URO-GENITAL SYSTEM

- ○ Handout
- ○ Sheet
- ● Slide

- ○ Anatomy
- ● Physiology
- ○ Pathology
- ○ Biochemistry
- ○ Microbiology
- ○ Pharmacology
- ○ PBL

Done By:

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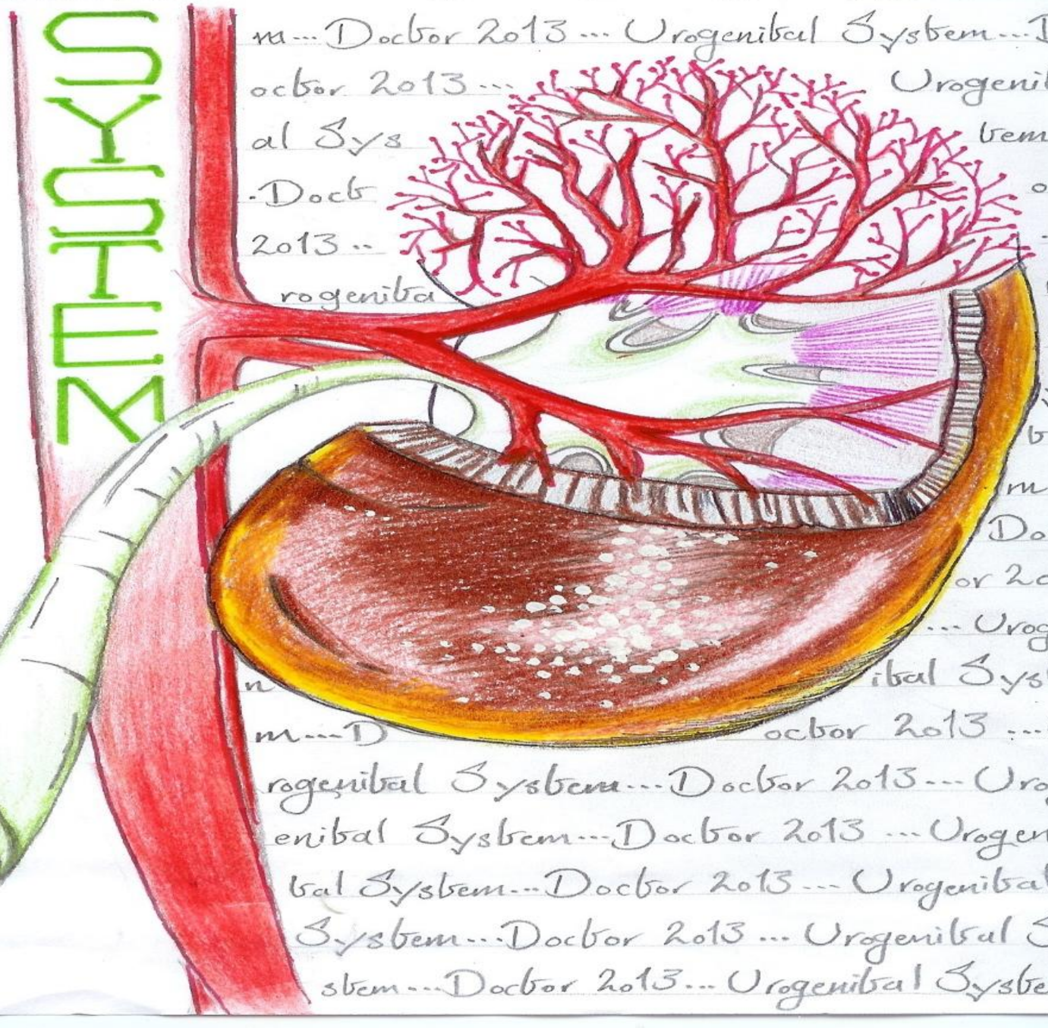


Drawn By Tariq Bushnaq...

