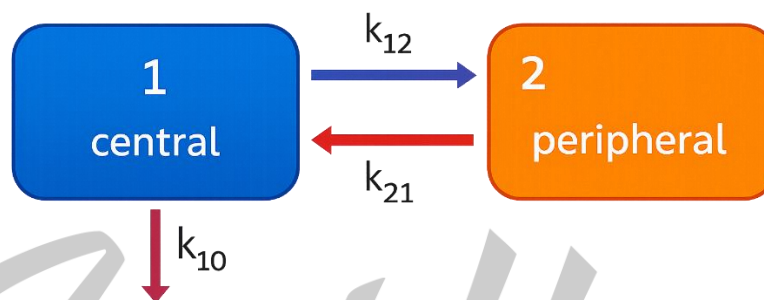


Multicompartment models

Two Compartment Open Model

Introduction to Multicompartment Models

- In pharmacokinetics, the body is often simplified into "compartments" to model how a drug is distributed and eliminated.
- A two-compartment open model assumes the body consists of two interconnected areas:
 - Central compartment:** Represents the blood/plasma and organs with high blood flow (e.g., liver, kidney).
 - Peripheral compartment:** Represents tissues/organs with lower blood flow (e.g., muscle, fat).



- “Open” means that drug can be eliminated from the system (unlike closed models where there's no elimination).

Key Components and Parameters

- Drug Administration:** Usually via IV bolus or IV infusion.
- Distribution phase (α -phase):** Initially, the drug rapidly distributes from the central to the peripheral compartment.
- Elimination phase (β -phase):** The drug is eliminated primarily from the central compartment over time.
- Rate constants:**
 - k_{12} : rate constant for drug moving from central to peripheral compartment.
 - k_{21} : rate constant for drug returning from peripheral to central.
 - k_{10} : elimination rate constant from central compartment.

Mathematical Expression

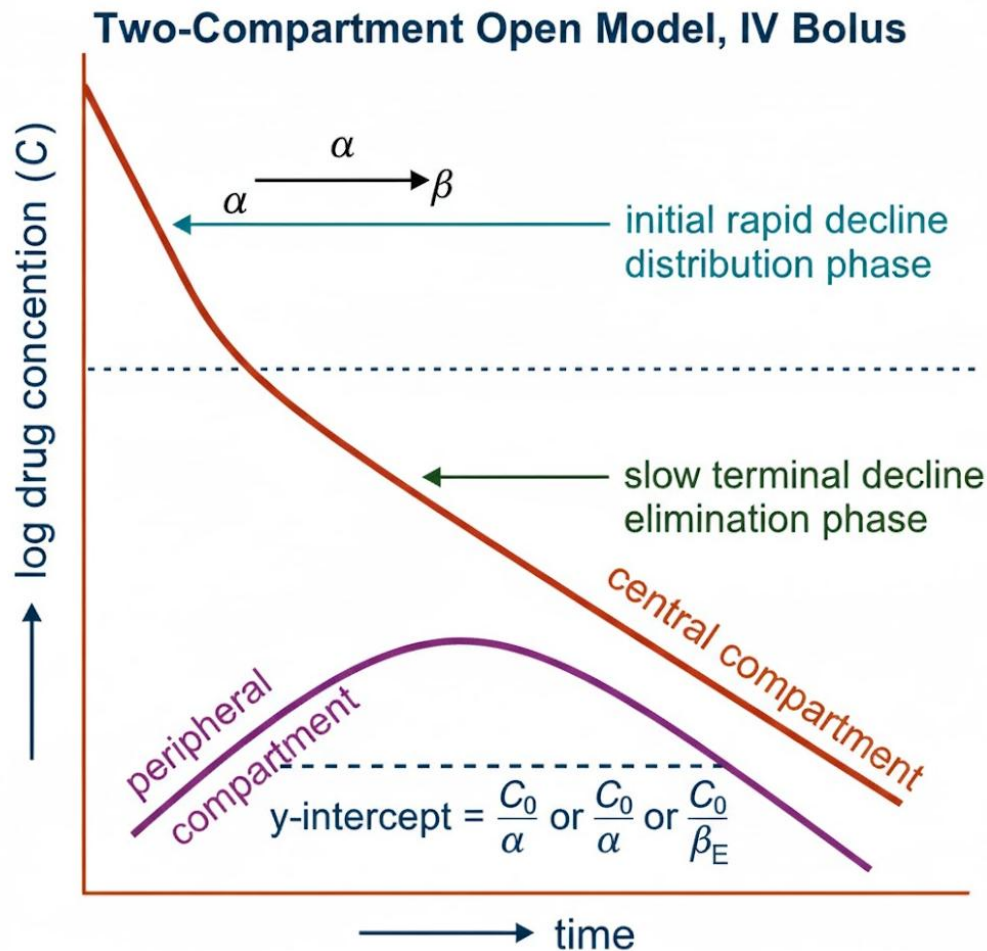
- After an IV bolus injection, the plasma concentration–time curve is biexponential and described as:

$$C(t) = Ae^{-\alpha t} + Be^{-\beta t}$$

- Where:

- A, B : intercepts (hybrid coefficients).
- α : distribution rate constant.
- β : elimination rate constant (slower phase).
- $C(t)$: plasma concentration at time t .

Graphical Interpretation



- The graph shows how drug concentration in plasma changes over time after an IV bolus in a two-compartment model.
- It has two phases:
 - **Distribution Phase (initial steep drop):** Drug moves rapidly from the central to the peripheral compartment.
 - **Elimination Phase (slower decline):** Drug is gradually eliminated from the central compartment.
- The curve is biexponential, meaning it has two distinct slopes, reflecting both distribution and elimination processes.

Clinical Significance

- Understanding distribution kinetics helps in predicting onset of action.
- Dose calculation becomes more accurate, especially in drugs with wide tissue distribution.



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