Case Study 1

Fall 2014

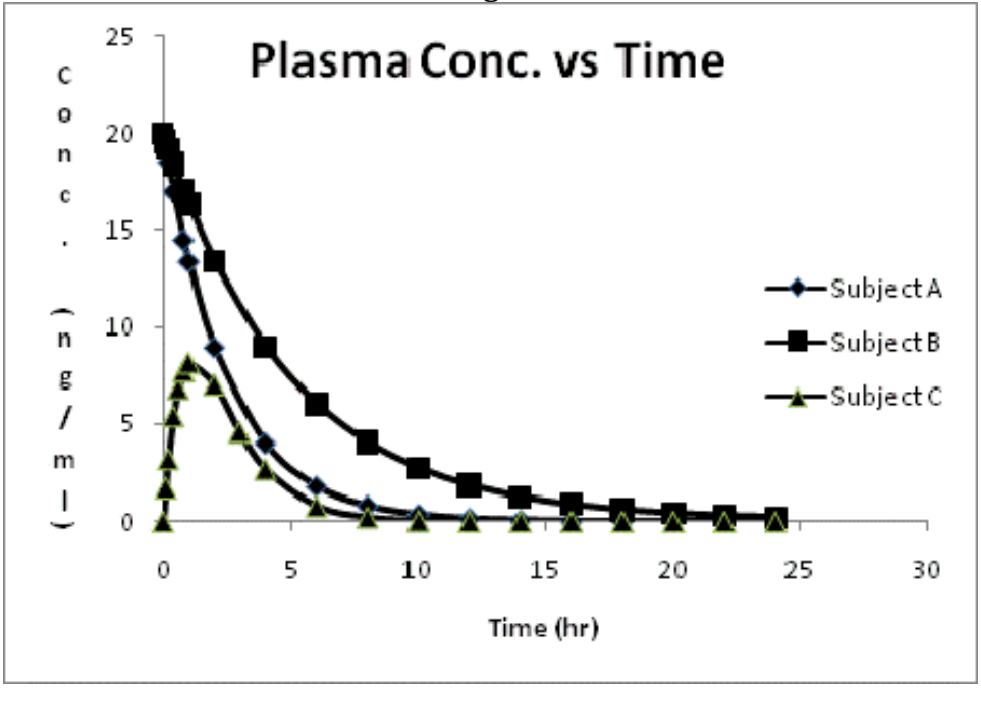
1. Define pharmacokinetics (PK) and pharmacodynamics (PD). Discuss how you would label the axes of each graph that shows the PK, PD, and PK/PD profiles.

2. Fig 1 shows the plasma concentration time profiles of three subjects (A, B and C) after the administration of the same mg dose of a drug X.

    a. From the profiles, what is a possible route of administration for each subject? Write a short answer in terms of LADME.

    b. Between subjects A and B, when is drug X eliminated faster?

Fig 1



3. Table 1 shows the serum concentration profiles of a certain drug in patient X.

    a. Determine if the elimination process is a first order or a zero order process. Plot the data on a semilog paper.

    b. Calculate k_e, the first order elimination rate constant.

Table 1

Time (hr)	Conc (ng/mL)
0	20
1	16.37
1.5	14.82
2	13.41
4	8.99
6	6.02
8	4.04
10	2.71
12	1.81

4. Answer the following about therapeutic drug monitoring.
    a. (T/F) Therapeutic Drug Monitoring (TDM) in individual patients is important for drugs with a narrow therapeutic index.
    b. Discuss what defines a therapeutic index or window. What makes for a wide or narrow therapeutic index?

5. Answer the following about elimination processes/kinetics.
    a. (T/F) When the change in amount of the drug in the body is independent of the amount at any given time (shown by the following equation $dX/dt=-k*X^0$, where X is the amount of the drug at a given time t), then we say that elimination is a zero order process.
    b. Discuss the value of half life as it relates to zero and first order processes.

6. (T/F) The plasma concentration time profile of a certain drug is dependent on the dosage form.

ANSWERS

1. Pharmacokinetics: The time course of the drug and metabolite concentrations in the body.

   Pharmacodynamics: The pharmacological effect for varying concentrations in the body.

