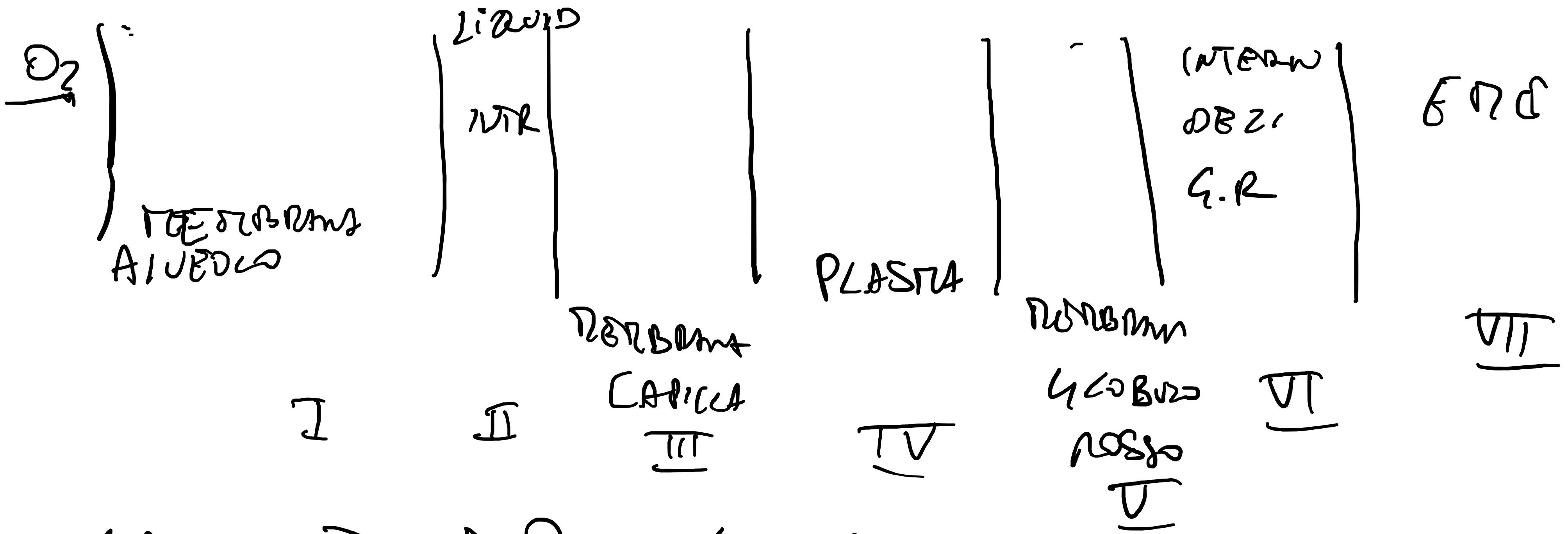


$$W = -D \frac{\Delta P}{\delta} \cdot K_D A$$

$$W_{I} = -D_{MA} \frac{\Delta P_{AM}}{\delta_{AM}} \cdot K_D^{ALV} \cdot A_{ALV}$$

$$W_{II} = -D_{LI} \frac{\Delta P_{LI}}{\delta_{LI}} K_D^{LI} A_{LI}$$

$$W_{\underline{III}} = -D_{\pi E}\frac{\Delta p_{\pi G}}{\delta_{\pi E}} \cdot K_D^{\pi E} A_{\pi G}$$

$$W_{\underline{IV}} = -D_{PL}\frac{\Delta p_{PL}}{\delta_{PL}} K_D^{PL\pi} A_{PL}\,\alpha_{P2} \qquad \alpha_{PL} = 1$$

$$W_{\underline{V}} = -D_{GR}\frac{\Delta p_{GR}}{\delta_{GR}} K_D^{GR} A_{GR}.$$