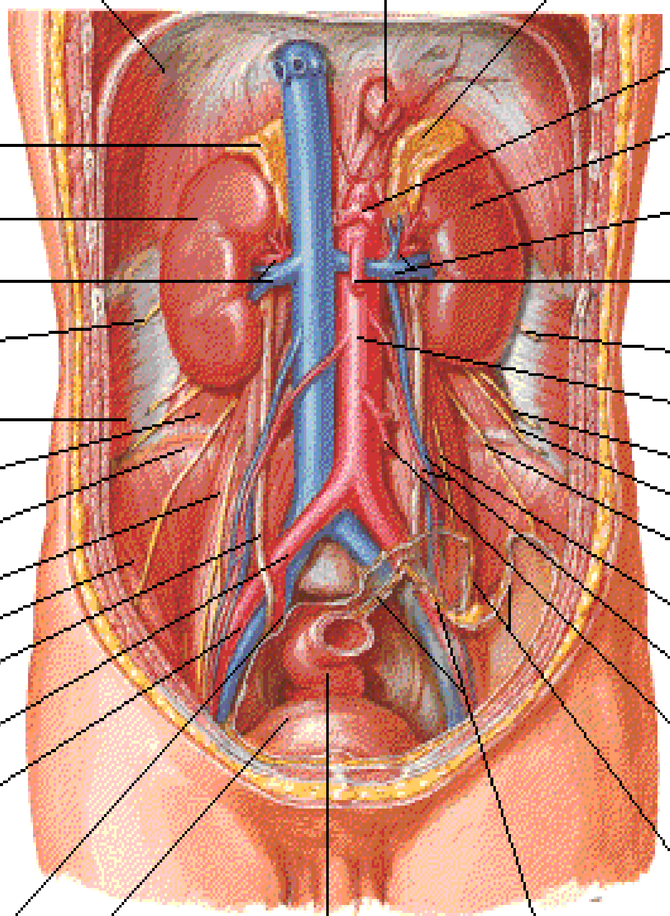
Renal System

Functions of kidney:

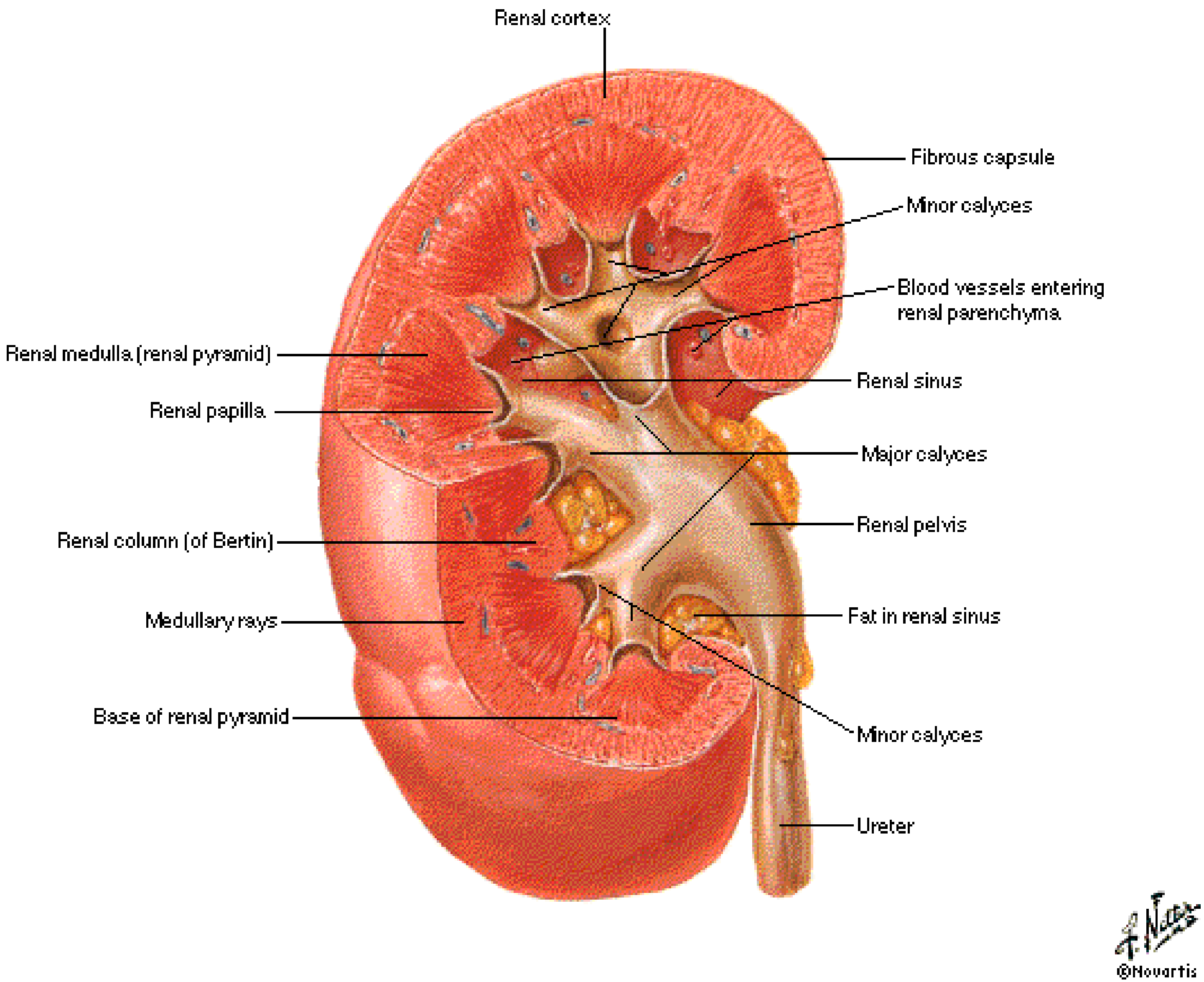
- Remove waste products from the blood
- Control the acid base balance (through HCO_3 - & H^+)
- Secrete Hormones and enzyme like erythropoietin and rennin.
- Activates Vitamin D.
- Make G from non CHO sources (make sugar from proteins at time of starvation (gluconeogenesis).)

