68

Easyrite

FILLER - NOTE BOOK

VERNON ROYAL LINE

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85 Lvs.
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②

$$1-\frac{1}{m}=\frac{\rho}{\rho-2k}\left[1-e^{-A(\rho-2k)T}\right]$$

$$1-\frac{1}{m}=\frac{1}{1-\frac{2k}{\rho}}\left(1-e^{-A(\rho-2k)T}\right)$$

$$1-\frac{1}{m}=\frac{1}{1-\frac{2k}{\rho}}\left[1-e^{-A\rho\left(1-\frac{2k}{\rho}\right)T}\right]$$

~~$T_{cond}(k=0)$~~

$$1-\frac{1}{m}=\frac{1}{1-\frac{2k}{\rho}}\left[1-e^{-A\rho\left(1-\frac{2k}{\rho}\right)T}\right]$$

$$T=\frac{1}{A\rho}\ln m+\frac{\Delta}{A\rho}$$

postponed ...

wait on p.5

$T_{cond}(k=0) \simeq \frac{\rho}{A\rho}$ $\rho=10^{-5}$ $k=10^{-7}$

~~number of enzyme / sec~~

rate of enzyme prod.

5 prophage make in 30 min 20,000

1 " makes 2 per sec

$$T=\frac{\rho}{A\rho}=\frac{1}{2}/\text{sec}$$

$\rho=10^{-5}$ $A=16\times10^{5}=\sigma\rho\, 2\, 0^{24}$

$\sigma\rho=8\,10^{-19}=10^{-15}\underbrace{\rho 10^{-4}}_{1000}$

$$\tau_{crit}=\frac{1}{A\rho}=\frac{1}{16}\text{ sec}$$

①

rate of hits $= A\rho$ ρ concentration of the

1) $\boxed{A\rho = \frac{1}{\tau_{hit}}}$

$A = 6\,10^{23} \times 10^{-3}\, v\, \sigma\, p$

$v = 3\,10^{3}$

$\boxed{A = \sigma\, p \times 2 \times 10^{24}}$

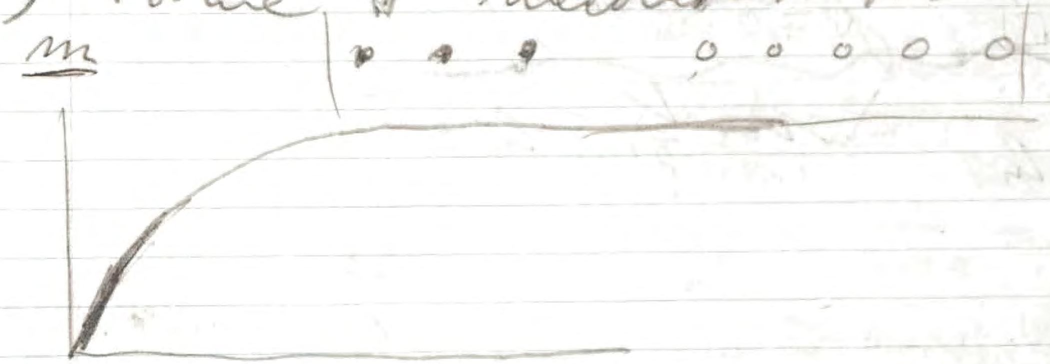
$AK = \frac{1}{2}\, 10^{13}\, e^{-\frac{Q}{RT}}$

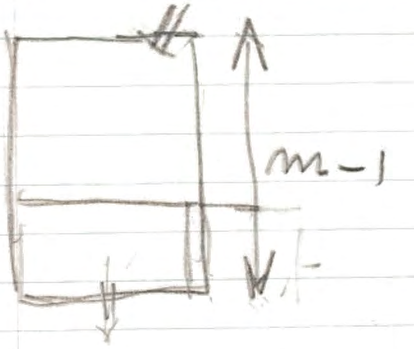
$2AK =$ rate of evaporation from bound state

2.) $2AK = \frac{1}{\tau_{evap}}$

$\boxed{\frac{\tau_{evap}}{\tau_{hit}} = \frac{1}{2}\frac{\rho}{K}}$

3) Determine T needed to fill m boxes





$$\boxed{\frac{df}{dt} = A\rho\,(m-f) - 2AKf}$$ Mirando

for $K=0$

$f = m(1-e^{-A\rho t})$

$\frac{m-1}{m} = 1 - e^{-A\rho t}$

$1 - \frac{1}{m} = 1 - e^{-A\rho T}$

$\ln m = (A\rho)\, T \;(K=0$

$$\boxed{\frac{1}{A\rho} + \frac{1}{A\rho}\ln m = T_{conden}(K=0)}$$

$m = 1000$

$$\boxed{\frac{8}{A\rho} = T_{evap}(K=0)}$$

with evaporation

$$f = \frac{\rho m}{\rho - 2K}\left[1 - e^{-A(\rho-2K)t}\right]$$

$T_{cond}(K)$

$m - 1 =$

4

A

B

C

working theory

$$\Delta t = m \cdot f \, \tau_{hit} = m \frac{k}{\rho} \tau_{hit}$$

~~RNA~~ TNR(+) ③

Ⓗ

RNA-

RNA(-) is made on DNA ⊕

a) hypothesis one

$$T_{unwinding} = \frac{n\,\tau_{condens}}{}$$

for $\rho = 10^{-5}$ $\frac{1000}{16}$ sec = 60 sec

b.) adjacent TNR complex

c.) $K = 10^{-7}$ $\tau_{evap} = \frac{1}{2AK} = \frac{1}{32\ 10^{5}\ 10^{-7}}$

$\cong 3$ sec too much

$$n\tau_n = \frac{1000}{32\ 10^{5}\ 10^{-7}} = 3000 \text{ sec}$$

① $2AK = 10^{13} e^{-\frac{Q}{RT}}$

$\frac{1}{3} = 10^{13} e^{-\frac{Q}{RT}}$

$\frac{Q}{RT} = \ln 3 + 13 \times 2.3 = 31$

Q = 18,000 Cal or 3000 Cal per bon

~~d K to 10^{-5}~~

d.) if $K = 10^{-5}$ then bonds less by 3000 cal. total

or two bond each are reduced to $\frac{1}{2}$ i.e to 1500 cal.

Impossible Problem

approximate:

$2AKM$ rate of evap at end $\longrightarrow$

Trouble if

$$2AKM = A\rho$$

New Idea

, holes

$$\tau_{hit}(1+\log m) + m\frac{K_0}{\rho}\tau_{hit}$$

$$\tau_{hit}\left(8 + 10^3\frac{K_0}{\rho}\right) = \text{rate of formation}$$

Total time $= \tau_{hit}\left(8 + 10^3\frac{K_0}{\rho}\right) +$

$$= \frac{1}{A\rho}\left(8 + 10^3\frac{K_0}{\rho}\right)$$

$\frac{K_0}{\rho} \approx \frac{1}{100}$ for this to be tolerable for $\rho = 10^{-5}$ (it doubles time

~~rate~~ τ of evap of single TNR

$$\tau_{evap} = \frac{1}{2AK_0} = \frac{1}{2A\rho\frac{K}{\rho}}$$

50 times longer

not tolerable

Minimum

continued 5 [illegible] H

from p. 2

$$1-\frac{1}{1-\frac{2k}{\rho}}+\frac{1}{1-\frac{2k}{\rho}}e^{-A\rho(1-\frac{2k}{\rho})T_{end}}=\frac{1}{m}$$

$$-\frac{\frac{2k}{\rho}}{1-\frac{2k}{\rho}}+\frac{1}{1-\frac{2k}{\rho}}e^{-[\quad]}=\frac{1}{m}$$

$$e^{-[\quad]}=\frac{1}{m}+\frac{2k}{\rho}$$

~~So~~ $$e^{+[\quad]}=\frac{1}{\frac{1}{m}+\frac{2k}{\rho}}$$

$$A\rho(1-\frac{2k}{\rho})T=\log\frac{m\rho}{\rho+2km}=$$

$$\log\frac{m}{1+\frac{2k}{\rho}m}$$

$$=\ln m-\ln\left(1+\frac{2k}{\rho}m\right)$$

$$A\rho(1-\frac{2k}{\rho})T=\ln m-\ln\frac{2k}{\rho}m$$

$$T=\frac{+1}{A\rho(1-\frac{2k}{\rho})}\ln\frac{\rho}{2k}$$

? error ?