$$W_{\underline{VI}} = -D_{GI}\frac{\Delta p_{GI}}{\delta_{GI}} K_D^{GI} A_{GI}\,\alpha_{GI} \qquad \alpha_{GI} = 0.93$$

$$Hb + O_2 \underset{K_{-1}}{\overset{K}{\rightleftharpoons}} HbO_2.$$

$$W = K[Hb][O_2] - K_{-1}[HbO_2]$$

$$W = K[Hb][O_2] - K_{-1}[HbO_2]$$

$$W = \phi \qquad \frac{K_{-1}[HbO_2]}{K[Hb][O_2]} = 1$$

$$\frac{K_{-1}[HbO_2]}{K[Hb]HP_{O_2}} = 1 \qquad W = K[Hb]\left\{[O_2] - \frac{K_{-1}[HbO_2]}{K[Hb]}\right\}$$

$$P_{eq} = P_{O_2} = \frac{K_{-1}[HbO_2]}{K[Hb]H} \qquad W = K[Hb]H\{P_{O_2} - P_{eq}\}$$

$$W = W_{I} + W_{II} + W_{III} + W_{IV} + W_{V} + W_{VI} + W_{VII}$$

$$W = -\underbrace{\sum_{i=1}^{6} D_i \frac{\Delta p_i}{\delta_i} K^i A^i}_{\text{diffusivo}} + \underbrace{K[Hb]H\left[P_{O_2} - P_{eq}\right]}_{\text{reattivo}}$$

$$W = -\frac{\Delta p_{tot}}{\left[\frac{\delta}{DKA} + \frac{1}{K[Hb]}\right] = \frac{1}{D_L}} =$$

$= \frac{1}{D_L}$ = costante di diffusione lineare del sistema polmonare.

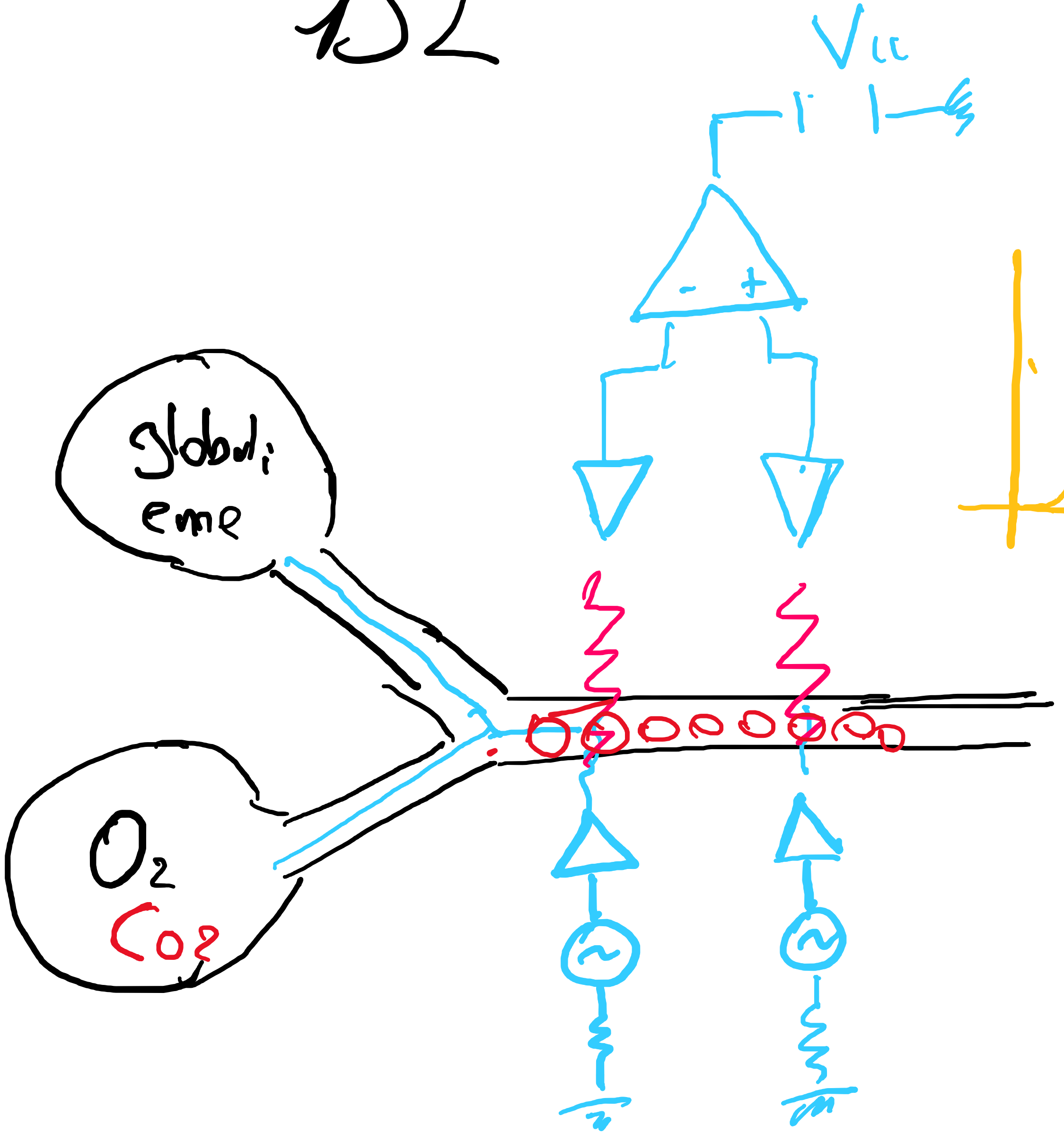
$$\boxed{\frac{1}{D_L}} = \frac{1}{D_m} + \boxed{\frac{1}{\theta V_c}}$$

