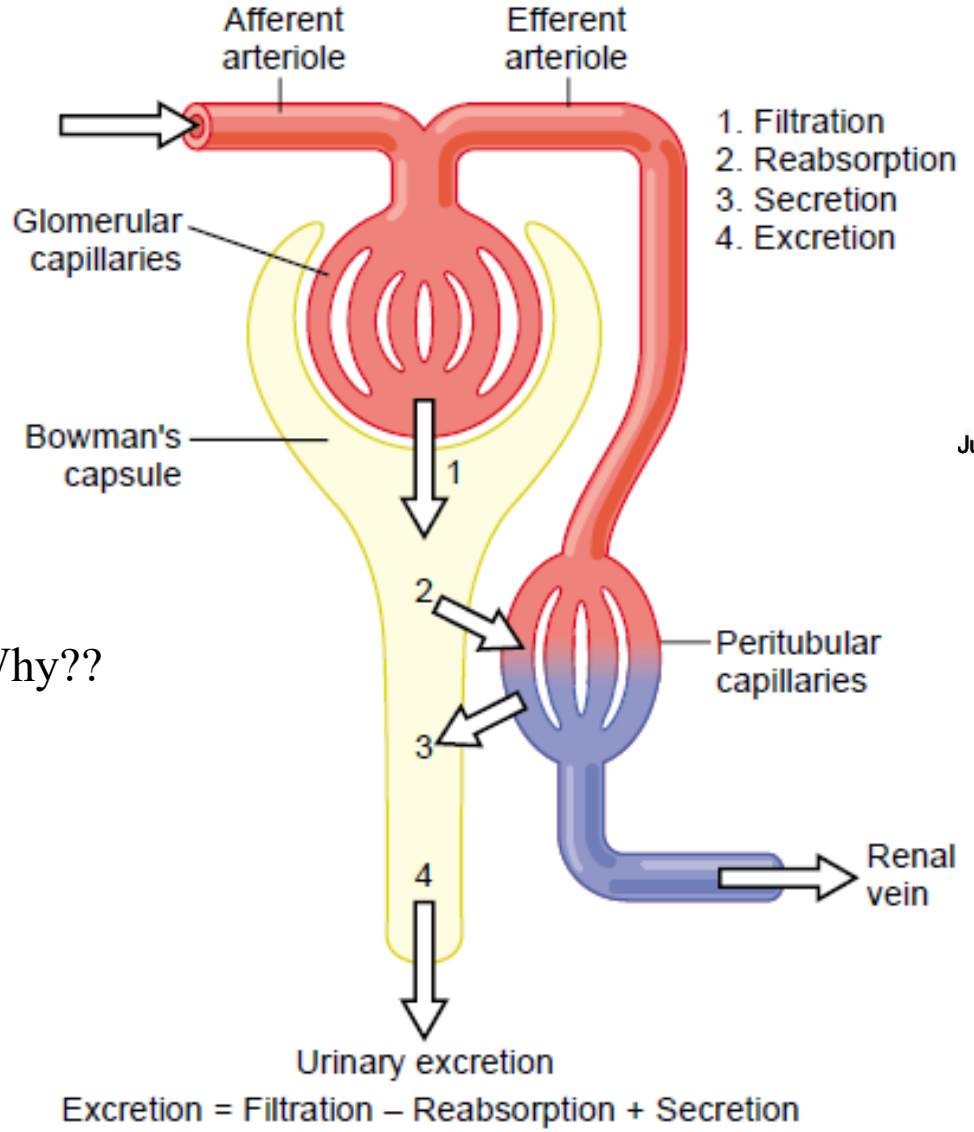