Can get by with lower ρ only if there is exchange. —

— Acid anhydride P-P ~~in~~ at 3 carbon position. —

exchange frequency

$\frac{1}{40}$ Volt

2^{1000}

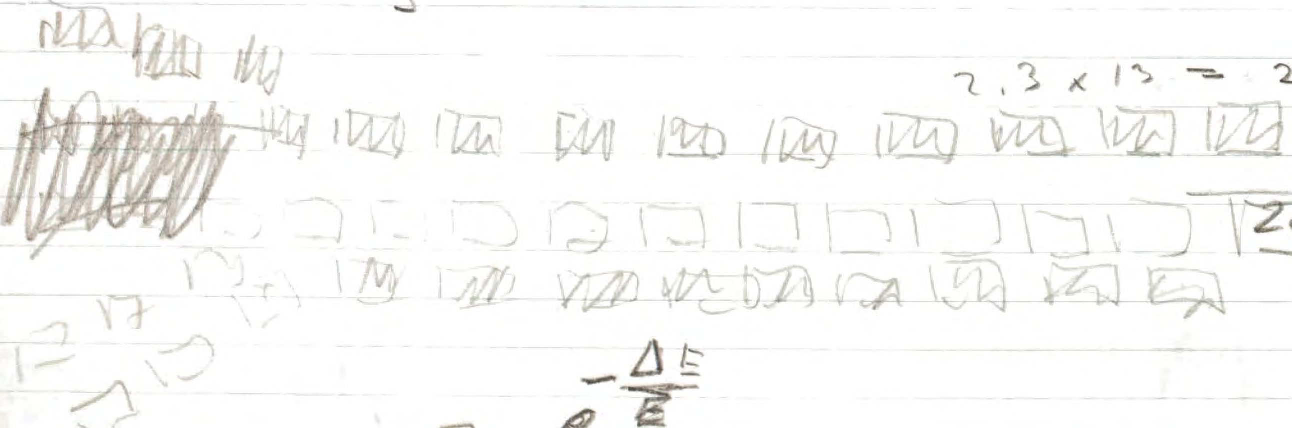
$\frac{K^{\circ}}{100} = \frac{1}{100} \cdot \frac{3\,10^{10}}{5\,10^{-5}}$

$e^{\frac{1000}{1.44}}$

$\frac{3}{5}\ 10^{13}$ osc/sec

$e^{>o}$

$\frac{3}{5}\ e$



$2.3 \times 13 = 26$

26

13

$\boxed{28}7$

$= e^{-\frac{\Delta E}{E}}$

$\frac{1}{10}$ Protein 100 gm in a liter Protein

Total time =

$$\frac{1}{A\rho}\left(8 + 10^3\frac{K}{\rho} + \frac{1}{2\frac{K}{\rho}}\right)$$

~~optimum~~; minimum

$$10^3 X + \frac{1}{2}\frac{1}{X} \qquad \frac{K}{\rho} = X$$

$$2\,10^3 X + \frac{1}{X}$$

$$2\,10^3 - \frac{1}{X^2} = 0$$

$$X = \sqrt{2000}^{\,-1} = \frac{1}{\boxed{50}} \quad 45$$

$$T_{min} = \left(8 + 22\tfrac{1}{2} + 22\tfrac{1}{2}\right) = \cancel{4}\boxed{53}$$

Aρ ought to be raised 7 fold

raise ρ 10 fold and reduce ρ

~~raise M by ten for example~~

$\rho = 10^{-4}$ molar $K = 5\,10^{-5}$ molar

for RNA to come off DNA

$$1000\,\frac{1}{2AK}$$

$$\frac{7\,\text{sec}}{100}$$

permanently RNA

$\boxed{4\ \text{min}}$

$T_{min}\ \frac{1}{4\ \text{sec}}$ $T_{min} = \frac{1000}{4} = 250$ sec

Origination of $\overset{8}{}$ repressor

4

$$\frac{dx}{dt} = a\rho - b - \frac{x}{\cancel{T}}$$

$$x = \frac{a\rho - b}{b+1}$$

$$\frac{dy}{dt} = cx - \frac{y}{\cancel{T}}$$

$$\underline{y = cx}$$

x repr.

y [illegible]

Kuntoff in Bacteria

7 μ mol purines per 10^{12} bact

~~4 μ~~ 2.75 μ puri~~midines~~ ena

4 μ mol pirimidines

Guanine - Adenine Ratio

1.7 in RNA

1.4 in DNA

Phys. Sol. 0.9% NaCl

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4 10^{-6} moles per cc

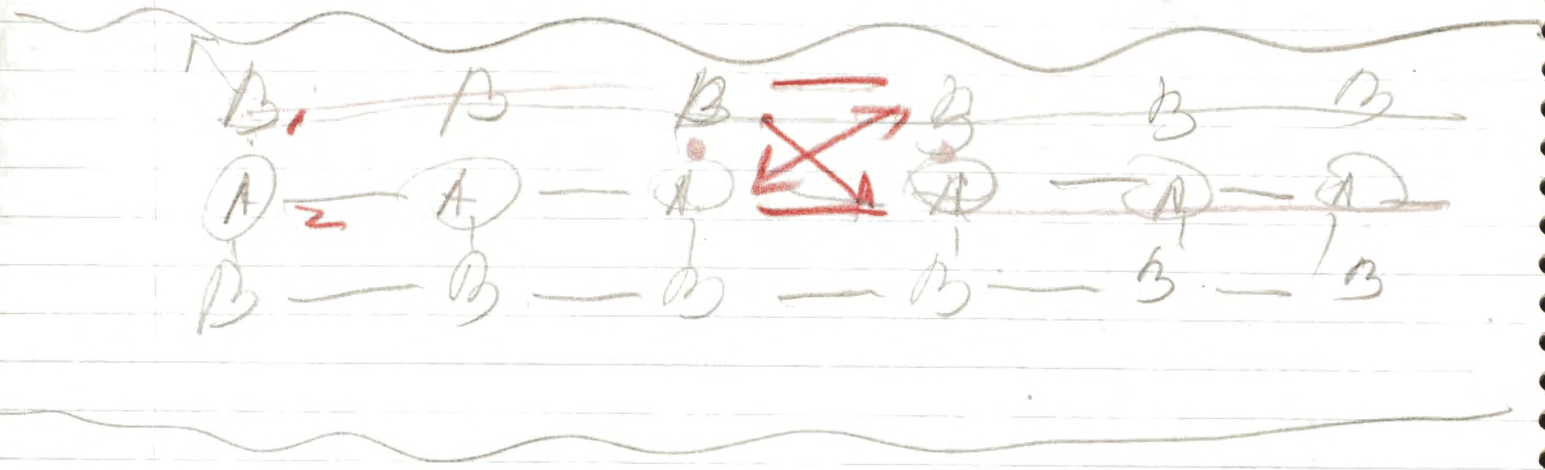
4 10^{-3} mol per liter

10^{-4} mol per liter ribonucleotides of each kind

$$\frac{10^{-3}}{20} \quad \frac{7\,\text{total}}{3} = \frac{2}{20}\,10^{-3} = \boxed{10^{-4}}$$

$T_{\text{Detachment}} = \frac{1000}{4} = 250 =$

$= 4$ min



$\boxed{\frac{K}{\rho}}$

$\frac{8}{A\rho}$ | $\frac{K}{\rho}\frac{1}{A\rho} + \frac{1}{2A\rho\frac{K}{\rho}}$

T_{min} $\frac{1}{A\rho}\left\{8 + \frac{1000K}{\rho} + \frac{1}{2\frac{K}{\rho}}\right\}$

$2000\cancel{4}x + \frac{1}{\cancel{4}x}$

$2000 - \frac{1}{x^2} =$

$\boxed{\frac{\rho}{K} = 50}$ $\frac{1}{x}$ $\cancel{x} = \sqrt{2000} = 50$

$$\text{Time} = \frac{1}{A\rho}\left(\overbrace{8 + 20 + 25}^{53}\right) = \frac{53}{A\rho}$$

$\frac{1}{2\,\text{sec}} = \frac{53}{A\rho}$ $A\rho = \frac{100}{100}/\text{sec}$

$\cancel{A}\rho = 10^{-4}$

$\boxed{A = 10^{+6}}$

$\boxed{\tau_{ev} = \cancel{\frac{50}{2\,10^6\,10^{-4}}}}$

$= \frac{50}{2\,10^6\,\cancel{K}\rho} = \frac{1}{4}$

100

$A = 6\,10^{23}\,\sigma\rho\,3\,10^3\,10^{-3}$

$20\times 10^{23}\,\sigma\rho$

$2\times 10^{24}\,\sigma\rho = 10^6$

$2\sigma\rho = 10^{-18}$ $\sigma = 10^{-15}$

$\rho = \frac{1}{2000}$

~~RNA~~

$$T_{set} = \frac{1}{A\rho}\left(1000 \frac{1}{1+\frac{\rho}{K}} + \frac{1000}{2\frac{K}{\rho}}\right)$$

$$= \frac{1}{A\rho}\left(1000 \frac{K/\rho}{K/\rho+1} + \frac{1000}{2\frac{K}{\rho}}\right)$$

$$\frac{2x}{x+1} + \frac{1}{x}$$

$$\frac{2}{x+1} - \frac{2x}{(x+1)^2} - \frac{1}{x^2} = 0$$

$$2(x+1) - 2x - \frac{(x+1)^2}{x^2} = 0$$

$$2x^2 - x^2 - 2x - \cancel{1}$$

$$x^2 - 2x - 1 = 0$$

$ax^2 + bx + c = 0$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{2 \pm \sqrt{4+4}}{2} = 1 \pm \tfrac{1}{2}\sqrt{8}$$

$$1 + \tfrac{3}{2} = \tfrac{5}{2}$$

$$\frac{K}{\rho} = \frac{5}{2}$$

best for ~~AB~~D

$$T_{links} + T_{detachment} = \frac{1}{A\rho}\left(nn + \tfrac{5}{7}1000 + \frac{1000}{5}\right)$$

$$T \approx \frac{1}{A\rho}\, 2000$$

140
700
240

T = 20 sec

K changed by a factor 100

12

14

$$\frac{1}{1+\frac{\beta}{k}}$$

$$T_{Det} = \frac{1}{A\rho}\left(1000 \cancel{\frac{1}{\beta}} + \frac{1000}{\frac{k}{\rho}}\right)$$

