Three Models for Extraction

- naive engineer = K is defined by portal vein conc
- parallel tube = Km is defined by geometric mean of intra-hepatic concs
- well stirred = Km is defined by hepatic vein conc

Naive Engineer

- $CL_I = Vmax / (Km + C_{pv}) + CLFO$

Parallel Tube

- $C^* = (C_{pv} + C_{hv}) / \ln(C_{pv} / C_{hv})$
- $C_{hv} = C_{pv} * (1 - CL_I / (Q + CL_I))$
- $CL_I = Vmax / (Km + C^*) + CLFO$

Well Stirred

- $Chv = C_{pv}(t) * Q / (Q + CL_I)$
- $CL_I = Vmax / (Km + Chv) + CLFO$
- $CL_I \text{^} 2 * km + CL_I * (Q * (C_{pv}(t) + Km) - Vmax - CLFO * Km) - (CLFO * (C_{pv}(t) + Km) + Vmax) * Q = 0$

Rate Dependent Extraction

- $C_{pv}(t) = Cp(t) + Rate(t)/Q$
- solve for CL_I
- e.g. Well Stirred Model
- $ER(t) = CL_I(t) / (Q + CL_I(t))$
- $CLMO = ER * Q$
- $dCp/dt = (Rate(t) - (CLMO + CLFO) * Cp(t)) / V$