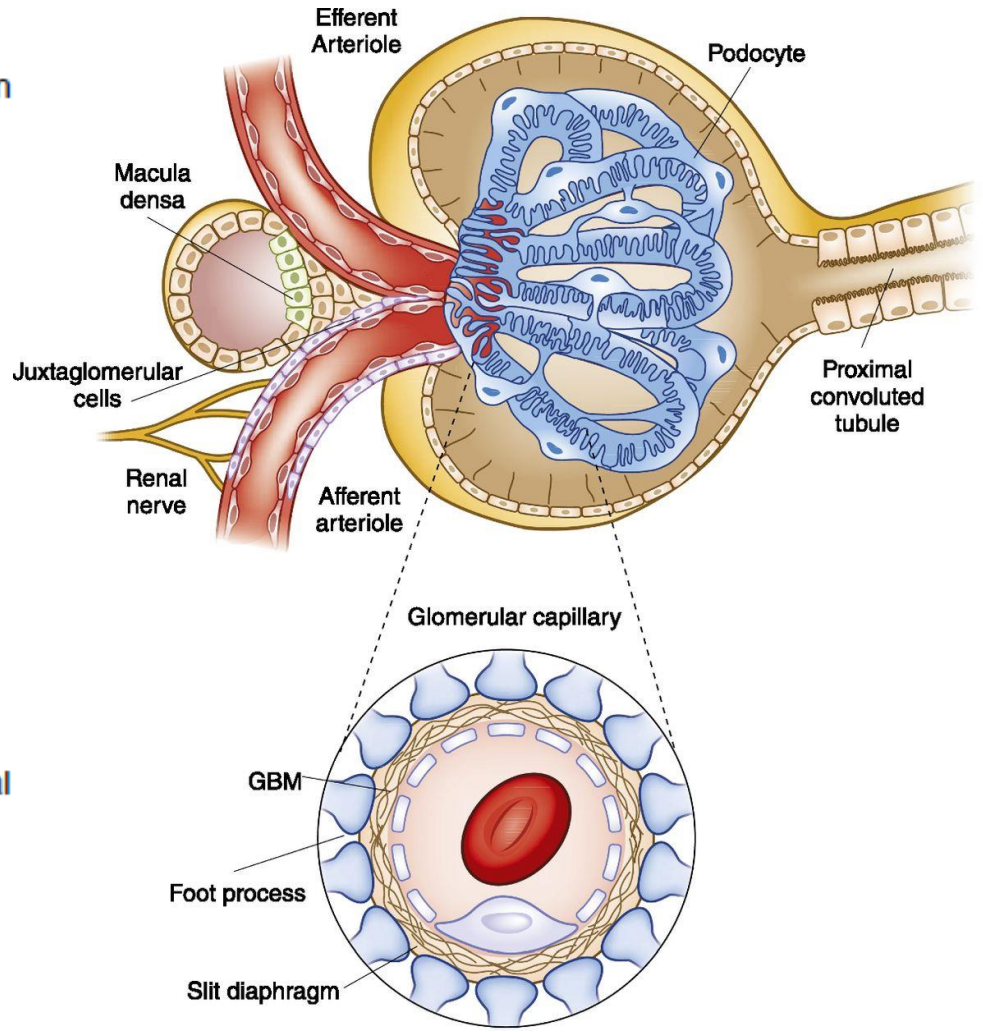