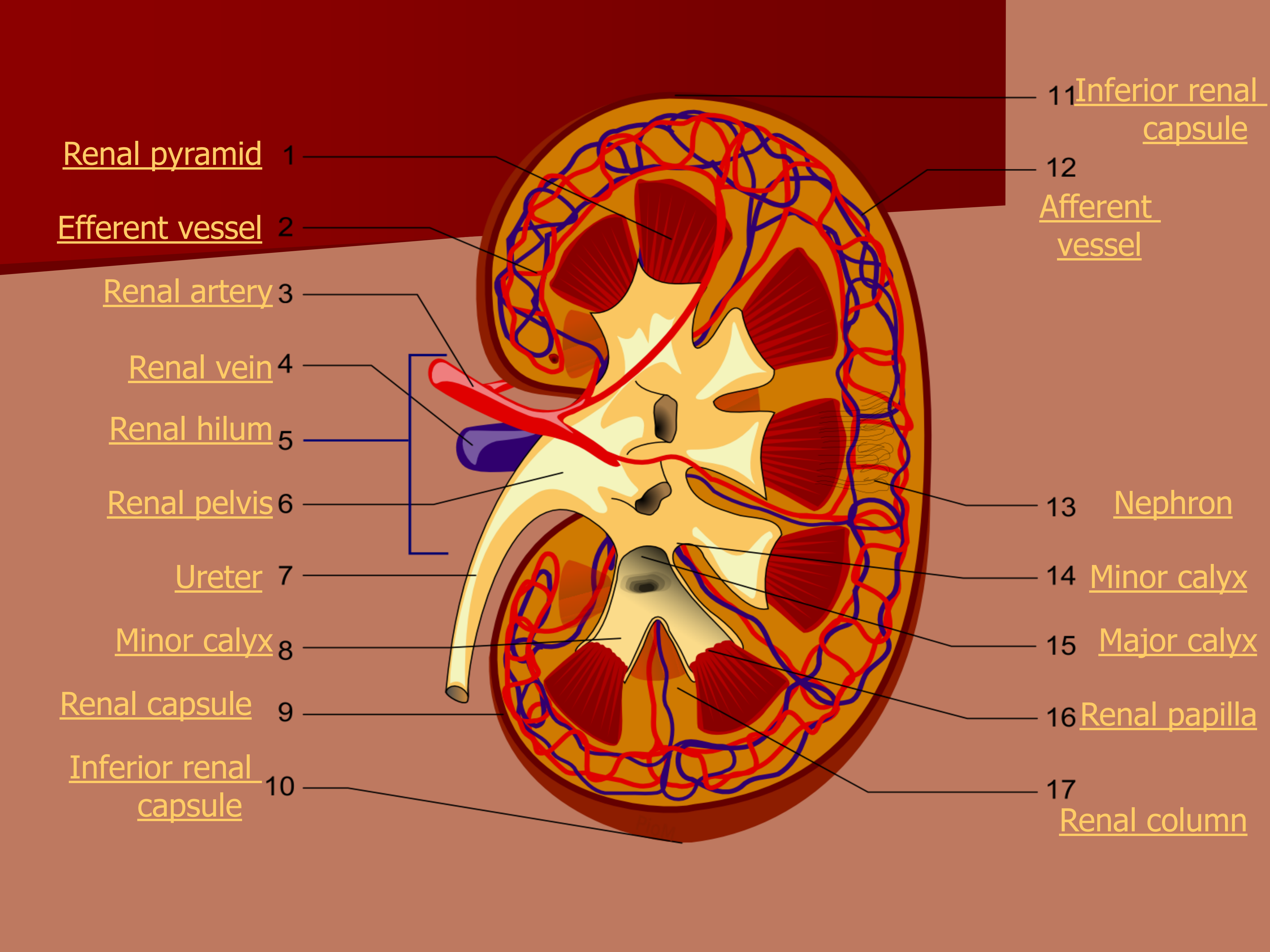
Kidneys in Situ

Anterior View



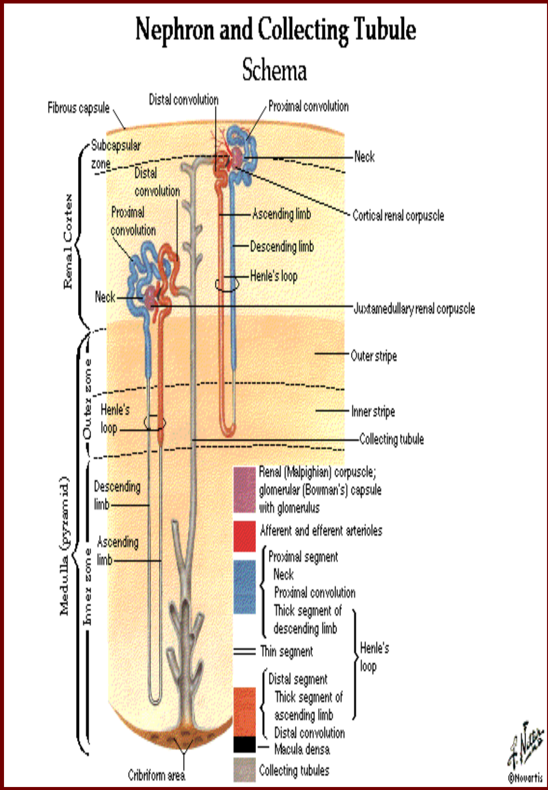
Right Kidney Sectioned in Several Planes