~~x ... x = 1~~

$$\boxed{\cancel{T_{Det} = \frac{2000}{A\rho}} = 20 \text{ sec}}$$

~~β~~ = 50 uniformity 10

1400 cal

K $e^{\frac{\Delta H}{RT}}$

10 ohm $\boxed{1000}$ 20,000 sec 30

Werner says B strain when grown in chemostat with Arg limitation (Orn E citr) E(-1) does not rise and Arg does not suppress. Block between citrulline & Arginine. — And Ornithine does not induce. —

Inducer is Ornithine – R is not made because E(-1) missing

Therefore Arg concentration does not effect E(-1) production –

14

H

Correction for RNA synthetase - is there time delay because of waiting for wrong (TND) to get out of the way

Make total time minimum for RNA-synthetase working at all positions

$$T = \frac{1}{A\rho_1}\int^{\rho_1}\left(\frac{m}{\cancel{Ak}} + \frac{m}{2\cancel{A}k_2/\rho_1} + \frac{m}{2\cancel{A}k_1/\rho_1}\right)$$

$$\cancel{\frac{1000}{200}} \quad \frac{1}{50} + \frac{1000}{4}$$

$$\frac{1}{A\rho_1}(1250) = \qquad k_2 = 100 k_1$$

$= 10$ sec for $\rho_1 = \rho_0$

$10\,\text{Å}$ $\quad \underline{15{,}000\,\text{Å}}$ $\quad \frac{(1.5)^2\, 10^{8}}{A}$

$$\rho = \frac{1}{2}10^{-8}$$

$* \; v = 30.$

$$K\; \underbrace{3\,10^{23}\,10^{-3}\,30\,\frac{1}{2}\,10^{-8}}_{A} = \frac{1}{2}10^{13}\,e^{-10^4}$$

Average enzyme levels: β galact N = ~~0.2~~ $\frac{2 \cdot 10^{-12} \text{ gm}}{10^5}$ $6 \cdot 10^{23}$

10^6 10^4 enzymes ~~10~~ 10^{-12} 10^{-17} 10^{23}

~~100~~ 10^2 on the average enzymes of each kind

$\frac{\rho}{K} =$

for $\rho = 10^{-6}$ [Mol weight 100 0.1 μ]

~~10~~

10^{-4} mol ~~approximately~~ TN each kind

$\frac{K}{\rho} = \frac{1}{100}$ $K = 10^{-6}$

repressor is not metabolite

or $K = 10^{-7}$ for 1000 fold ~~a~~ repression

~~most enzyme~~ 10000 enzymes

~~most~~ 50% repressed 1000 fold

10% repressed 100 fold

16

Henry J. Vogel p 276 The Chemical Basis of Heredity H

McElroy and Glass

The Johns Hopkins Press 1957

~~Arginine~~ Blocked before acetyl ornithine. Arg ~~sup~~ represses because ~~[illegible]~~ Arg-R rises faster with rising arginine than acetOrn-R

What is concentration of ~~enz(-1) etc.~~ enz(-1) etc.?

either enz(-1) ~~enz(0)~~ rise less than prop with enz(0). —

But enz(0) saturates assuming an equilibrium between

$$\cancel{1} \frac{\frac{\rho\, enz(\cancel{0}1)}{\cancel{K}\, enz(\cancel{0}1)}}{1+\frac{\rho\, enz(-1)}{K\, enz(-1)}}$$ — inducer

and

$$\frac{\cancel{1}+\frac{\rho\, enz(0)}{K\, enz(0)}}{1+\frac{\rho\, enz-1}{K(-1)}+\frac{\rho(0)}{K(0)}}$$

If arginine-R triggers also more complicated formula

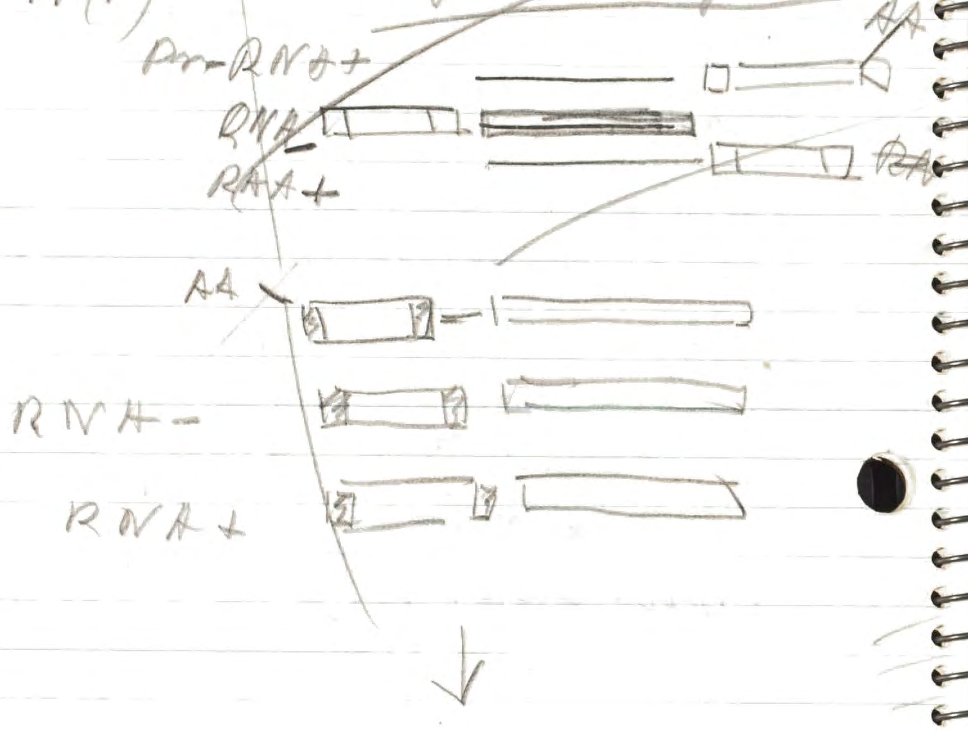
Assume Protein is formed together with RNA(+)

interlopers evaporate 100 times ~~must link in succession~~ faster

RMN(+) RTN(+)

DMN(+) DTN(+)

Protein synth



sugars will link when neighbor is already linked

? time needed ?

! time is classical time !

RNA(–) → DNA(+)

DNA(+) → RNA(–)

DNA(+) → DNA(–)

DNA(–) → DNA(+)

RNA– → RNA(+) + Prot

RNA(+) → zero

~~DNA – DNA+~~ ?

18

suppressor

'repressor' is ribose trinucleotide of arginine. —

AA–RTN–R

sits on head

Synthesis of ~~RMDA~~ MRN and MDN from mononuc

(1.) from a.) mononucleotides riboses carrying PP on 5 carbon (or 3 carbon) ~~nothing~~ ~~no P on 3 (or 5~~

b.) carrying ~~ribose~~ PP on 5 (or 3 carbon) and AA on 3 (or 5) carbon

Synthesis of DNA from mononuc

a.)

b.)

2.) synthesis from TRN and TDN

here difference 2 kind of

	PP on leading letter	PP on Trailing letter
PP on 3		
PP on 5		

	RNA−	DNA−
RNA+		
DNA+		

~~13~~ ~~10~~

$10^{13} e^{-15}$

$10^{13} \cdot 10^{-\frac{15}{2.3}}$

$= 10^{7}$

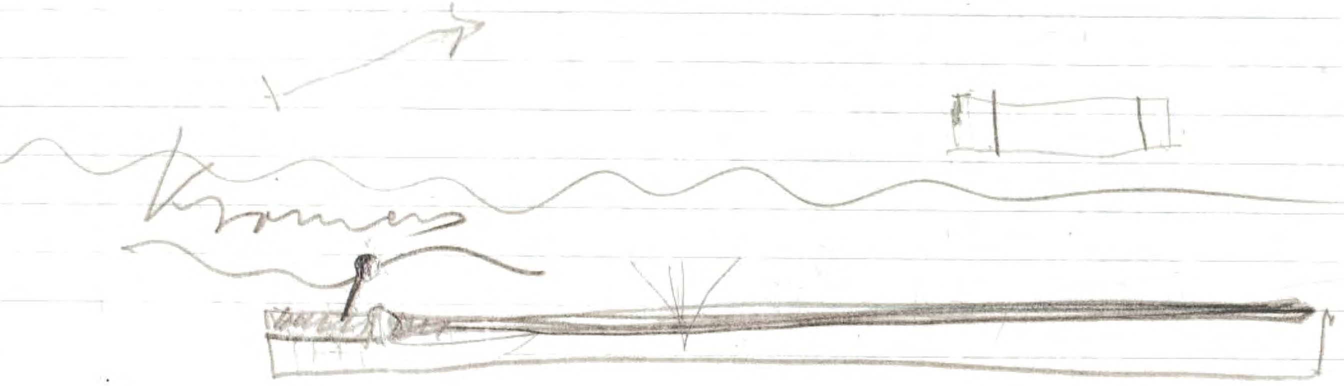
150 123

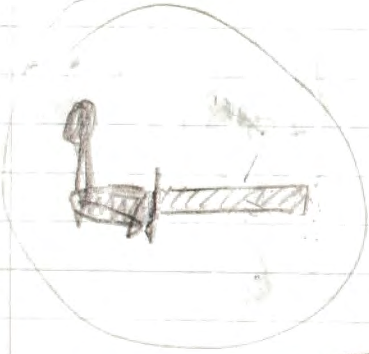
$\frac{3\bar{X}^2}{t} = \frac{2D}{t}$

$\lambda = \sqrt{\frac{2}{3} D t}$

$\sqrt{10^{-5} 10^{-11}} -$

1 Å





24
3 x 4
4

40

HAB
ABA
AAA

4

Levinus Problem ^{20}

How does RNA or DNA pull apart take Hydrogen Bond 1 sec oscillation and negative charge repulsion