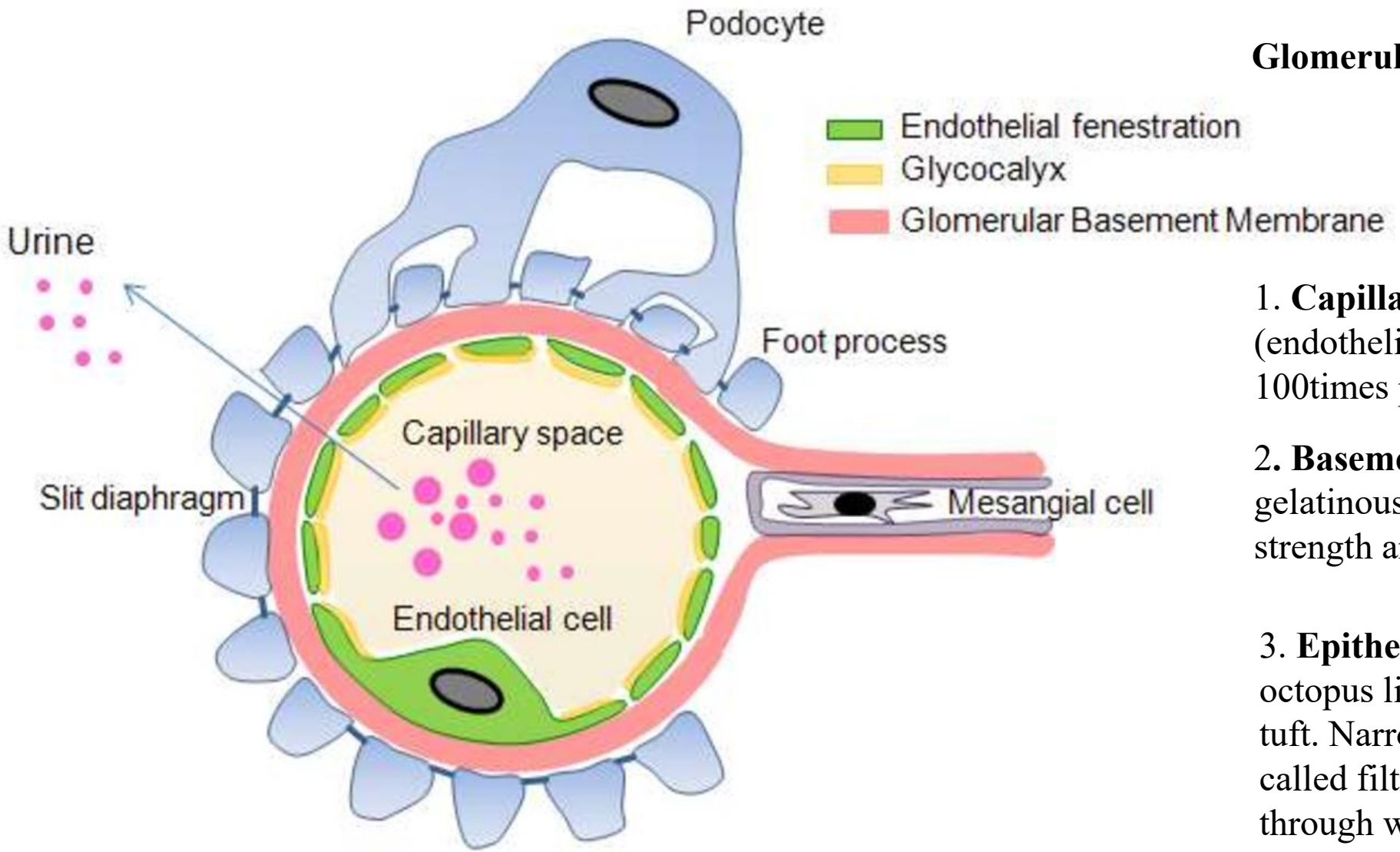


