(1)

ALV	MEMBR ALV	LIQUIDO INT	MEMBR END	PLASMA	MEMBR GLOBUL	GLOBULI ROSSI	EMG
$O_2 \rightarrow$							
$CO_2 \leftarrow$							
	I	II	III	IV	V	VI	VII

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

$$W_I = -D_{ALV} \frac{\Delta P_{ALV}}{\delta_{ALV}} K_D^{ALV} A_{ALV}$$

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

$$W_{III} = -D_{ME} \frac{\Delta P_{ME}}{\delta_{ME}} K_D^{ME} A_{ME}$$

$$W_{IV} = -D_{PL} \frac{\Delta P_{PL}}{\delta_{PL}} K_D^{PL} A_{PL}$$

$$W_V = -D_{GR} \frac{\Delta P_{GR}}{\delta_{GR}} K_D^{GR} A_{GR}.$$

$$W_{VI} = -D_{IG} \frac{\Delta IG}{\delta_{IG}} K_D^{ID} A_{GI} \alpha_{GI}$$

0.93 - 0.99

$$Hb_4 + O_2 \underset{K_{-1}}{\overset{K}{\rightleftharpoons}} Hb_4 O_2$$

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

$$P_{eq} = \frac{K^{-1}[HbO_2]}{K[Hb]}$$

$$W_{IV} = -D_{PL} \frac{\Delta P_{PL}}{\delta_{PL}} K_D^{PL} A_{PL} \alpha_{PL}.$$

0.93

$$W = K[Hb][[O_2] - P_{eq}]$$

$$W_{VII} = [Hb]K[H_{O_2} P_{O_2} - P_{eq}].$$

(2)

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

$$-W = \underbrace{\sum_{i=1}^{6} D_i \frac{\Delta p_i}{\delta_i} K^i A_i}_{\text{Diffusivo puro}} + \underbrace{K[Hb]\left[H_{O_2} P_{O_2} - P_{eq}\right]}_{\text{reazione}}$$ modello dei sette strati.

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

$$\frac{1}{D_L} = \frac{\delta}{DKA} + \frac{1}{K \cdot [Hb]} = \frac{1}{D_M} + \frac{1}{\theta V_C}$$

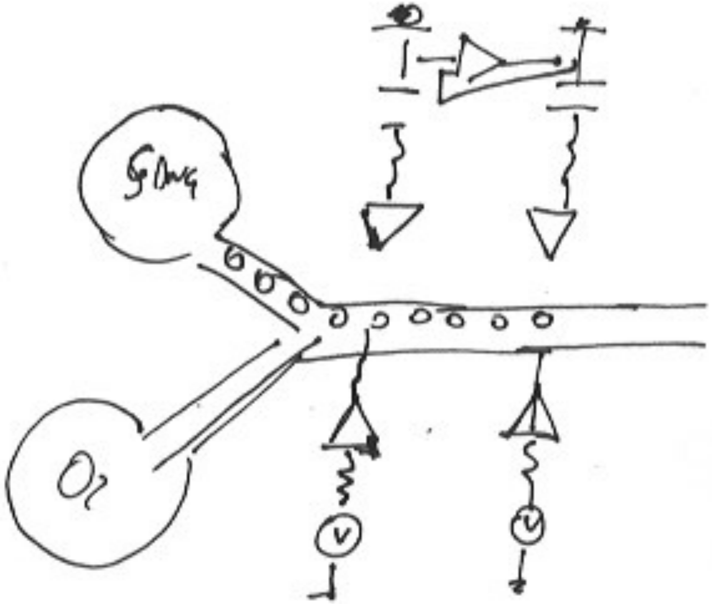
$A = 70\ m^2$ $\quad D_{O_2}$ ⟶ $\boxed{D_{O_2}\ \text{sano}}$

$\delta = 10\ \mu m$ $\quad K$ permeabilità

D_{O_2} sano: 39 mmHg: D_M: Δp H_2O

500 ml			39 mmHg
O_2	20%	159 mmHg	120 mmHg
CO_2	5%	0.3 mmHg	27 mmHg
N_2	75%	600 mmHg	560 mmHg
H_2O	ϕ		47 mmHg