~~18000~~

~~16000~~

~~6~~

$\underline{\underline{3\overset{0}{A}}}$ || 10^{-7} $10\overset{0}{A}$

$\frac{e^2}{10^{-14}}$ | $\frac{25\,10^{-20}}{10^{-14}} = 2.5\,10^{-5}$ dynes $\frac{1}{300}$

$\frac{2}{100}$ $\frac{2}{100}$ $^{P}/_{cm}$ Volt/cm = current/cm²

$\frac{100}{5}$

$\frac{3\,10^{9}\ \cancel{10}\ \text{el stat/cm}}{5\,10^{-10}\ \cancel{6}\,10^{20}}$ = ~~current~~ v

300

$\frac{1}{2}\ \frac{10^{19}}{10^{20}} =$ ~~1 Volt~~ ~~1/6 el stat~~ 300 $\frac{1}{20}\ \frac{cm}{sec}$

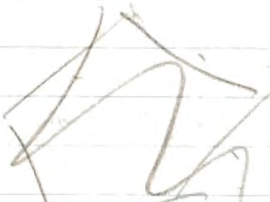
$\frac{5\,10^{-10}}{10^{-14}} = 5\,10^{4}$ el stat/cm for 1 el stat/cm $\frac{3 \cdot 10^{-8} \cdot 4}{10^{4}}$

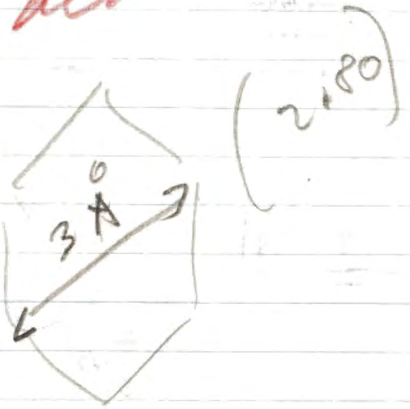
$\frac{1}{4}\,10^{4}$ cm/sec $\tau = 10\,10^{-12}$ $10 \cdot 10^{-12}$

$\tau = 10^{-11}$

Platt

O-H-C
esterified with amino acid



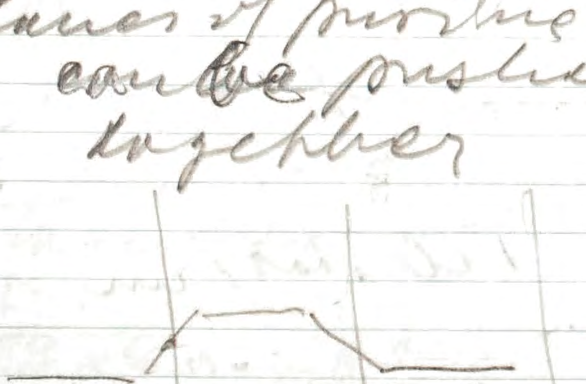


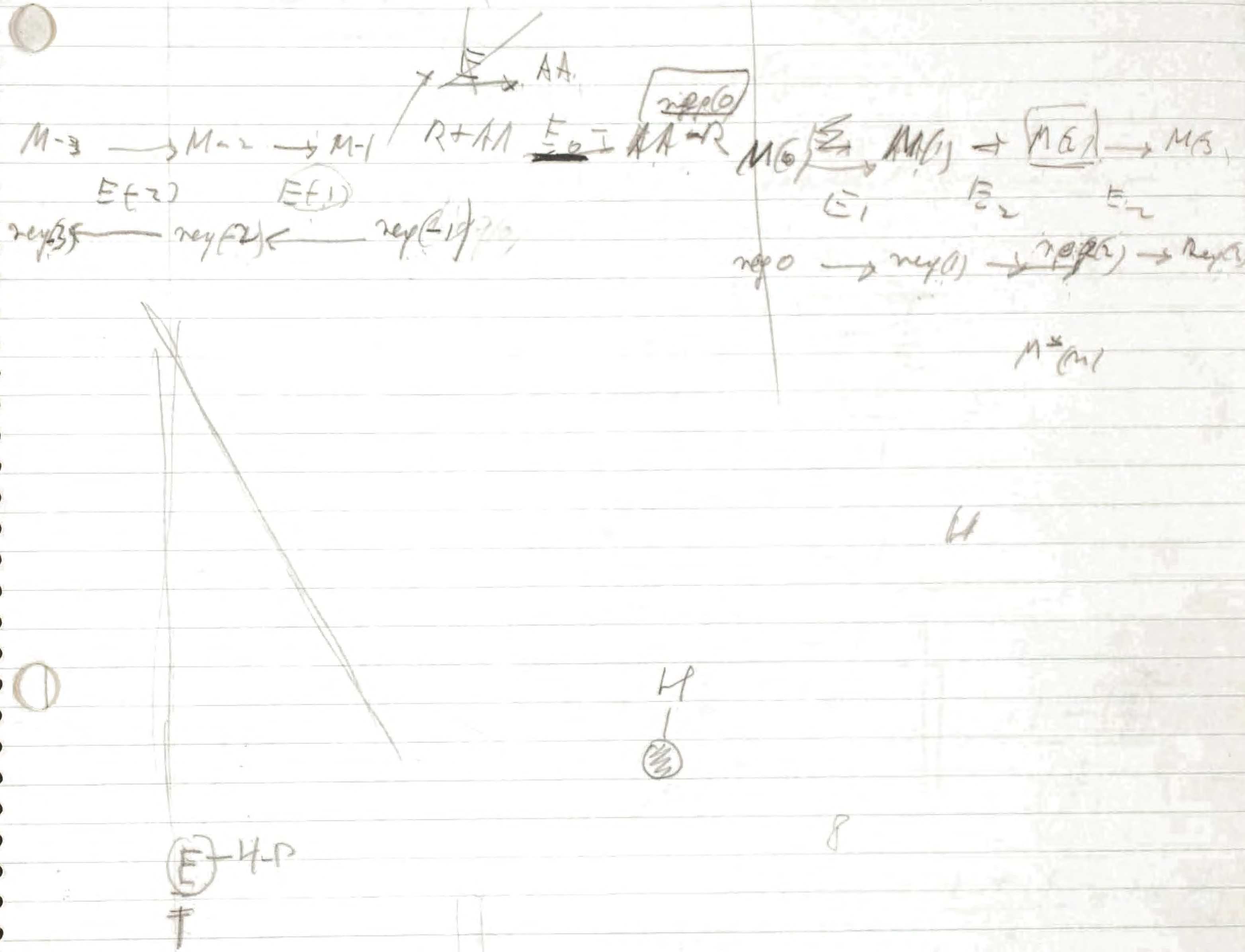
Polypeptide

1.54 + 1.35 + 1.40

1.54
1.35
1.40
4.29 = 4.30
reduce 15%
polypeptide distance

3.4 angstrom is closest, the planes of proline can be pushed together





~~Whe~~keland

Wheland

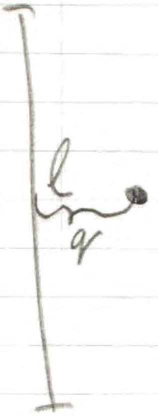
functional gene

m T_2 ~~ff~~ ~~4~~ = 100 " ~~genes~~ "

Kennedy trinucleotide

Balázs!

$\frac{Q}{l}$ is charge density



Potential for point in center

$$P = \frac{Q}{l} \ln \frac{\sqrt{q^2 + \frac{l^2}{4}} + \frac{l}{2}}{\sqrt{q^2 + \frac{l^2}{4}} - \frac{l}{2}}$$

$$= \frac{Q}{l} \ln \frac{\sqrt{\frac{4q^2}{l^2} + 1} + 1}{\sqrt{} - 1}$$

$$\frac{\sqrt{\left(\frac{2q}{l}\right)^2 + 1} + 1}{\sqrt{} - 1}$$

$$P = \frac{Q}{l} \ln \frac{2 + 2\left(\frac{q}{l}\right)^2}{2\left(\frac{q}{l}\right)^2} \qquad \frac{1 + \left(\frac{q}{l}\right)^2}{\left(\frac{q}{l}\right)^2}$$

$$P = \frac{Q}{l}\, 2 \ln \frac{l}{q}$$

$$\frac{1 + x}{x} = 1 + \frac{1}{x}$$

$$1 + \left(\frac{l}{q}\right)^2$$

$\frac{1}{5} 10^8 \; 5\, 10^{-10} = 10^{-2}$ el stat/cm

$\frac{l}{q}$ ln 20

$6\, 10^{-2} \times 5\, 10^{-10}$ el stat

$\frac{1}{100}$

$5 \times 6 \times 6\, 10^{23} \cdot 10^{-12} = 300 \times 10^{11} = 2\; 10^{13}$ ergs