Figure 26–8



Guyton and Hall Physiology



Glomerular membrane has 3 parts. What are those?

1. **Capillary wall** (endothelium), single, porous, 100times permeable

2**. Basement membrane**, a cellular, gelatinous, collagen + glycoprotein for strength and negative charge

3. **Epithelial cells**, podocytes, octopus like cells encircling the tuft. Narrow slits between called filtration slits, pathway through which fluids enter the BC

Guyton and Hall Physiology

What drives GFR
Or Net filtration pressure

- Size →Capillary Bed
- Permeability→ 50X
- Hydrostatic Pressure Gradients
- Osmotic Pressure Gradients

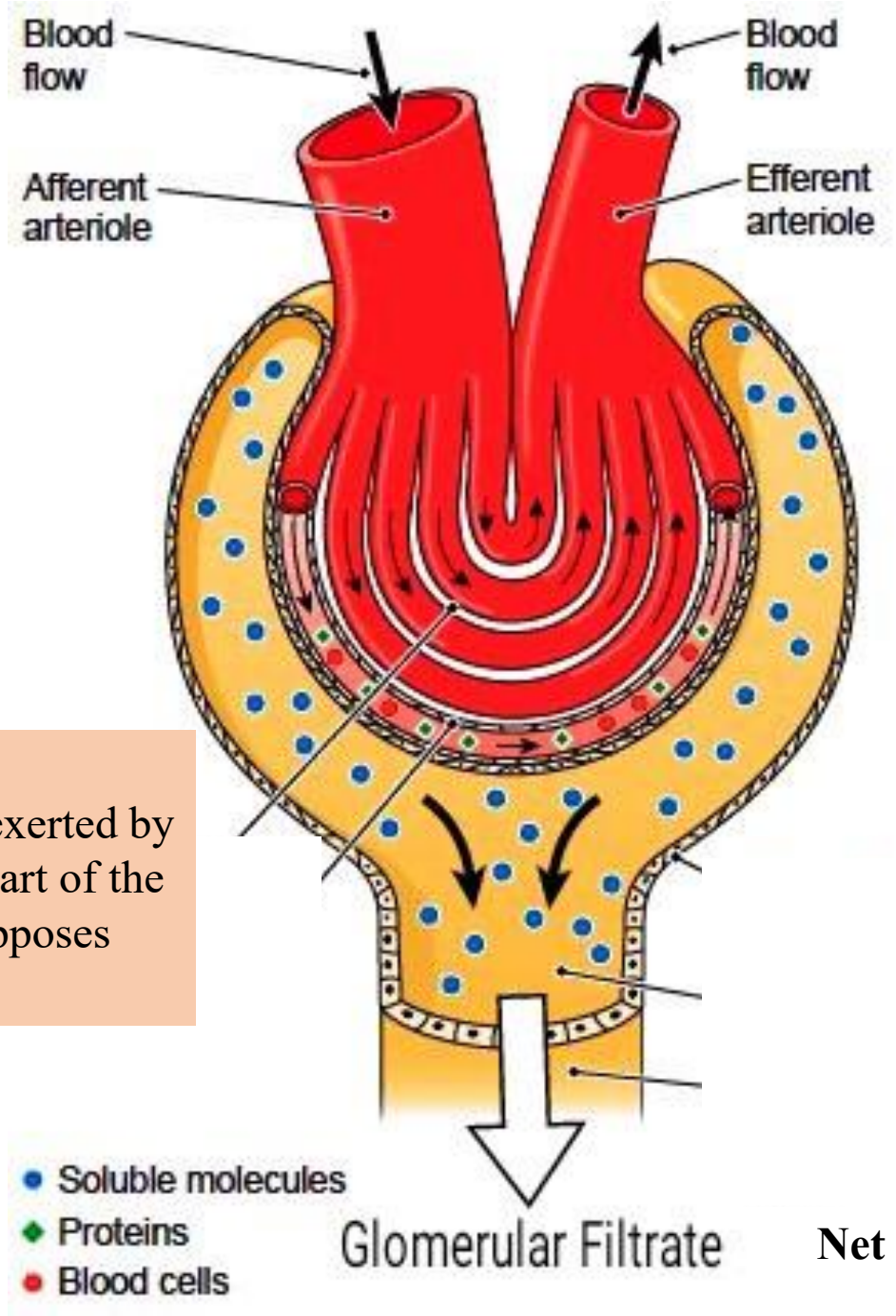
TABLE 38–3 Agents causing contraction or relaxation of mesangial cells.