$DR = \Theta V_c$



$DR_{CO_2} = \Theta_{CO_2} V_c$

FISIOLOGICA BEIGE

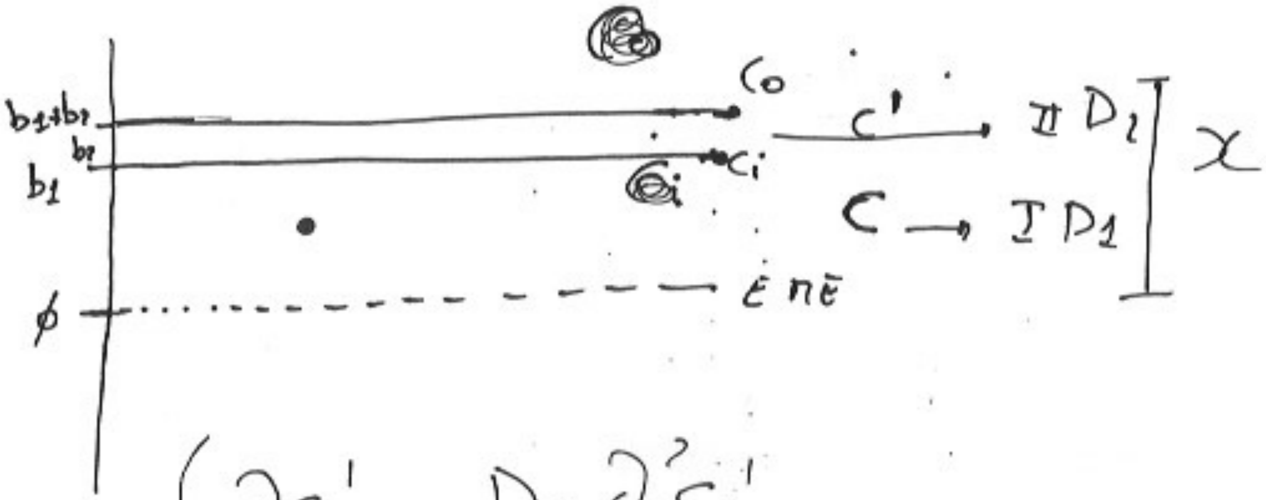
Aggiungo CO_2 GIALLO

O_2

$DR_{CO_2} = \frac{DKA}{\delta}$

$D_{CO} \simeq D_{O_2}$

$K_{CO} = K_{O_2}$



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

I° caso

caso stazionario

$$\frac{\partial c'}{\partial t} = \phi \quad \frac{\partial c}{\partial t} = \phi$$

$$D_{Hb} = \phi \qquad K' = \phi$$

$$\underline{c' \cdot \alpha = C}$$

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

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

(1)

$$\frac{\partial^2 c'}{\partial x^2} = \phi \qquad \frac{\partial c'}{\partial x} = A$$

$$c'(x) - c'(b_1) = A(x - b_1) + \underset{\phi}{\overset{\shortparallel}{B}}$$

$$c'(b_1 + b_2) = C_o$$

$$c'(b_1 + b_2) - c'(b_1) = A[b_1 + b_2 - b_1]$$

$$C_o - C_i = A b_2 \qquad A = \frac{C_o - C_i}{b}$$

$$c'(x) = C_i + \frac{(C_o - C_i)}{b}(x - b_1)$$

$$\frac{\partial Y}{\partial t} = -KcY$$

$$\int_{Y_0}^{Y(t)} \frac{\partial Y}{Y} = \int_0^t -Kc\,\partial t$$

$$\ln \frac{Y(t)}{Y_0} = -K\alpha \int_0^t c'\,\partial t = -K\alpha c' . t$$

$$Y(t) = Y_0\, e^{-K\alpha c' t}$$

$$D_1 \frac{\partial^2 c}{\partial x^2} = KcY = -\frac{\partial Y}{\partial t} = -Y_0 \left(-K\alpha c'\right) e^{-K\alpha c' t} = Y_0 K\alpha c'\, e^{-K\alpha c' t}$$

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

$$\frac{\partial}{\partial x}\left(\frac{\partial c'}{\partial x}\right)\cancel{\ \ } \cancel{\alpha D_2}$$

$$\cancel{\alpha} D_2 \frac{\partial}{\partial x}\left(\frac{\partial c'}{\partial x}\right) = Y_0 K \cancel{\alpha} c' e^{-K\alpha c' t}$$

$$\frac{\partial}{\partial x}\left(\frac{\partial c'}{\partial x}\right) = \frac{Y_0 K c'}{D_2} e^{-K\alpha c' t}.$$

$$\iint \frac{\partial^2 c'}{\underline{c' e^{-K\alpha c' t}}} = \iint_0^x \frac{Y_0 K}{D_2} \partial x^2 \qquad Y_0 \frac{K}{D_2} x\,dx \qquad Y_0 \frac{K}{D_2} \frac{x^2}{2}$$

$$= \frac{Y_0 K}{2 D_2} x^2$$

$$\frac{\cancel{\ }\,\iint}{f(x) e^{-\alpha f(x)}}$$

$$e^{-x} = 1 - x + o(x^2)$$

$$\iint \frac{\partial^2 c'}{c'[1-(-K\alpha c' t)]} = \iint \frac{\partial^2 c'}{c' + K\alpha c'^2 t} = \iint_{c'(0)}^{c'(x)} \frac{\partial^2 c}{c'} = \int \ln \frac{c'(x)}{c'(0)}\, dc' =$$

$$\int \ln(x) = x\ln(x) - \int x\cdot\frac{1}{x}\,dx = x\ln(x) - x = x[\ln(x) - 1]$$

$$\int \ln\frac{c'(x)}{c'(0)} = \frac{c'(x)}{c'(0)}\cdot\left[\ln\frac{c'(x)}{c'(0)} - 1\right] = Y_0\,\frac{K}{D_2}\,\frac{x^2}{2}$$

$$\alpha c' = c$$

$$\frac{c(x)}{\cancel{\alpha}\,\frac{c(0)}{\alpha}}\left[\ln\frac{c(x)}{\cancel{\alpha}\,\frac{c(0)}{\alpha}} - 1\right] = Y_0\,\frac{Kx^2}{2D_2}$$

$$c(x)\left[\ln\frac{c(x)}{c(0)} - 1\right] = Y_0\,c(0)\,\frac{Kx^2}{2D_2}$$

$$c(0) = H\underbrace{P}_{40\,\mathrm{mmHg}}$$