Bioavailability

Absolute bioavailability

$$F = \frac{AUC_{oral}}{AUC_{IV}} \times \frac{Dose_{IV}}{Dose_{oral}}$$

If doses are the same, $F = \frac{\mathrm{AUC_{oral}}}{\mathrm{AUC_{IV}}}$

Example calculation

- Oral dose: 100 mg → AUC = 400
- IV dose: 100 mg → AUC = 800

$$F = \frac{400}{800} = 0.5 = 50\%$$

Only half the drug reached systemic circulation.

Relationship between oral dose and bioavailability

$$Amount\ reaching\ blood = Oral\ dose \times F$$

Example:

- Oral dose = 100 mg
- Bioavailability (F) = 0.4

$100 \times 0.4 = 40$ mg

Only **40 mg** effectively reaches circulation.

Adjusting oral dose using bioavailability (VERY IMPORTANT)

To achieve the same effect as an IV dose:

$$Oral\ dose = \frac{\mathrm{IV\ dose}}{F}$$

Example:

- Required IV dose = 20 mg
- Oral bioavailability = 0.5

$Oral\ dose = \frac{20}{0.5} = 40$ mg

Oral dose must be **higher** to compensate for losses.

Relative bioavailability

Used to compare **two non-IV forms**

Example:

- Tablet AUC = 600
- Capsule AUC = 500

$$F_{rel} = \frac{600}{500} = 1.2$$

Tablet has **20% higher bioavailability**.

Why bioavailability is crucial in medicine

Time (h)	Concentration (mg/L)
0	0
2	20
4	15
6	10
8	5

Step 1: Interval 0–2 h

$$AUC_{0-2} = \frac{0+20}{2} \times (2-0) = 10 \times 2 = 20$$

Step 2: Interval 2–4 h

$$AUC_{2-4} = \frac{20+15}{2} \times (4-2) = 17.5 \times 2 = 35$$

Step 3: Interval 4–6 h

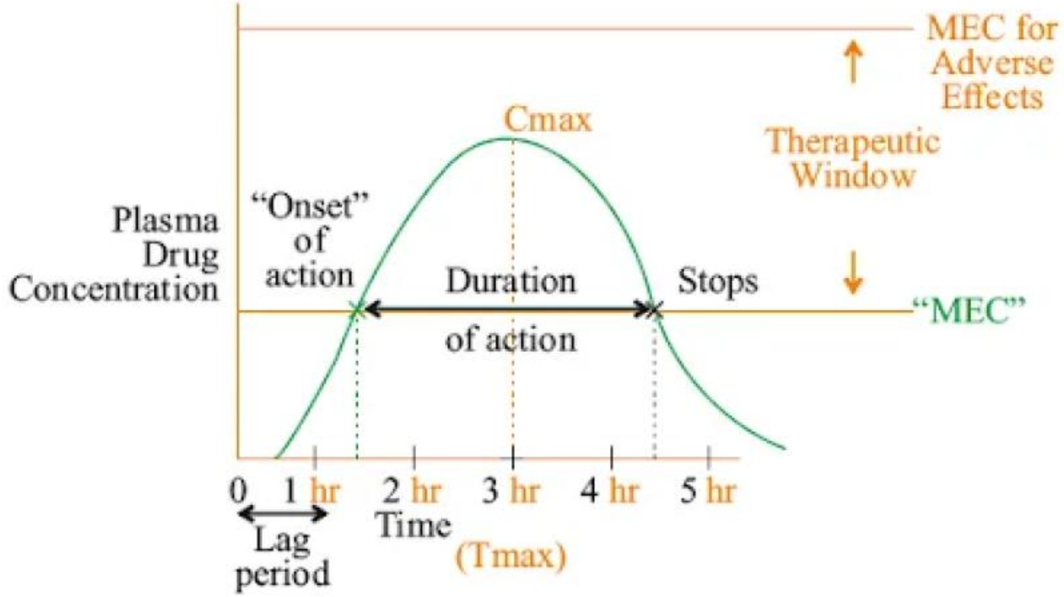
$$AUC_{4-6} = \frac{15+10}{2} \times 2 = 12.5 \times 2 = 25$$

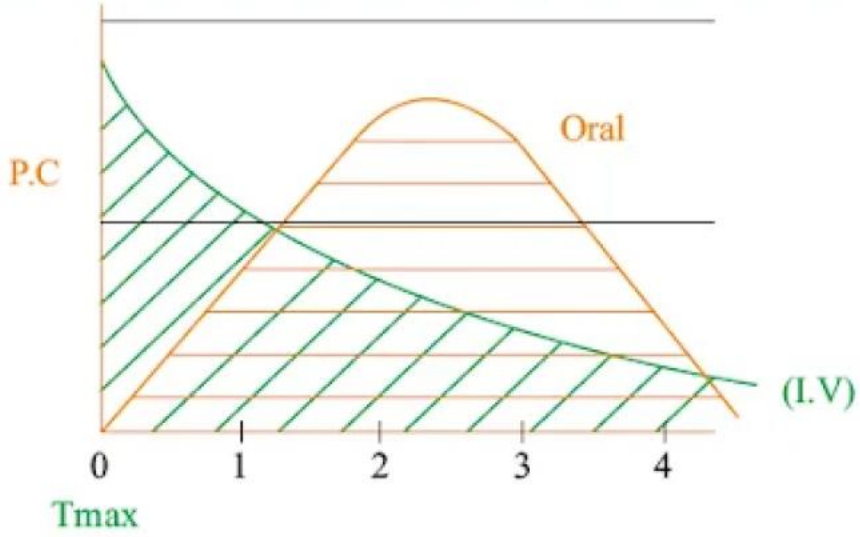
Step 4: Interval 6–8 h

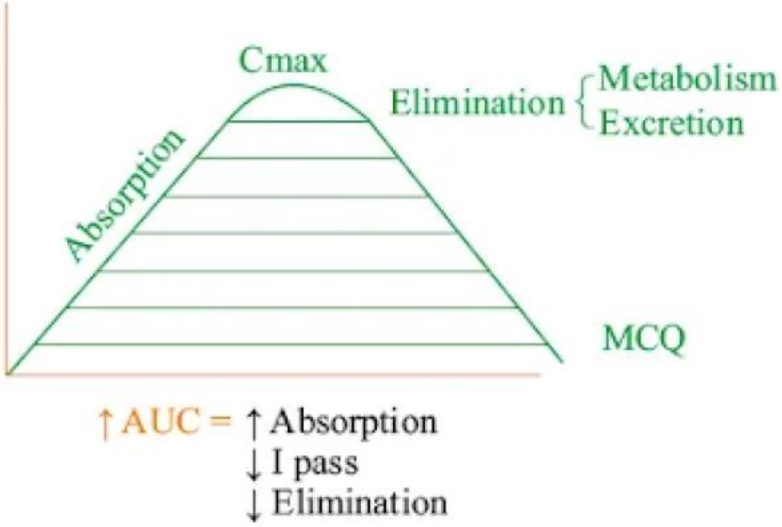
$$AUC_{6-8} = \frac{10+5}{2} \times 2 = 7.5 \times 2 = 15$$

Step 5: Total AUC

$$\text{AUC}_{0-8} = 20 + 35 + 25 + 15 = 95 \text{ mg\cdotph/L}$$







Bioequivalence