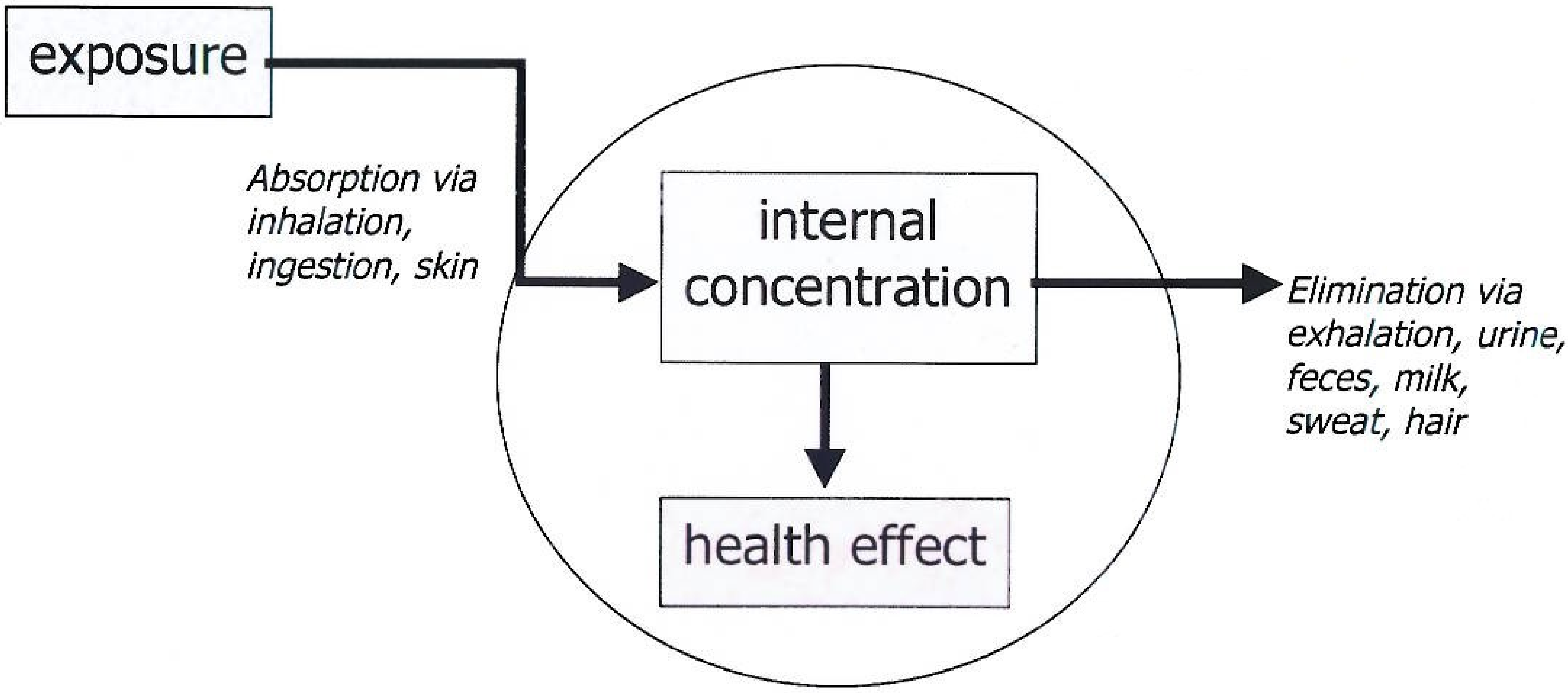
TOXICOKINETICS



The concentration of a chemical in the body during exposure depends on the rate of absorption, the rate of elimination, the volume over which the chemical is distributed in the body, and the duration of exposure.

The following relationship expresses the chemical concentration in the body at time, t, assuming there is no initial body burden of the chemical.

$$C_t = \frac{k_a\,(1 - e^{-(k_e\,t)})}{k_e\,V}$$

where:
- C_t = concentration in body at time t (in mg/L)
- k_a = absorption rate (in mg/minute)
- k_e = elimination rate constant (in minutes^{-1})
- t = time since contaminant absorption began (in minutes)
- V = volume of distribution in body (in litres)

When t becomes long, the concentration in the body reaches steady state:

$$C_{ss} = \frac{k_a}{k_e V}$$

where: C_{ss} = steady state concentration in body (in mg/L)

The concentration of a chemical in the body after exposure stops depends on the rate of elimination and the time since exposure stopped, following this relationship:

$$C_2 = C_1 \left[e^{-(k_e t)}\right]$$

where: C_1 = initial concentration in body when exposure ends (in mg/L)

t = time since contaminant absorption stopped (in minutes)

Note that the biological half-life ($T_{½}$) can be derived from the above relationship, as follows:

$$C_2 = ½ C_1 = C_1 \left[e^{-(k_e T_{½})}\right]$$

$$½ = e^{-(k_e T_{½})}$$

$$\ln ½ = -k_e T_{½}$$

$$\frac{-0.693}{-k_e} = T_{½}$$

$$T_{½} = \frac{0.693}{k_e}$$