Renal pyramid 1
Efferent vessel 2
Renal artery 3
Renal vein 4
Renal hilum 5
Renal pelvis 6
Ureter 7
Minor calyx 8
Renal capsule 9
Inferior renal capsule 10
11 Inferior renal capsule
12 Afferent vessel
13 Nephron
14 Minor calyx
15 Major calyx
16 Renal papilla
17 Renal column

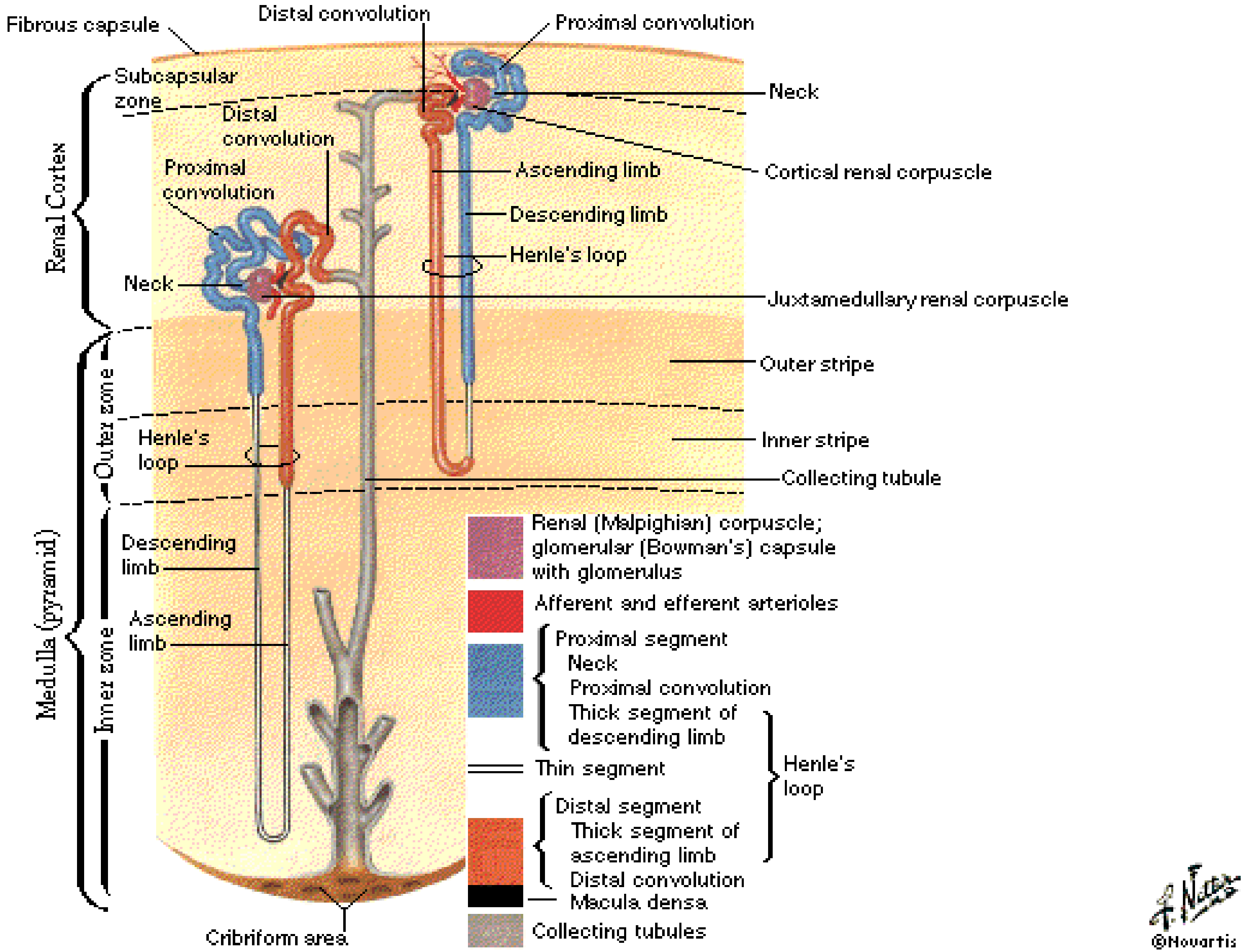
Anatomy of kidneys:



- Cortex : contain glomeruli ----->filtration
- Medulla : contain tubules ----->secretion and reabsorption
- (each tubule is 5-6 cm long)
  - * Cortical atrophy : glomerulonephrits
  - * Medullary atrophy : tubular nephritis
- Cortical nephron have short loop of Henle
- Juxta-medullary nephron Have long loop of Henle and this is important in urine concentration (15-20%).
- In each kidney we have 1 million afferent arteriole & nephron.

Nephron and Collecting Tubule

Schema



Functional Anatomy of the Kidney

- Structure & function of the kidney are closely matched. The kidney is a combination of:

1. Ultrafiltation device (the glomerular apparatus).
2. Epithelium (tubules), which modifies the ultrafiltarte by:
   - addition (secretion) or
   - removal (reabsorption).

- Filtration in kidney is also affected, as systemic capillaries, by Starling forces (Hydrostatic & Osmotic pressure in & out…4 forces).
- Bowman’s capsule stands for the interstitium
- To be discussed with regulation of GFR

RBF

- Kidneys are reconditioning organs i.e. Receive too much blood. RBF= 20-25% of Q →→ This makes the A-V oxygen difference small.
- Nevertheless, kidneys consume twice O_2/per gm tissue as brain.
- This O_2 consumption is directly related to Na^+ reabsorption. If GFR is high → Na+ reabsorption is high→O_2 consumption is high. When GFR is severely depressed (Acute RF) → decrease need for O_2
- If RBF decreases →→**acute** renal Failure

Tissue	Blood flow (ml/g/min)	A-V difference Vol%
Heart	0.8	11
Brain	0.5	6.2
Sk muscles	0.03	6
Liver	0.6	3.4
Kidney	4.2	1.4
Carotid bodies	20	0.5

How to measure Renal Plasma Flow (RPF) :

- RPF : how much plasma enter both kidneys per minute.
- We use a substance X that is completely removed (cleaned) from the blood once it reaches the kidneys: i.e. Renal vein concentration of X = 0
- i.e; once comes to the peritubular capillaries is completely secreted.
- The substance used commonly here is the PAH (para-aminohippuric acid.)

RPF

- 650 ml is the RPF.
- 125 is filtered (GFR).
- How much is the filtration fraction?
- 525 leave through efferent arteriole and go to peritubular capillaries.
- 1 ml/min is the urine output..

Example

- NOTE : this is **not** a routine clinical test.
- So.. if we inject a certain amount of PAH in blood to achieve certain blood concentration.
- If RPF is 650ml/min.
- And urine output is 1 ml/min
- Then, the concentration of PAH will increase 650 times in the urine.
- But actually this is not the case. Because 10 % of renal blood goes to nourish the kidney i.e. don’t participate in the renal function….don't reach the glomeruli
- So 585 ml/min (90%) is the effective RPF and 650 ml/min (100%) is called true or total RPF.
- True = effective / 0.9 .

PHA CURVE for FILTRATION and SECRETION :

- Filtration is passive.
- Secretion is active (saturation).
- Filtered load of "x" : is how much of "x" is being filtered/minute.
- Filtered load is proportional to its plasma conc. (linear)
- Since GFR = 125…………filtration counts for 125/650 = 20 % of excretion of PAH in urine.
- Secretion counts for 80 %.
- Secretion exhibit Tmax; (Transport maximum.)
- The excretion curve is the sum of the above two curves.

PHA CURVE for FILTRATION and SECRETION :