$= 2\, 10^{11}$ ergs

$2\, 10^4$ Joule

$\boxed{5{,}000 \text{ Cal}}$

$\boxed{\sqrt{\overline{V_x^2}}}$

$$\boxed{\frac{1}{2} m\left(\overline{V_x^2} + \overline{V_y^2} + \overline{V_z^2}\right) = \frac{3}{2} kT}$$

$$\frac{3}{2} m \overline{V_x^2} = \frac{3}{2} kT$$

$$\sqrt{\overline{V_x^2}} = \sqrt{\frac{kT}{m}}$$

~~$M \frac{1}{3} \overline{v^2} = RT$~~

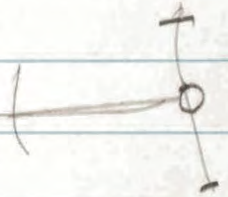
$P = nb$

$\frac{1}{3} \sqrt{\overline{v^2}}$

$$\frac{m u^2}{2} = \frac{3}{2} RT$$

$$\sqrt{\overline{u^2}} = \sqrt{\frac{3RT}{m}}$$

$$\frac{1}{3} N \sqrt{3} \frac{1}{\sqrt{m}} \sqrt{kT}$$



$$\overline{V}_{x_{\text{forward}}} = \frac{\int_0^\infty v\, e^{-\frac{1}{2}\frac{mv^2}{kT}}\, dv}{\int_0^\infty e^{-\frac{1}{2}\frac{mv^2}{kT}}\, dv} = \frac{\frac{1}{2a}}{\frac{1}{2}\sqrt{\frac{\pi}{a}}} = \frac{1}{a}\sqrt{\frac{a}{\pi}} = \sqrt{\frac{1}{a\pi}}$$

$-aV^2$

$$= \sqrt{\frac{2kT}{\pi m}} = \sqrt{\frac{2RT}{\pi M}}$$

Debye shielding.

$$k^2 = \frac{4\pi e^2}{\varepsilon kT} \frac{1}{V} \left(z_1^2 N_1 + z_2^2 N_2 \right)$$

$z_1 = -z_2 = 1$

$N_1 = N_2$

$$k^2 = \frac{4\pi e^2}{\varepsilon kT} 2 \frac{N}{V}$$

$$\frac{e^2}{L^3 E} \cdot \left(\frac{e^2}{L} \frac{1}{E} \right) \frac{1}{L^2}$$

$\frac{1}{k}$ = shielding distance = λ

$$\lambda = \frac{1}{k} = \left(\frac{\varepsilon kT}{8\pi e^2} \frac{1}{N/V} \right)^{1/2} =$$

10^{-3} mole/liter

10^{-6} mole/cc

$10^{-6} . 6 . 10^{23}$ N/cc

$6 . 10^{17}$ N/cc

$$\lambda = \left(\frac{10^2 . 10^{-16} . 3 . 10^2}{25 . \underset{25}{5^2} 10^{-20} . \underset{2}{\cancel{6}} . 10^{17}} \right)^{1/2}$$

$$= \left(\frac{10^{-12}}{6 . 10^2 . 10^{-20} . 2 . 10^{17}} \right)^{1/2} = \left(\frac{10^{-12}}{10^3 . 10^{-20} . 10^{17}} \right)^{1/2} = 10^{-6} \text{ cm.}$$ ✓

10^{-8} cm

1 Å

$\frac{1}{3}$ mole/liter

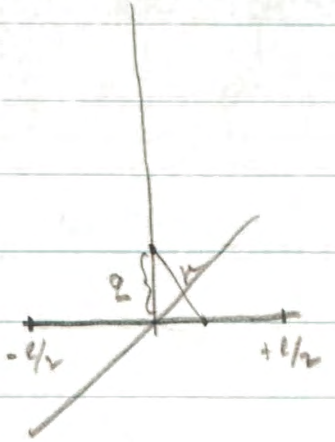
$\frac{1}{3} . 10^{-3}$ mole/cc

$\frac{1}{3} . 10^{-3} . 6 . 10^{23}$ N/cc

$2 . 10^{20}$ N/cc.

$$\lambda = \left(\frac{10^2 . 10^{-16} . 3 . 10^2}{25 . 25 . \cancel{10^{-20}} . 2 . \cancel{10^{20}}} \right)^{1/2} = \left(\frac{3 . 10^{-12}}{\underset{2}{6} . 10^2 . 2} \right)^{1/2} = \left(\frac{1}{4} 10^{-14} \right)^{1/2} = \frac{1}{2} 10^{-7} . \text{cm}$$

$$\boxed{\lambda = 5 \text{ Å}}$$



$\rho\, dx$ = (linear) charge element =

$= \frac{Q}{l} dx$

$$\phi = \int \frac{\rho\, dx}{r}$$

$$r = \sqrt{x^2+q^2} \qquad = \frac{Q}{l} \int_{-l/2}^{l/2} \frac{dx}{\sqrt{x^2+q^2}} = \frac{Q}{l} \Big[\ln \left(x + \sqrt{x^2+q^2} \right) \Big]_{-l/2}^{+l/2}$$

$$= \frac{Q}{l} \ln \left(\frac{\frac{l}{2} + \sqrt{l^2/4 + q^2}}{-\frac{l}{2} + \sqrt{l^2/4+q^2}} \right)$$

$$\boxed{\phi = \frac{Q}{l} \ln \left(\frac{\sqrt{q^2 + \frac{l^2}{4}} + \frac{l}{2}}{\sqrt{q^2 + \frac{l^2}{4}} - \frac{l}{2}} \right)}$$

Q total charge

q distance of Aufpunkt from rod

l : length of rod.

$q << l$

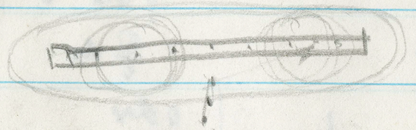
$$\phi = \frac{Q}{l} \ln \left(\frac{\cancel{\frac{l}{2}} \sqrt{1 + \frac{4q^2}{l^2}} + \cancel{\frac{l}{2}}}{\cancel{\frac{l}{2}} \sqrt{1 + \frac{4q^2}{l^2}} - \cancel{\frac{l}{2}}} \right) =$$

$$= \frac{Q}{l} \ln \frac{1 + 2\frac{q^2}{l^2} + 1}{\cancel{1} + 2\frac{q^2}{l^2} \cancel{-1}} = \frac{Q}{l} \ln \frac{\frac{q^2}{l^2} + 1}{\frac{q^2}{l^2}} =$$

$$= \frac{Q}{l} \ln \left(1 + \frac{l^2}{q^2} \right) \sim \frac{Q}{l} 2 \ln \frac{l}{q}$$

$\frac{e}{l}(z)$ $e, \varepsilon, \frac{N}{V}$

$\frac{e^2}{l}$

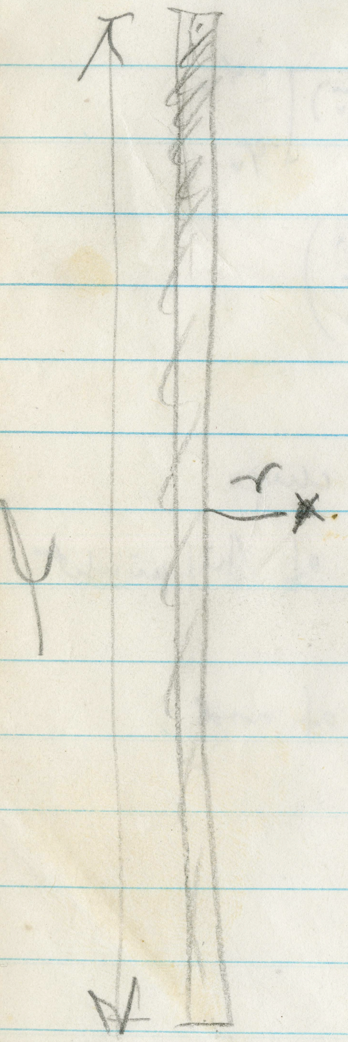


$\varepsilon < r$

$\Delta\psi = \rho$

$\rho = \rho_0 e^{-e\psi/kT}$

$\rho_0(1 - e\psi/kT)$



$E = \frac{e^2}{l}$ $\Delta\psi = \rho_0(1 - \psi/kT)$

$l = \frac{e^2}{E}$

$\frac{1}{\varepsilon}\left(\frac{V}{N}\right)^{1/3}$

$E = \frac{e^2}{\varepsilon\sqrt[3]{\frac{V}{N}}}$

$$\boxed{l = \frac{1}{\varepsilon}\sqrt[3]{\frac{V}{N}}} = \frac{1}{\varepsilon\, c^{1/3}}$$

$\frac{1}{5} \cdot 10^{-3}$ mole/liter

$\frac{10^{-6}}{5}$ mole/cc

$\frac{10^{-6}}{2} \cdot$ [illegible] N/cc

$\frac{10^{-5}}{6} \cdot 10^{-23} = \frac{10^{-28}}{6}\ \frac{N}{cc}$

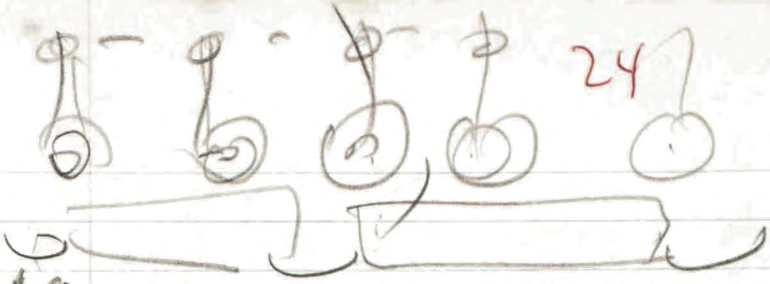
$\frac{10^{-6}}{2} \cdot 6 \cdot 10^{22}$ N/cc

