In Class Exercises (ICE) - 2/14/01

Not all drugs obey the linear pharmacokinetic law. With some drugs (like alcohol when taken in large doses) the metabolic pathways that remove the drug from the body can only work at a certain fixed rate. This situation is sometimes called the "zero-order law of pharmokinetics."[1]

- ***Express the zero-order law as a differential equation. What kind of function would you expect to satisfy this differential equation?***

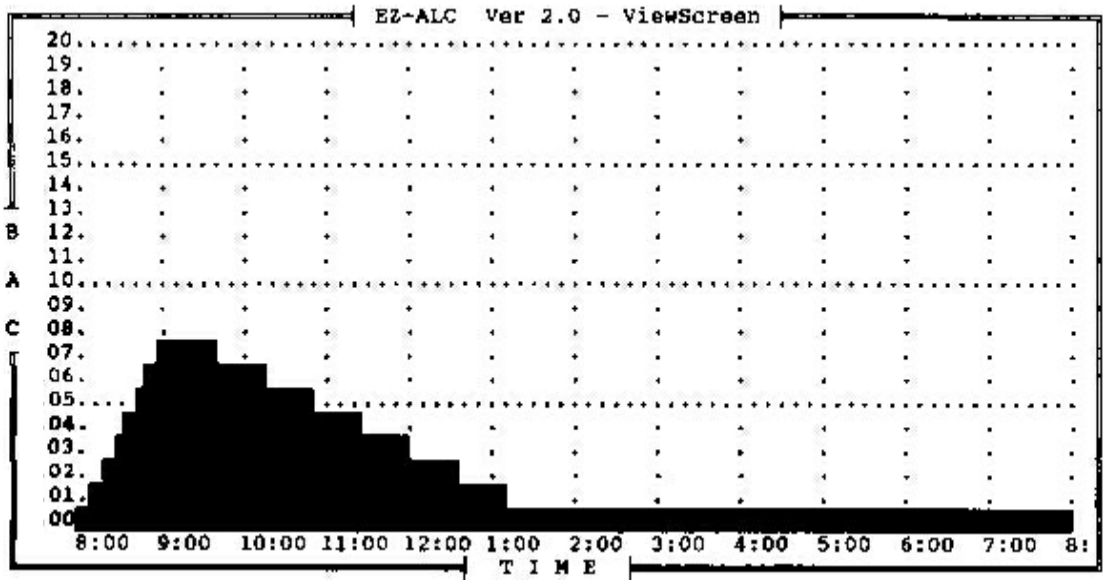

Figure 1: Output from a digital Blood Alcohol Concentration meter. (BAC is measured in mg/100ml and time is in hours.)

- ***Figure 1 shows the blood alcohol concentration (BAC) of a man as a function of time. This data was obtained using the same blood test that hospitals normally use to establish BAC in the case of an alcohol-related traffic accident. Is the appearance of the graph in Figure 1 consistent with the zero-order law? Explain why or why not.***

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[1] See `http://www.chanel1.com/users/medlaw/etoh/etoh.htm` for a discussion of the pharmacokinetics of ethanol in the body.

The rate at which an individual can remove alcohol from his or her system is (to a good approximation - especially when you're talking about an individual who has consumed large amounts of alcohol) determined by the persons genetic make-up. For males, this rate varies between 1 and 25 mg/100ml per hour, with 17 mg/100ml per hour being about average.

- ***A reckless individual walks out of a bar at midnight and drives away in his car. At 1am, the individual is involved in a traffic accident, and at 2am, his BAC is measured to be 3 mg/100ml. What range of BAC could this individual have had when the accident occured at 1am?***

- ***Most states have a set BAC level for intoxication. If you are apprehended with a high BAC in most states, you are automatically charged with DUI. Massachusetts is unique in that it does not have a set BAC for its DUI law[2]. Instead, if you are caught with a BAC in Massachsetts of greater than 8 mg/100ml, then the law enforcement officer may infer intoxication if other signs (e.g. your behavior or driving) suggest that this might be the case. Would it be reasonable to infer that the individual involved in the accident was intoxicated at the time when the accident occured?***

[2] Massachusetts General Law, Chapters 24 and 90.