Contraction	Relaxation
Endothelins	ANP
Angiotensin II	Dopamine
Vasopressin	PGE_2
Norepinephrine	cAMP
Platelet-activating factor	
Platelet-derived growth factor	
Thromboxane A_2	
PGF_2	
Leukotrienes C_4 and D_4	
Histamine	

Ganong Physiology

What drives GFR
Or Net filtration pressure

a) Glomerular capillary pressure→ 55 mmHg = Favors filtration



b) Plasma Colloid Osmotic pressure= unequal distribution of plasma protein = 30 mmHg= Opposes filtration

c) Bowman's Capsule hydrostatic pressure= exerted by the fluid in the initial part of the tubule =15 mm Hg =opposes filtration

d) Capsular Colloid Osmotic pressure= ??? mmHg

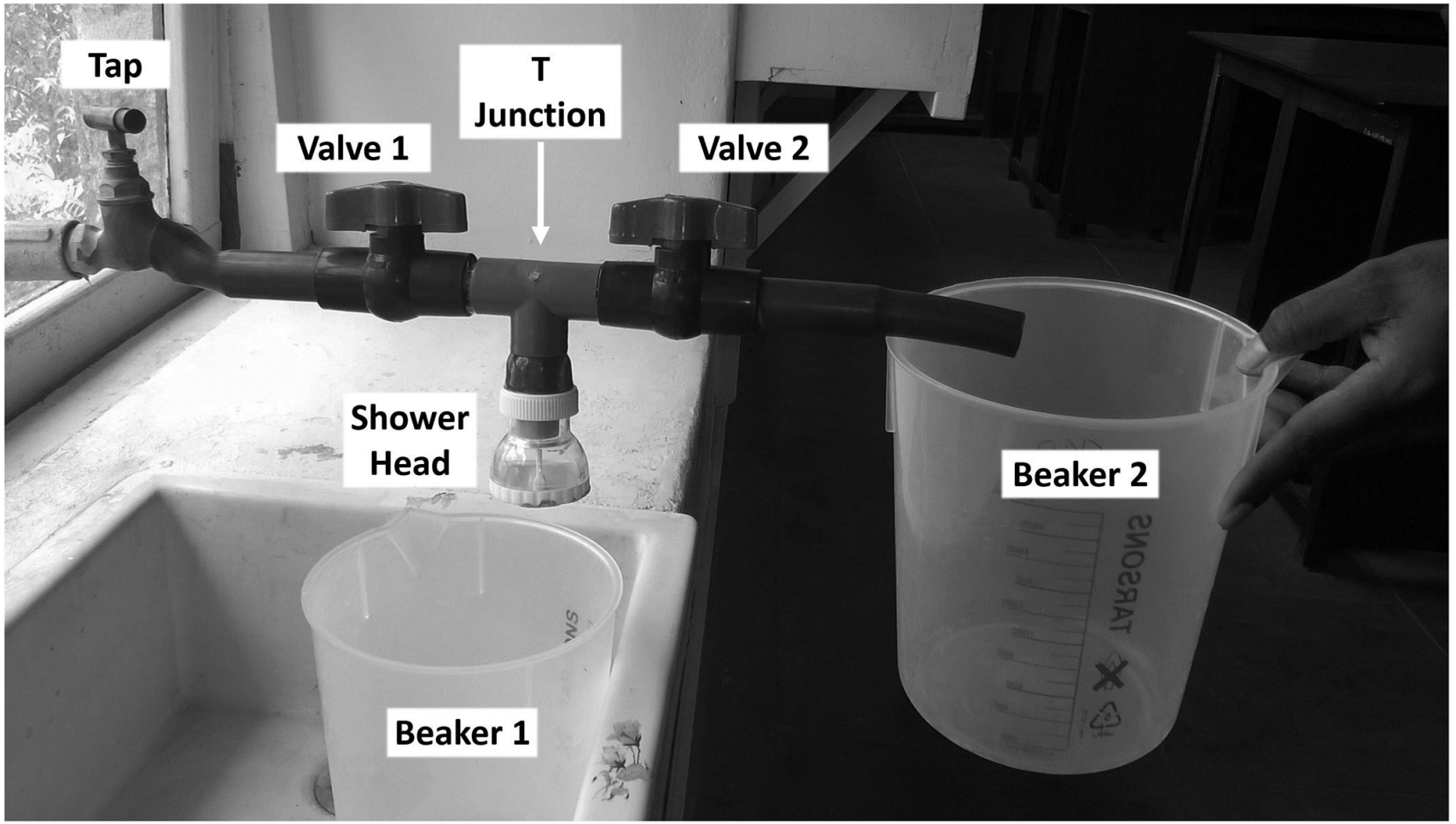
20% filtered

80% leaves through as is

125 ml of filtrate/min =180L/day

Avg plasma in human body = 2.75L
Filtered=65times a day
Dialysis??