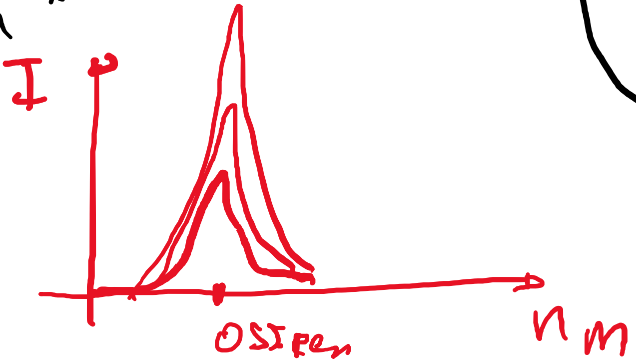
$$D_m = \frac{\delta}{K \cdot D \cdot A} \qquad \theta V_c = K[Hb]$$

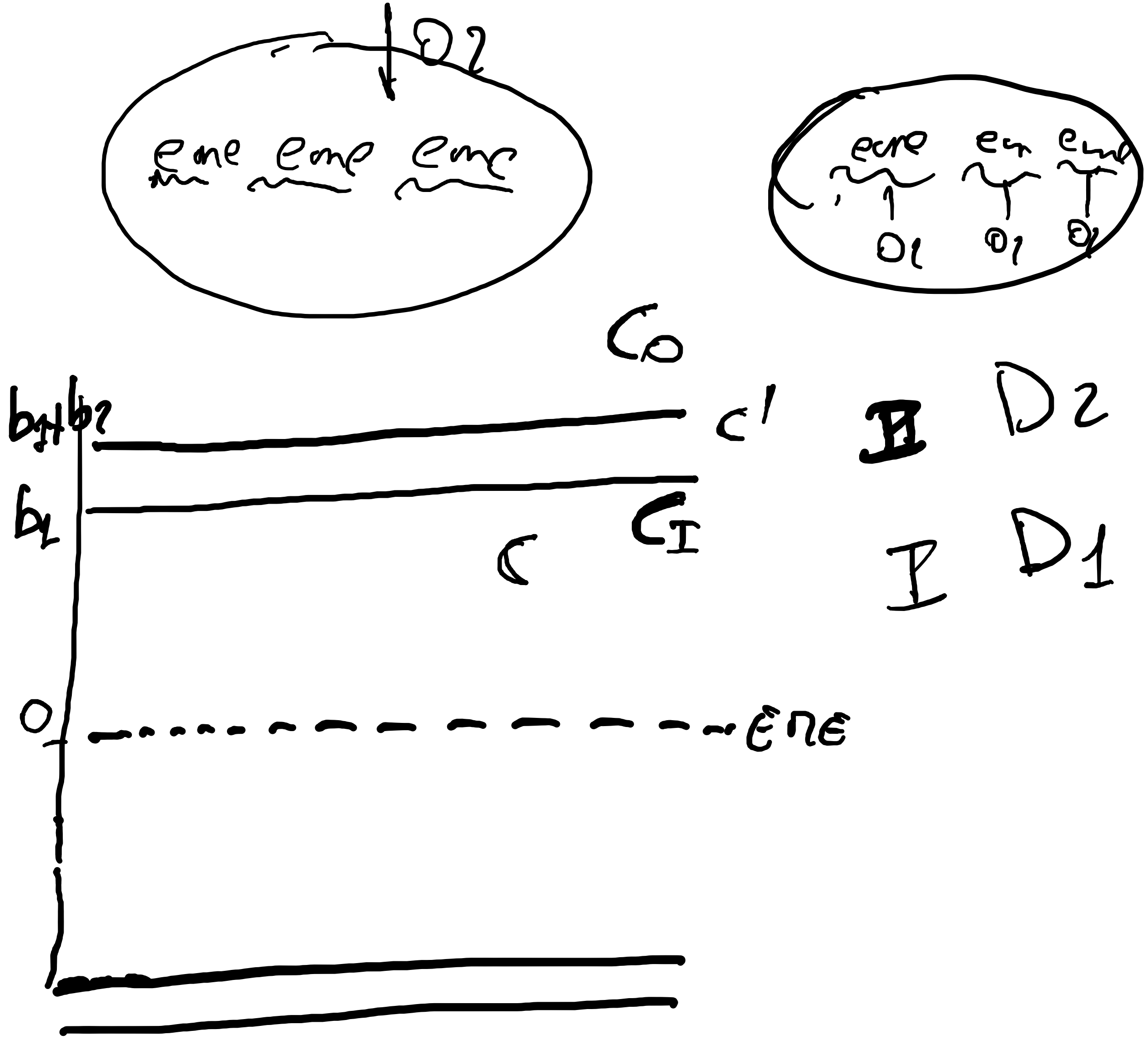
$\delta = 10\ \mu m$

$A = 76\ m^2$

D_L







$$
\begin{cases}
\dfrac{\partial c'}{\partial t} = D_2 \dfrac{\partial^2 c'}{\partial x^2} \\[2ex]
\dfrac{\partial c}{\partial t} = D_1 \dfrac{\partial^2 c}{\partial x^2} + K'(y_0 - y) - Kcy \\[2ex]
\dfrac{\partial y}{\partial t} = D_{Hb} \dfrac{\partial^2 y}{\partial x^2} + K'(y_0 - y) - Kcy
\end{cases}
$$

y_0 = conc. iniziale di emoglobina

y = conc. di emoglobina dopo t

Caso stazionario

$$\frac{\partial c'}{\partial t} = \frac{\partial c}{\partial t} = \phi \qquad Hb + O_2 \underset{K_{-1}}{\overset{K}{\rightleftarrows}} HbO_2 \qquad DHb \simeq \phi$$

