Renal Calculations Homework Key
BI-374, Spring '06, Dr. C. S. Tritt
Due: 5/1

1.   What is a patient's GFR if her inulin clearance 120 ml/min?

GFR = 120 ml/min (the inulin clearance is a direct measure of GFR).

2.   What is a patient's RBF if his clearance of PAH is 325 ml/min and Hct is 0.44?

RPF = 325 ml/min/(0.90) = 361 ml/min (0.90 is the assume extraction ratio for PAH).

RBF = RPF/(1 – Hct) = 361 ml/min / 0.56 = 645 ml/min (325/56 = 580 ml/min also accepted).

3.   The concentration of an experimental drug in a patient's plasma is 1.2 µg/dl. Its concentration in his urine is 3.0 mg/l. His urine flow rate is 0.80 ml/min and his GFR is 120 ml/min. Calculate his renal clearance of the drug and comment on how this drug is treated by in the patient's renal tubules (i.e. is it secreted, reabsorbed or neither?).

By material balance, the clearance of substance S is defined as $C_s = U_s V/P_s$, so

C = ((3.0 mg/l)(0.80 ml/min)/(1.2 µg/dl))(1000 µg/mg)(0.1 l/dl) = 200 ml/min

Since C > GFR we conclude the drug is secreted in the renal tubules.

4.   Assuming that acetoacetate is freely filtered (i.e., the acetoacetate concentration in the filtate is the same as the acetoacetate concentration in the plasma), determine the subject's transport maximum for acetoacetate from the following data:

Acetoacetate Concentrations

Flows [ml/min]		Concentrations [mg/dl]	
GFR	Urine	Plasma	Urine
123	0.97	15.7	0
130	0.97	19.4	0
125	1.04	25.6	10
131	1.04	29.6	680
118	0.99	35.8	1020
122	1.00	41.0	1730
126	0.99	46.2	2600

Calculate the filtered loads (GFR's)(Plasma Concentrations) and excretion rates (Urine Flows)(Urine Concentrations) and plot them. Put a line through the non-zero excretion and extrapolate it to zero to find the transport maximum. See the plot below.
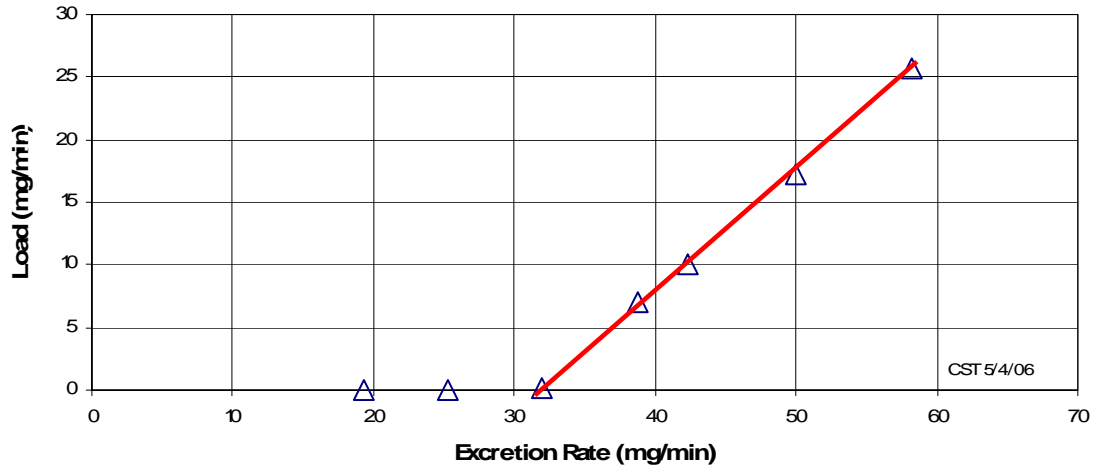
So the transport maximum is about 32 mg/min.