$2 \cdot 10^{17}$ N/cc

$200 \cdot 10^{15}$ N/cc

$c^{1/3} = 6 \cdot 10^5$

$l = \frac{1}{100 \cdot 6 \cdot 10^5} = \frac{1}{6}\, 10^{-7}$ cm



24

~~ABCD~~ ~~64~~

24

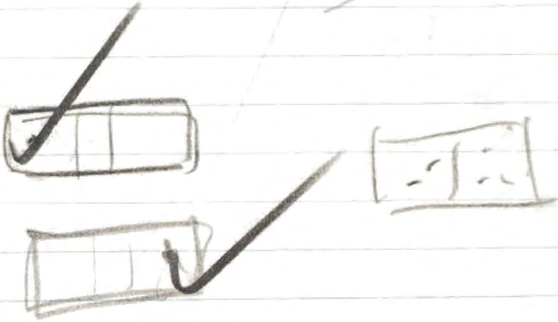
~~A~~ ~~24~~

AA ~~AA~~ ~~2 x4 = 8~~ 3x4=12

~~AA~~

~~A A~~

~~12~~
~~4~~
~~52~~



1) 

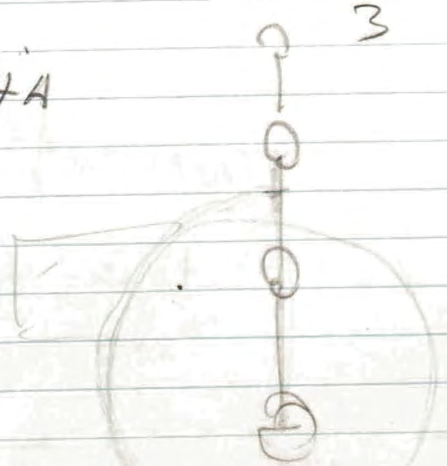
Check:

2) ABCD

3) A BC CB BD DB CD DC

4) AA
AA
A A

24
12
12
12
4
64



3

32

H

Enzymes

Acetyl Orn E(2) ~~Anth...~~ ornithine

~~...~~

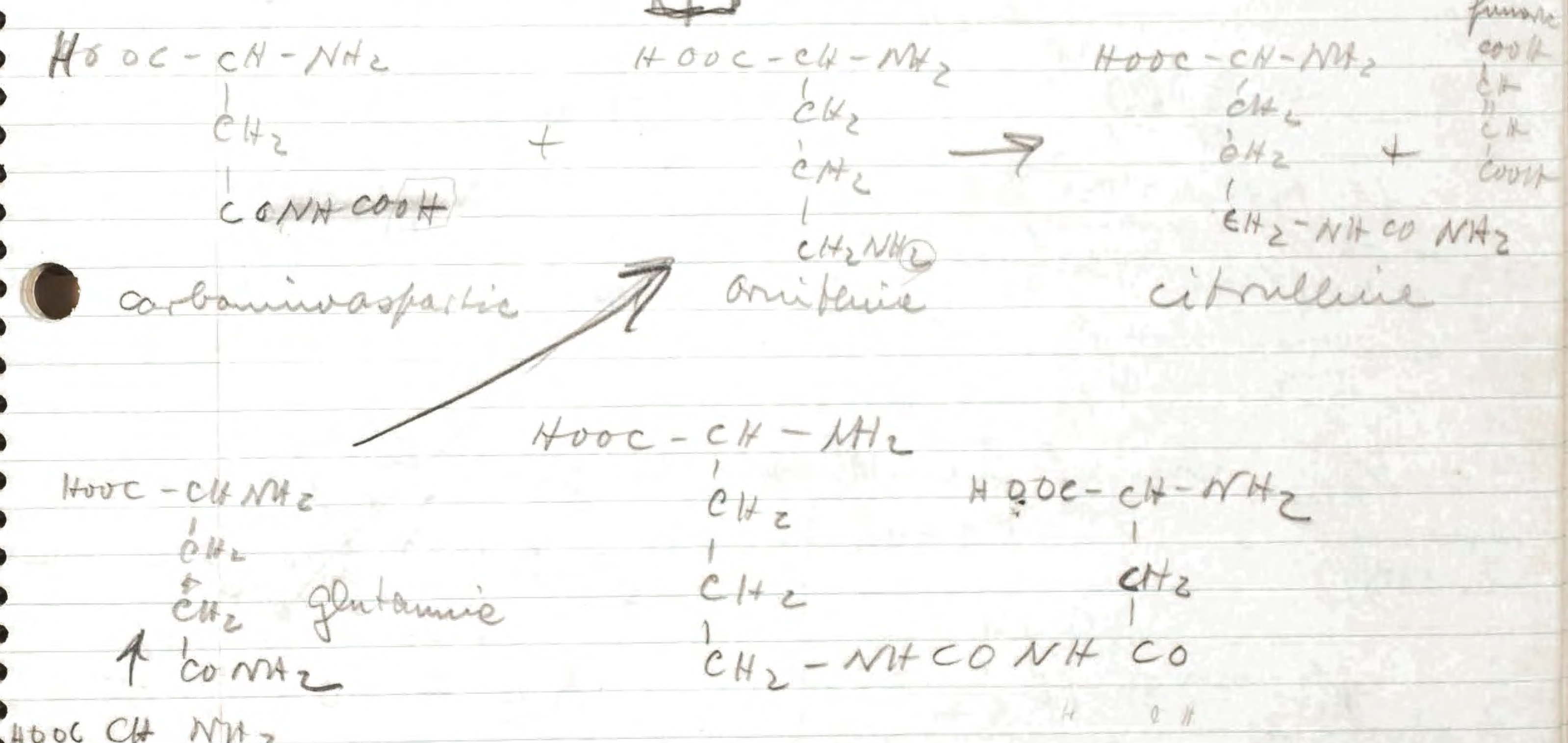
hydrolises

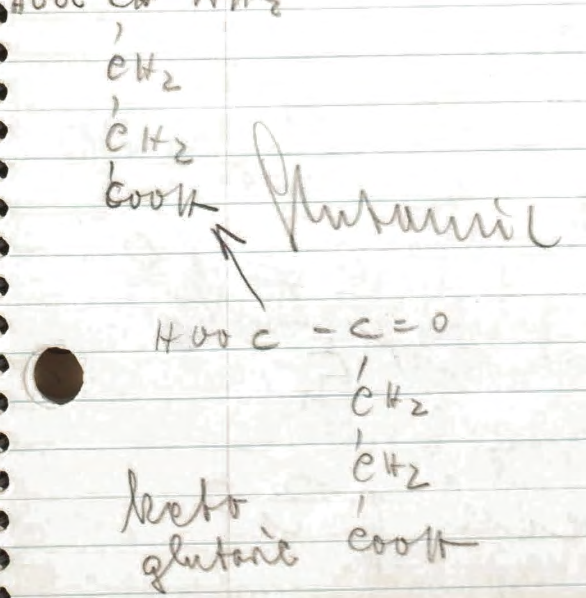
free acetic acid

ornithine E(1)

+

Carbamino aspartic acid





Also whole fundamental problem —

Baldwin

29

$A = \rho\ 6\,10^{23} \times 10^{-3}\ \sigma\ p\ \cancel{v}\ 1.5\,10^{4}$ $\times 10^{-15}$ $v \equiv 1.5\ 10^{4}$

10^{-15}

$\boxed{p = 1/10}$

~~2A~~ $\boxed{A = 10^{10}}$

$5\,10^{3}$

$\boxed{A = 10^{9}}$

$2A\,K_{AA} = 300$

~~$2A/K_{AA}$~~

$K_{AA} = \dfrac{300}{2\,10^{10}}$

$= \frac{3}{2}\,10^{-8}$

K larger if A smaller

K_{AA}

$2K_{AA}A$ = rate of emp = 60

$K_{AA} = \frac{3}{2}\,10^{-9}$

$\boxed{K_{AA} = 3\,10^{-8}}$

K_E must be ~~[illegible]~~ larger by factor 30

$K_E = 5.10^{-7}$

$\dfrac{\rho}{K_E} = \dfrac{1}{6{\times}5}\dfrac{10^{-6}}{10^{-7}} = \dfrac{10}{30}$

not repressed

$A_E = \frac{1}{30}10^{9} = \frac{1}{3}10^{8} = 3\,10^{7}$

$K_E = \dfrac{60}{6\,10^{7}} = 10^{-6}$

$K_E = 5 \times 10^{-8}$

~~[illegible]~~

$\dfrac{\rho}{K_E} = \dfrac{1}{6{\times}5}\dfrac{10^{-5}}{10^{-8}} = 30$

$\dfrac{\rho}{K_E} = \dfrac{10}{6}$

3 v [illegible]

repressed

continued p 30

28

Enzyme Regulation

$\frac{2}{10}$ gm protein in ~~10^{12} cc~~ 1 cc

or 1 AA = $\frac{1}{20}$

$= \frac{2}{200} = \frac{1}{100}$ gm ~~P~~ AA / cc made in 30 min

by 100 to 1000 E

10^{-4} gm mols AA made per cc in 30 min

~~total per enzyme molecules / cell 10^{-12}~~

10^{14} Enzyme Molecules/cc

10^{17} E per liter

$\frac{10^{17}}{6\,10^{23}} = \rho = \frac{1}{6}\,10^{-6}$

10^{15} E/cc

10^{18} E/liter

$\boxed{\rho = \frac{1}{6}\,10^{-5}}$

AA made in 30 min 10^{-4} gm mols / cc

or per sec ~~A~~ per cc

$\frac{10^{-4}}{\underbrace{30 \times 60}_{2000}}$ gm mols $= \frac{1}{2}\,10^{-7}$ gm mols per sec per cc

3060

$\frac{1}{2}\,10^{-7}\;6\,10^{23}$ Molecules of AA per sec per cc

$= \boxed{3\,10^{16}}$

~~Nevap~~ rate of evap

300 per sec

rate of evap

if half of enzyme is complexed

30 per sec

60 per/sec

31

Point trigger mispairs.