Graph of	*Axis Label*	
	X	*Y*
PK profile	Time	Conc
PD profile	Conc	Effect
PK/PD profile	Time	Effect

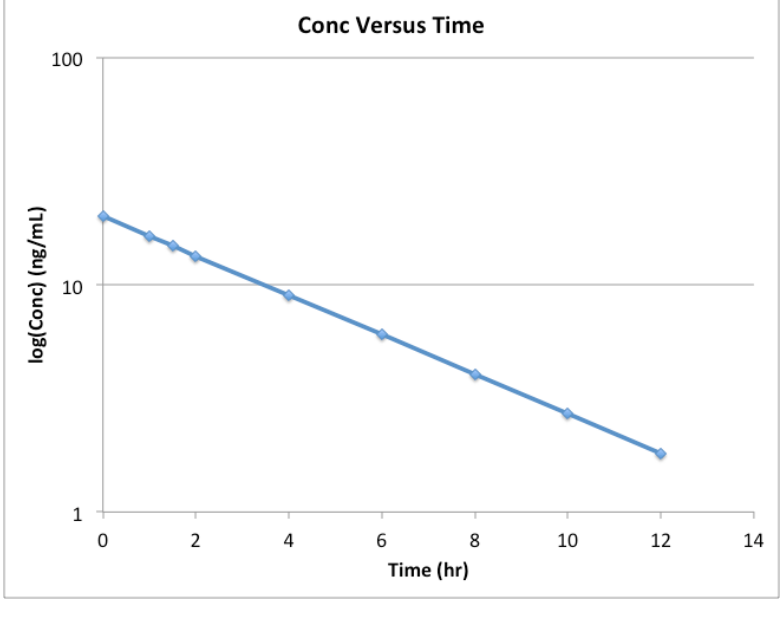
2.

   a. Subject A and B received the drug by an IV bolus (no Liberation and Absorption step). Subject C received a dosage form where the drug had to be liberated from the dosage form and absorbed into the blood (Liberation and the Absorption step involved).

   b. In subject A the drug is eliminated faster. The plasma concentration fall faster in subject A when compared to subject B.

3.

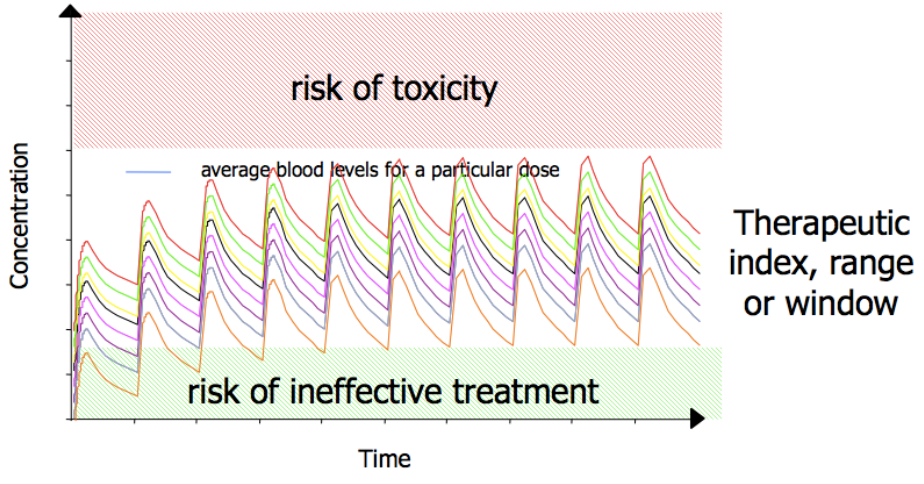
   a. First order process



   b. The equation is ln(Conc) = 2.995 - 0.2*t. Therefore the value of k_e = 0.2 hr^{-1}

4.

a. True
b. The thresholds for effective treatment and toxicity are the bounds of a therapeutic range. If the thresholds for effective treatment and toxicity are close together, a drug would be considered to have a narrow therapeutic window.



5.

a. True
b. The value of half life in a zero order elimination process is dependent on the concentration at a given time, while half life is independent of concentration in a first order elimination process.