**Kidney Function Assignment: 2 pts each=10 pts**

**Work in groups if you like, although each person hands in separateanswers to the D2L drop box.**

**Easiest way is to print this assignment packet, and hand write your answers/make your drawings then take a picture with your phone and submit the image to the D2L drop box.**

1) **Draw** the path that blood takes moving from renal artery to vena cava with perfusion of cortex and medulla. Indicate where blood in capillaries is filtered and where oxygen is removed from capillaries for use by mitochondria. (10+ items)

2) **Draw t**he path that filtrate/urine takes from a glomerular corpuscle to the urethra . Indicate the osmolarity of the filtrate in the PCT, short or long Loops of Henle, DCT and collecting duct in **presence** OR **absence** of ADH. (10+ items)

3) **Compare and contrast** Glomerular Filtration Rate (GFR), Urine Formation Rate (UFR) and Renal Blood Flow (RBF). Compare and contrast the causes and effects of Diabetes mellitus (type 1) vs Diabetes Insipidus 20-30 words each). What are the two different reasons the urine has a low specific gravity in these diseases? Discuss these hormones with respect to the dehydration each disease can create: ADH, Angiotensin II, and Aldosterone.

4) **Consider the ball-park factors (mmHg) that alter GFR.** Positive net=> you made GFR Negative or 0 = no GFR possible

|  |  |  |  |
| --- | --- | --- | --- |
| Normal GFR and Blood 120mmHg/80mmHg🡪 PulsePressure = 40mmHg MeanArtPress (MAP) = 93.3 mmHg MAP in afferent artery is about 60mmHg | Hypotension: a patient’s blood pressure is very low 90/60 MAP= 70mmHg and MAP in afferent arteriole is only 30 mmHg | Patients Ureter is partly blocked: drainage of capsule is poor so hydrostatic pressure in capsule backs up (45mmHg) | Proteinuria: patient has a urinary track infection so oncotic pressure in capsule is not “0 mmHg” but 10 mmHg due to protein that is located in capsule. |
| *Hydrostatic pressure in capillary= 60mmHg (out of capillary)*Hydrostatic pressure in capsule= 20 mmHg (into capillary)Oncotic pressure in plasma= 28mmHg (into capillary)Oncotic pressure in filtrate=0mmHgWhat is the net pressure? Show Math: 60out-20in-28in+0= +22 out | *Hydrostatic pressure in capillary= 30mmHg* Hydrostatic pressure in capsule= 20mmHg Oncotic pressure in plasma= 28mmHg into capillaryOncotic pressure in filtrate=0mmHgWhat is the net pressure? Show Math: 30out-20in-28in+0= -18 in | Hydrostatic pressure in capillary= 60mmHg*Hydrostatic pressure in capsule= 45mmHg* Oncotic pressure in plasma= 28mmHg Oncotic pressure in filtrate= 0mmHg What is the net pressure? Show Math: 60out-45 in-28in+0= -13 in | Hydrostatic pressure in capillary= 60mmHgHydrostatic pressure in capsule= 20mmHg Oncotic pressure in plasma= 28mmHg *Oncotic pressure in filtrate= 10mmHg (Protein in Filtrate pulls fluid into GFR)*What is the net pressure? Show Math: 60out-28in-20in+10 out=32out |
| Net mmHg In or Out?\_net22out\_\_\_**+ out**, so fluid leaves as GFR\_\_\_\_\_Why would urine formation change?\_\_\_Urine formation changes if the % reabsorption of GFR changes\_\_ | Net mmHg In or Out?\_\_NO GFR\_\_More or less urine? \_NO Urine if no GFR\_\_\_\_\_Why would urine formation change?\_\_\_No GFR to reabsorb\_\_ | Net mmHg In or Out?\_\_NO GFR\_\_More or less urine? \_No Urine if No GFR\_\_\_\_\_ Why would urine formation change?\_No GFR to reabsorb\_\_ | Net mmHg In or Out?\_\_\_net32 out\_More or less urine? More GFR than normal, so “potential” for more urine if reabsorption % not increased\_\_\_\_\_\_Why would urine formation change?\_Urine formation might go up, but if reabsorption doesn’t go up\_\_\_\_ |
| How do does vasodilation/vasoconstriction of the afferent arterioles, and efferent arterioles work to conserve GFR as long as MAP is maintained at between 70-150mmHg? Why it is best to “lose” GFR below a 70 mmHg MAP and have increased GFR above about 150mmHg?  |

**5) How do these factors alter our GFR values? (look in the book, try google or look in the notes)**

a) Age- young, middle aged, old?

b) Sex- male vs female?

c) Race- Black vs white?

d) Why does a low GFR serve as a risk factor for kidney failure?

e) Why might hypertension lead to kidney failure which leads to ever more hypertension and death from heart disease? (*Classic “insipid-evil” Positive Feedback Loop-*)

Estimate GFR based on age, sex and race based on plasma creatinine standardized to the average surface area of a young adult 1.73 meter2 . This is a good online GFR calculator ***http://nephron.org/mdrd\_gfr\_si***  Use the MDRD GFR estimate to assess the renal health of these patients (who all have **plasma creatinine concentration of 1.2 mg/dL** and assume that a **GFR of less than 60 ml/min-1.73 m2** means kidney disease and increased cardiovascular disease risk for renal status assessment. ***Rank best to worst and why.***

|  |
| --- |
| Why Study the Kidney? These are the faces of the real people who may need kidney consultation from you someday.Tyga (Rapper) Dr Wilson(not-so-famous) Chris Rock(comedian) Demi Moore(actress) Barbara Bush (Ex 1st lady) |
|  |  |  |  |  |
| 26 yrs, black, male | 53 yrs, white, male | 53 yrs, black, male | 53 yrs white female | 92 yrs white female |
| GFR \_\_\_\_\_\_ml/min-1.73 m2 | GFR \_\_\_\_\_\_ml/min-1.73 m2 | GFR \_\_\_\_\_ml/min-1.73 m2 | GFR \_\_\_\_\_\_\_ ml/min-1.73 m2 | GFR \_\_\_\_\_\_\_ ml/min-1.73 m2 |
| Renal Status? **Why?** | Renal Status? **Why?** | Renal Status? **Why** | Renal Status? **Why?** | Renal Status? **Why?** |
| ***V.I.P. How can a 1.2 mg/dL plasma creatinine be associated with so MANY different GFR values and health outcomes?*** |