---

makes A(n) at rate $\underline{\underline{10}}^{E}$ / cell

$$\frac{3\ 10^{6}}{f}$$

~~[illegible]~~ foro

30

(H)

~~1000~~ Average Enzyme level

$\frac{2}{10}$ gm Protein/cc

$\frac{2}{10}\ 10^{-4}$ gm/ per ~~Enzyme~~ kind of
cc

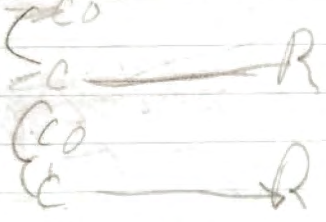
$\frac{2}{10}\ 10^{-4}\ 10^{-5}\ 6\ 10^{23}\ 10^{-12}$ Enzyme molecules per bact

$\sim 10^{-21}\ 10^{23}$ = 100 Enzyme Molecules on average. —

$\text{acetyl O} \xrightarrow{E(2)} \text{Ornithine} \xrightarrow{E(1)} \text{Citrulline} \rightarrow \text{Arg}$

T-■-Citrulline

T-□-A



A — MN

$A \xrightarrow[E(1)]{} A(1) \xrightarrow[E_2]{} A(2) \rightarrow A(n-1) \overset{E_n}{\Rightarrow} A(n)$

$A\!-\!T \rightarrow A(1)^{*}\!-\!MN \rightarrow A(2)\!-\!MN \quad \text{Arg}(n-1) \xrightarrow{E_n} \text{Arg}\ n$

A(n-1)

T — Mu — AA(1)

$AA(1)\!-\!Mu + T(1) \overset{E_0}{\rightleftarrows} AA\!-\!Mu \sim T(1) \quad T(n) \sim Mu\!-\!AA(n)$

An inducer is a what is present in larger quantity than ~~the~~ normally is the precursor and has a ~~a lower~~ higher K for the enzyme than

An inducer is

a.) a chemical analogue that ties up the enzyme even if the inducer does not couple with the ~~trigger~~ receptor

b.) ~~a good~~ a chem analog that couples with the receptor ~~is a~~ and is a ~~good~~ better trigger ~~when free~~ than its direct counterpart.

c.) a chem analog that ~~the stop~~ is a moderate trigger but has a high K for the enzyme

"Quadratic" equation for "Tryptophane Synthetase"

$$\underset{\cancel{b+c}}{a}\,\cancel{rec(0)}[E] + b\,\cancel{rec(0)} - \cancel{A}(E)\,\frac{E}{\tau} = 0$$

is not quadratic + indep of rec(0)

32

~~count~~ continued from page 29

What K_E can we stand

Number of tyr residues on template that are tied up is given by

$$\frac{1}{1 + \frac{\rho_E}{K_E}}$$

for $\underline{1000}$ enzyme molecules per cell

$A_E = 3\,10^{7}$

$\rho_E =$ [illegible] $\frac{1}{6}\,10^{-5}$

$\rho A_E =$ [illegible]

$$\boxed{K_E = 10^{-6}}$$

fraction tied up

$$1 - \frac{1}{1+\frac{\rho_E}{K_E}} = \frac{\frac{\rho_E}{K_E}}{1+\frac{\rho_E}{K_E}}$$

$$\frac{\rho_E}{K_E} = \frac{10}{6}$$

~~for 100 enzymes molecules per cell~~

$\rho = \frac{1}{6}\,10^{-6}$ [illegible] $K_E = 10^{-5}$

$$\frac{\rho_E}{K_E} = \text{[illegible]}\ \frac{1}{60}$$

Saturation begins

if $K_E = 30\ 10^{-5} = 3\,10^{-4}$

at $\rho(E) =$ ~~$3\,10^{-1}$~~ $\frac{1}{3}\,10^{4}$

of 10000 E per cell or ~~10^{16}/cc~~ $\rho_E = \frac{1}{6}\,10^{-4}$

$\sim 2\,10^{-5}$

$$\frac{\frac{\rho}{K}}{1+\frac{\rho}{K}}$$

not saturated at all!

New considerations
May 27/57

10^2 enzyme per cell is ~~..~~ !

10^{14}/cc 10^{17} per liter and

$$\rho_E = \frac{1}{6} 10^{-6} \sim 2\,10^{-7}$$

What fraction of metabolite is ~~f~~ free

$$\frac{1}{1 + \frac{\rho\,\cancel{m}\,E}{K_m}}$$

if ρ is increased by 100 ($E = 10^4$/cell)

$$\rho_E = 2\,10^{-5}$$

$$MK = 10^{-5}$$

concentration of trigger reduced by factor 3 and since there is competition between triggers and rate of enzyme is reduced also !

fraction of template covered by trigger

$$\frac{\frac{\rho^*(Trig)}{K(Templ)}}{1 + \frac{\rho^*_{Trig}}{K_{Templ.}}} = \frac{\frac{\rho_{TR}}{K_{Te} + \rho_E \frac{K_{Te}}{K(Tr-E)}}}{1 + \text{ditto}}$$

ρ^* is free trigger

$$\rho^*_m = \frac{\rho_{Trig}}{1 + \frac{\rho_E}{K(Trig\ to\ E)}}$$

$p = \frac{1}{10}$ substrates conc. H

$A_1 = A_2$ 10^{-3} gm/l

~~[illegible]~~

$\rho_2 = \rho_1$ 10^{-5} molar

10^4 enzymes / cell ~~[illegible]~~

10^{14} E/cc makes $3\,10^{16}$ AA/sec.

300 ~~[illegible]~~ per E per sec

10^{-15}

10^{10}

6.10^{23} $\bigcirc{10^{-5}}$ 10^{-3} ~~[illegible]~~ 1.5×10^4 $\sigma . p = A\rho$ / per E

ρ

~~$A = 6\,10^{23}$~~ ~~10^{25}~~ $\underline{10^9}$

$\rho = 10^{-5}$ $2AK_1$

$A\rho = 10^4$/sec

$$\underline{A\rho}\ \frac{\rho/K_1}{1+\rho/K_1} \times [E]/cc = 3\,10^{16}$$

smaller ~~10^6~~ $10^4 \times 10^{14} \times X = 3\,10^{16}$

$= \bigcirc{\frac{3}{100}}$

10^{14}/cc

$\rho E = \boxed{\frac{1}{6}\,10^{-6}}$

$\sim 2\,10^{-7}$

$$\frac{10^{17}/\text{liter}}{6\,10^{23}} = \frac{1}{6}\,10^{-6}$$

Paper

$$(1-e^{-\beta t}) = \qquad e^{-\frac{1}{gm}} = 1-\frac{1}{gm}$$

~~$(1-e^{-\beta t}) =$~~

~~$\ln \beta t =$~~

$$e^{-\beta t} = \frac{1}{gm}$$

$$\beta t = \ln gm$$

$$N = \frac{\alpha}{\beta-\alpha}\left[e^{-\alpha t} - e^{-\beta t}\right] = \frac{1}{gm}$$

$$N = \frac{1}{gm}$$

$$1-N = e^{-\frac{1}{gm}} = 1-\frac{1}{gm} \qquad \ln(1-y)$$

$$N = \frac{\alpha/\beta}{1-\alpha/\beta}\left(e^{-\alpha t} - e^{-\beta t}\right) = \frac{1}{1000}$$

$$= \frac{\alpha/\beta}{1-\alpha/\beta}\, e^{-\beta t}\left(e^{\beta(1-\frac{\alpha}{\beta})t} - 1\right) = \frac{1}{gm}$$

$$\frac{1}{N} = \frac{1-\alpha/\beta}{\alpha/\beta}\, e^{+\beta t}\, \frac{1}{e^{\beta(1-\frac{\alpha}{\beta})t} - 1} = gm$$

$$\ln gm = \ln \frac{1-\alpha/\beta}{\alpha/\beta} + \beta t + \ln \frac{1}{e^{\beta(1-\frac{\alpha}{\beta})t} - 1}$$

β lost rate $A\rho$.

$$e^{(1-\frac{\alpha}{\beta})\ln m}$$

$$e^{\ln m^{(1-\alpha/\beta)}} = m$$

$$\ln \frac{1}{m}$$

$$-\ln m$$

$$\alpha = 2AK \qquad \beta >> \alpha$$

$$-\ln(e^{x}-1)$$

$$-\ln e^{x}\left\{1-\frac{1}{e^{x}}\right\}$$

$$\ln gm = \ln\frac{1-\alpha/\beta}{\alpha/\beta} + \beta t - \beta\left(1-\frac{\alpha}{\beta}\right)t + \frac{1}{e^{\beta(1-\frac{\alpha}{\beta})t}}$$

$$\ln gm = \alpha t + \ln\frac{1-\alpha/\beta}{\alpha/\beta} + \frac{1}{e^{\beta(1-\frac{\alpha}{\beta})t}}$$

New computation for I

Ⓗ luck

~~$\left[[1-e^{-\alpha t}] + e^{-\beta t}\right]$~~ = probab. that [illegible] filled with new particle