Net filtration = 55 – (30+15) = 10 mmHg



1. **Tap Fully open vs Partially open**
2. **Shower Hole 30 Vs 15**
3. **Valve 1 Fully open vs Partially open**
4. **Valve 2 Fully open vs Partially open**

A simple model for demonstrating the factors affecting glomerular filtration rate
https://doi.org/10.1152/advan.00195.2017

Renal handling of four hypothetical substances

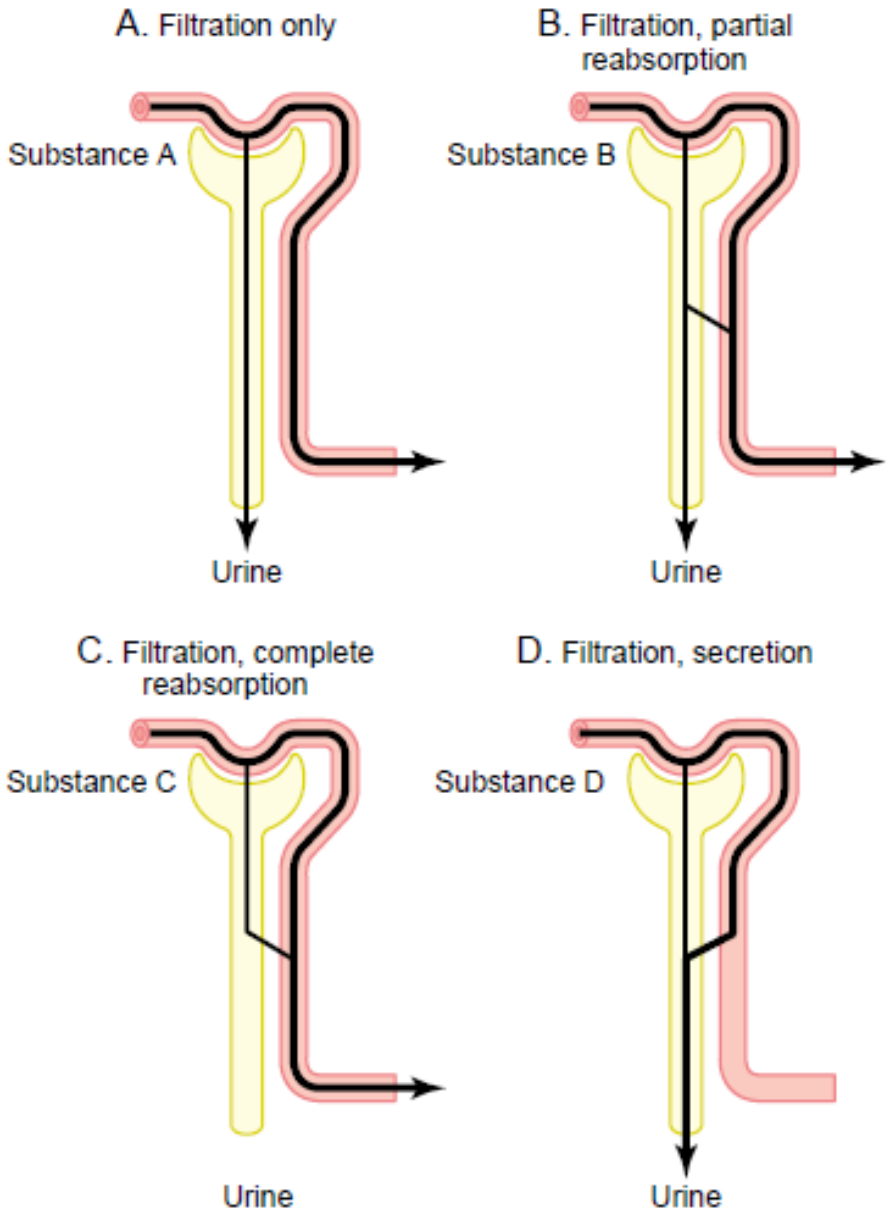


Figure 26–9

Guyton and Hall Physiology

RECAP: What changes the filtration rate:

Physiological factors	
Holey membrane→ leaky under low pressure	Regular GFR
Afferent Arteriole Dilation	High glomerular capillary hydrostatic pressure, High GFR
Afferent Arteriole Constriction	Low glomerular capillary hydrostatic pressure, Low GFR
Efferent Arteriole Dilation	Low glomerular capillary hydrostatic pressure, Low GFR
Efferent Arteriole Constriction	High glomerular capillary hydrostatic pressure, High GFR
Pathological	
Decrease protein concentration (Burns) Increase protein concentration (Dehydration) Increase BC hydrostatic pressure (UT obstruction) Increase thickness of basement membrane (HTN, DM)	High GFR Low GFR Low GFR Low GFR