$$K' \simeq \phi$$

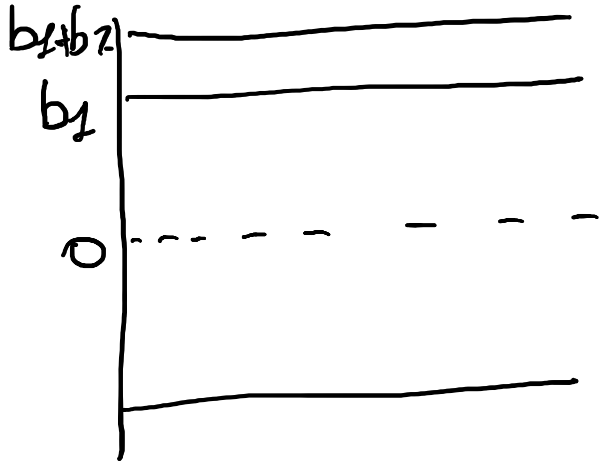
$$\begin{cases} D_2 \frac{\partial^2 c'}{\partial x^2} = \phi \\ -D_1 \frac{\partial^2 c}{\partial x^2} = K'(y_0 - y) - Kcy \\ \underset{\phi}{\underset{\parallel}{DHb}} \frac{\partial^2 y}{\partial x^2} + \underset{\phi}{\underset{\simeq}{K'}}(y_0 - y) - Kcy = \frac{\partial y}{\partial t} \end{cases}$$

$$\begin{cases} D_2 \frac{\partial^2 c'}{\partial x^2} = \phi \\ D_1 \frac{\partial^2 c}{\partial x^2} = Kcy \\ \frac{\partial y}{\partial t} = -Kcy \end{cases}$$

$$C = \alpha C'$$

$$C'(b_1+b_2) = C_0$$

$$C'(b_1) = C_I$$



$$\begin{cases} D_2 \dfrac{\partial^2 c'}{\partial x^2} = 0 & (1) \\ D_1 \dfrac{\partial^2 c}{\partial x^2} = Kcy & (2) \\ \dfrac{\partial y}{\partial t} = -Kcy & (3) \end{cases}$$

$$\frac{\partial c'}{\partial x} = A$$

$$\int_{c'(x)}^{c'(b_1+b_2)} \partial c' = A \int_{x}^{b_1+b_2} \partial x$$

$$c'(b_1+b_2) - c'(x) = A\left(b_1+b_2-x\right)$$

$$C_0 - c'(x) = A\left[b_1+b_2-x\right]$$

$$A = \frac{c_0 - c'(x)}{(b_1 + b_2 - x)}$$

$$c'(b_1) = c_I$$

$$A = \frac{c_0 - c_I}{b_1 + b_2 - b_1} = \frac{c_0 - c_I}{b_2}$$

$$\boxed{c_0 - \left(\frac{c_0 - c_I}{b_2}\right)(b_1 + b_2 - x) = c'(x)}$$

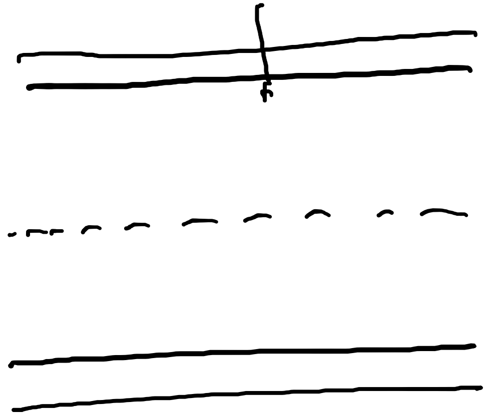
$$\frac{\partial y}{\partial t} = -Kcy \Rightarrow \int_{y(0)}^{y(t)} \frac{\partial y}{y} = -Kc\int_0^t \partial t = -K\alpha c'\int_0^t dt$$