Auto regulation

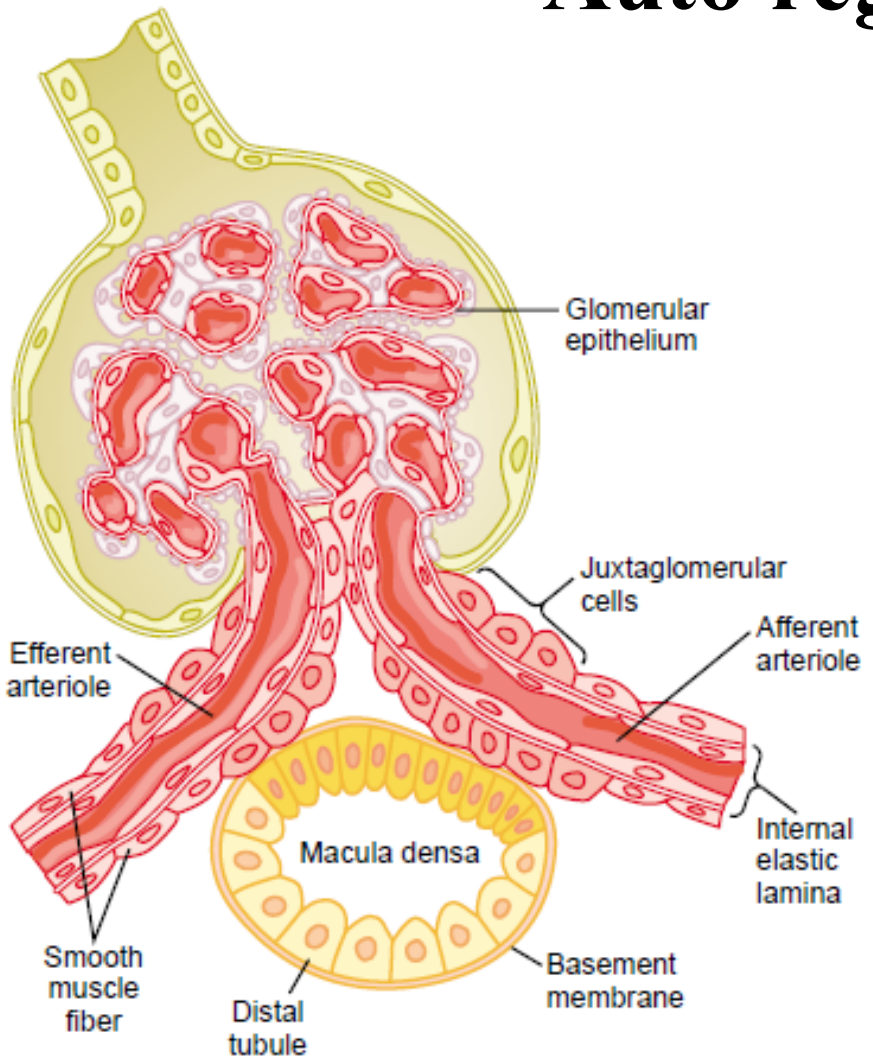


Figure 26–17

Structure of the juxtaglomerular apparatus, demonstrating its possible feedback role in the control of nephron function.

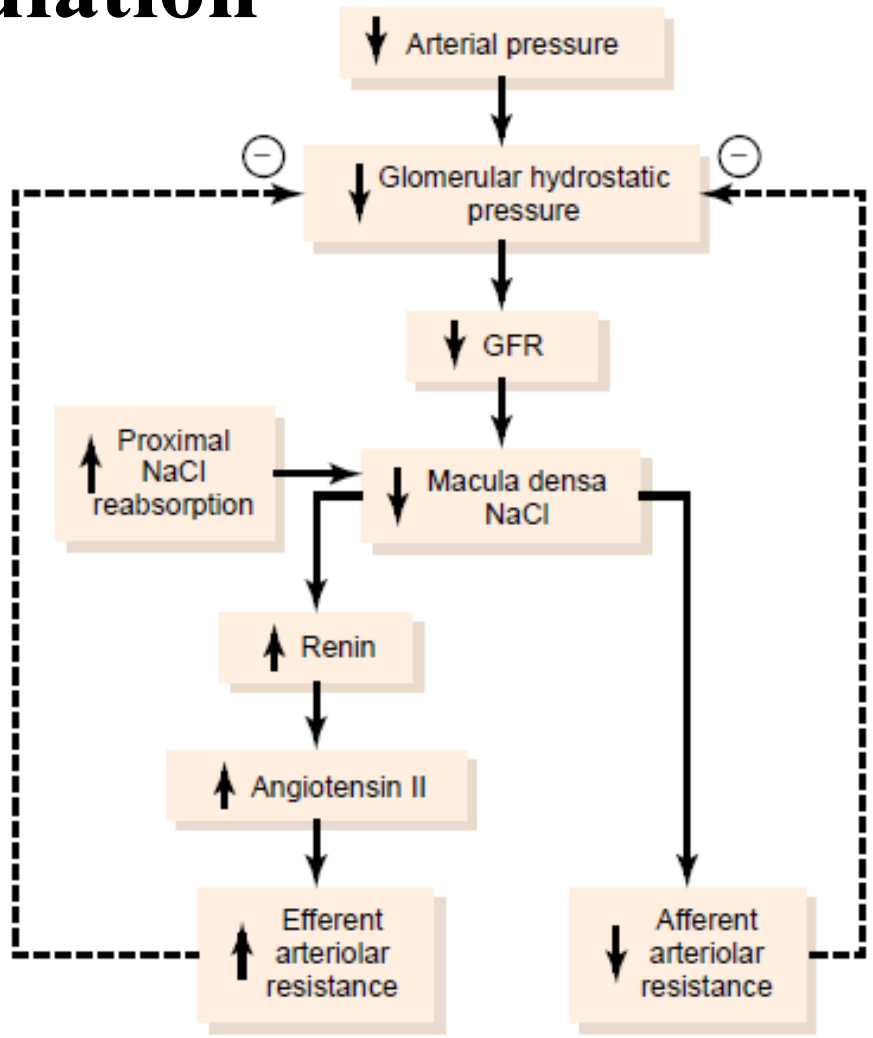


Figure 26–18

Macula densa feedback mechanism for autoregulation of glomerular hydrostatic pressure and glomerular filtration rate (GFR) during decreased renal arterial pressure.

Guyton and Hall Physiology