$y(0) = y_0 \qquad c = \alpha c'$

$$\ln \frac{y(t)}{y_0} = -K\alpha c' t$$

$$\boxed{y(t) = y_0 e^{-K\alpha c' t}}$$

$$D_1 \frac{\partial^2 c}{\partial x^2} = -K c y = \frac{\partial y}{\partial t}$$



$$y(t) = y_0 e^{-K c' \alpha t}$$

$$D_1 \frac{\partial^2 c}{\partial x^2} = y_0 \cdot \left(-K c' \alpha\right) e^{-K c' \alpha t} = -K c' \alpha y_0 e^{-K c' \alpha t}$$

$$\boxed{D_1 \frac{\partial c}{\partial x} = \alpha D_2 \frac{\partial c'}{\partial x}}$$

$$D_1 \frac{\partial^2 c}{\partial x^2} = D_1 \frac{\partial}{\partial x}\left(\frac{\partial c}{\partial x}\right) = \frac{\partial}{\partial x}\left(D_1 \frac{\partial c}{\partial x}\right) = \frac{\partial}{\partial x}\left(\alpha D_2 \frac{\partial c'}{\partial x}\right) = \alpha D_2 \frac{\partial^2 c'}{\partial x^2}$$

$$\frac{\alpha D_2}{-}\frac{\partial^2 c'}{\partial x^2} = -K c' \frac{\alpha}{-} y_0 e^{-K c' \alpha t}$$

$$\iint \frac{\partial^2 c'}{c' e^{-K c' \alpha t}} = \iint -\frac{K y_0}{\alpha D_2}\, \partial x^2 = -\frac{K y_0}{D_2 \alpha} \frac{x^2}{2}.$$

$*$

$$c' e^{-K c' \alpha t} = f(x)\, e^{-\varepsilon f(x)} = f(x)\left[1 - \varepsilon f(x)\right]$$

$$e^{-x} = 1 - x + o(x^2) \quad * \quad \iint \frac{d^2 c'}{c'\left[1 - K c' \alpha t\right]} = \iint \frac{d^2 c'}{c' - K c'^2 \alpha t}$$

$$\approx \phi$$

$$\iint \frac{d^2c'}{c'} = \int \frac{dc'}{c'} \int dc' = \int \ln \frac{c'(x)}{c'(0)}\, dc' = \int \ln \frac{c'(x)}{c_0}\, dc'$$

$$c'(0) = c_0$$

$$\int \ln(x)\, dx = x\left[\ln(x) - 1\right]$$

$$\frac{c'(x)}{c_0}\left[\ln \frac{c'(x)}{c_0} - 1\right] = -\frac{K y_0}{D_2 d}\frac{x^2}{2}.$$

$$c'(x)\left[\ln c'(x) - c_0\right) = -\frac{K y_0 c_0}{D_2 d}\frac{x^2}{2}.$$

$$dc'(x)\left[\ln c'(x) - c_0\right] = -\frac{K y_0 c_0}{D_2} \cdot \frac{x^2}{2}$$

$$\boxed{C(x) = -\frac{K y_0 C_0}{D_2} \frac{x^2}{2} \frac{1}{\left[\ln(C(x)) - C_0\right]}}$$

$$\begin{cases} D_2 \dfrac{\partial^2 C'}{\partial x^2} = \dfrac{\partial C'}{\partial t} \\ \dfrac{\partial C}{\partial t} = D_1 \dfrac{\partial^2 C}{\partial x^2} \\ \dfrac{\partial Y}{\partial t} = D_{Hb} \dfrac{\partial^2 Y}{\partial x^2} \end{cases}$$

CO_2.

$$\frac{\partial C'}{\partial t} = \frac{\partial C}{\partial t} = \phi$$

$$D_{Hb} = \phi$$

$$D_2 \frac{\partial^2 C'}{\partial x^2} = \phi$$

$$D_1 \frac{\partial^2 C}{\partial x} = \phi$$

$$\frac{\partial Y}{\partial t} = \phi \qquad Y = \text{cost.}$$