~~$W(t)$~~

~~$W(t)\,e^{-\beta t W(t)}\,dt$~~

~~$e^{-\beta\int_0^t W(t)\,dt}$~~

~~$e^{-\beta\int_0^t t(1-e^{-\alpha t})\,dt}$~~

For paper

~~$e^{-(\beta t+1)}$~~

~~$e^{-\beta t}\int_0^t t\,W(t)\,dt$~~

~~$W(t)=\{1-e^{-\alpha t}\}$~~

$W(t)$ = number free at time t

$W'(t)$ - number that becomes free at ~~times~~ between t and ~~$t+dt$~~ λ and $\lambda+d\lambda$

① $$N = \int_0^{\lambda=t} e^{-\beta(t-\lambda)}\,W'(\lambda)\,d\lambda$$ = number ~~empty~~ not filled with new particle

② $$W(\lambda)=\{1-e^{-\alpha\lambda}\}$$

see other book p. 66 Bulois

~~$$N = e^{-\beta t}\int_0^{\lambda=t} e^{\beta\lambda}\,\alpha\,e^{-\alpha\lambda}\,d\lambda$$~~

$$N = \frac{\alpha}{\beta-\alpha}\left[e^{-\alpha t} - e^{-\beta t}\right]$$

α rate of evap.

$$(1-N)^m = e^{-\frac{g}{g}\frac{1}{t}}$$

g is integer (not large)

$$1-N = e^{-\frac{1}{gm}} = 1-\frac{1}{gm}$$

Can precursor be inducer – directly; without MuN? !

$\rho = (1\,\text{mgm}/l)\,4 = 10^{-5}$ moll/liter

Hit rate:

$$A\rho = \rho\; 6\,10^{23}\;10^{-3}\;1.5\,10^{4}\;\overset{10^{-15}}{\sigma}\;\overset{\frac{1}{10}}{p}$$

$$\rho\;10\;10^{20}\;10^{4}\;10^{-16} = \rho\;10^{9}$$

$A = 10^9$

$$\frac{1}{1+\frac{10^{-5}}{K}}$$

K can be [illegible] set because enzyme must not bother Arginine on Templates.

$K_E = 30K$

$$\frac{\frac{\rho_E}{K_E}}{1+\frac{\rho_E}{K_E}}$$ is fraction complexed

$$\boxed{\frac{\rho_E}{K_E} << 1}$$

$$\cong \frac{\rho_E}{K_E}\left(1-\frac{\rho_E}{K_E}\right)$$

$$\frac{\rho_E}{K_E} < \frac{1}{100}$$

$K_E > 100\rho_E$

$K > 3000\rho_E$

for 100 E/cell, $\rho E \cong \frac{1}{6}\,10^{-6}$

$$\boxed{\begin{aligned}\alpha t &= \ln q m - \ln\frac{\beta}{\alpha}\\ &= 1 + \ln m - \ln\frac{\beta}{\alpha}\end{aligned}}$$

For paper

$$T = \cancel{\frac{1}{A\rho}}\ T_1 + T_2 \qquad T_2 = \frac{1}{\alpha}\overbrace{\left\{\ln q m - \ln\frac{\beta}{\alpha}\right\}}^{B}\beta$$

$$\alpha = 2\cancel{A\rho}\frac{K}{\rho}.$$

$$T_2 = \frac{1}{A\rho}\cancel{\frac{K}{\alpha}}\frac{\rho}{2K}\left\{1+\ln m - \ln\frac{\beta}{\alpha}\right\}$$

$$T_1 = \frac{1}{A\rho}\ \frac{m}{1+\frac{\rho}{K}}$$

$$T = \frac{1}{A\rho}\left\{\frac{m}{1+\frac{\rho}{K}} + \underbrace{\Big(\underbrace{1+\ln m}_{7} - \ln\frac{\beta}{\alpha}\Big)\frac{\rho}{2K}}_{B}\right)$$

$$\{\underbrace{1+\ln 30}\}\,5$$

$$\frac{m}{\left(1+\frac{\rho}{K}\right)^2} = \frac{B}{2}$$

$$\left(1+\frac{\rho}{K}\right)^2 = 2\frac{m}{B}$$

$$\boxed{\frac{\rho}{K} = \sqrt{\frac{2m}{B}} - 1}$$

$$\boxed{\frac{\rho}{K} = 9}$$

$$T = \frac{1}{A\rho}\underbrace{\left\{\underset{\substack{\|\\30}}{\frac{m}{10}} + 23\right\}}_{53}$$

Good

Ind enzyme theory

$$\frac{2AK}{X_1}\, E_1 \frac{\frac{X_1}{K}}{1+\frac{X_1}{K}} = \rho(X_2)$$

$$\rho(X_3) = {}^{2AX_1}$$

$$\frac{dE_2}{dt} = a_2 \frac{\frac{X_2}{K}}{1+\frac{X_2}{K}} - \frac{E}{\tau}$$

II recovery of enzyme level:

II

III

write (memo) on hetero-caryons for Yanofsky

[Precursor]

[AA]

$$a_1 \frac{\rho^1/K_1}{1+\rho_1/K_1+\frac{\rho_2}{K_2}} + a_2 \frac{\frac{\rho_2}{K_2}}{1+''+''}$$

~~a_2~~

$a_2 = 0$

Remark. Repression!

If we assume precursor conc 10^{-5} M/l in wild type and ~~steps~~ of repression is 100 fold

then ~~$\frac{\rho_A}{K_A} = 100 \frac{\rho_{Prec}}{K_{Prec}}$~~

100/cell

$K = \frac{3000}{6} 10^{-6}$

$K = 5\,10^{-4}$ H

1000/cell

$K = \frac{3000}{6} 10^{-5}$

$K = 5\,10^{-3}$

---

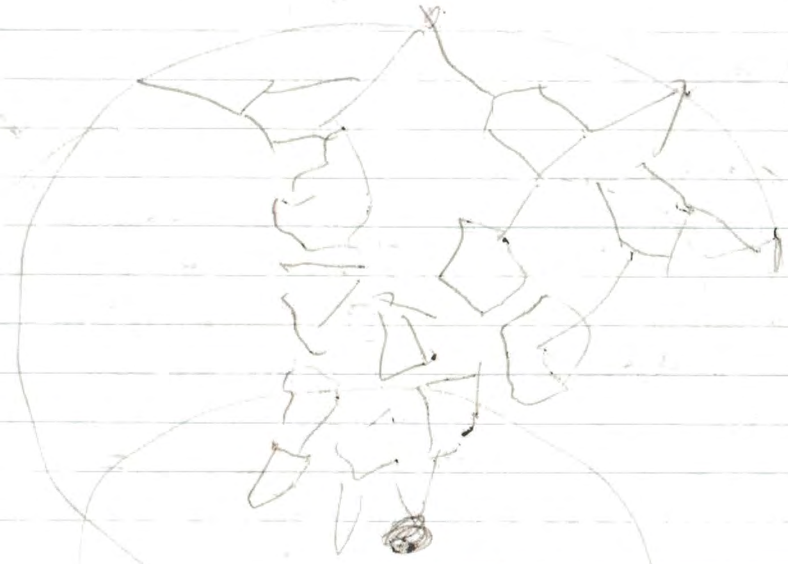
liberation by arginine $\frac{1}{20}$ of max
liberation by ornithine max
This way arginine can not repress.

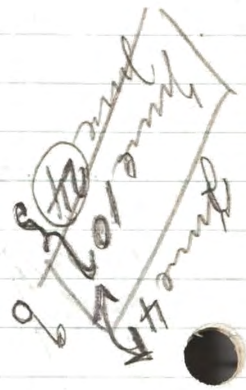
What does turnover number of say 1000/min mean for arginine synthesis:
Number of enzymes 100/cell;
10^{14} per cc must make
$3\,10^{16}$ arg molecules per sec

or 300 per sec (if saturated)

turnover number per min 300x60

Maximum enzyme content
quoted by Mitchell work
0.1% or $\frac{1}{1000}$ gm/cc ~ 10^5 E/cell at
10^5 mol weight





5 10^3 genes   5 10^4 paragenes
or 10 paragenes
per enzyme

5000 diff enzymes   how many
of each?

0.1 gm Protein/cc

~~####~~ $\frac{1}{5} 10^{-4}$ gm

$\frac{1}{5} 10^{-4} \times 10^{-5} \; 6 \, 10^{23} \; 10^{-12}$

≈ $\boxed{100}$

5 to 10 paragenes

Repression by Arg:

H

$$\frac{\frac{\rho_{pres}}{K_{prec}}}{1+\frac{\rho_{prec}}{K_{prec}}} = 100\,\frac{\frac{\rho_{prec}}{K_{prec}}}{1+\frac{\rho_{prec}}{K_{prec}}+\frac{\rho_A}{K_A}}$$

$$\frac{\rho_A}{K_A} >> 100$$

$2/\rho = 10^{-5}$

$K_A \sim 10^{-7}$

Correction for Proteins

Dry weight of Bacteria $\frac{1}{5}$ of this $\frac{2}{3}$ Prot. or

$\frac{2}{15}$ gm of Protein / cc = 0.13 gm

TMG induces; 2% of Proteins is enzyme Z in fully induced wild type. Constitutive may be 5 times higher in enzyme

---

1 gm DNA 4 gm Prot

1 Nucleotide 40 Amino acids

DNA $\frac{1}{5}\,10^{-12}\,\frac{3}{100} \sim \frac{1}{2}\,10^{-14} = 5\,10^{-15}$ gm

$5\,10^{-15}$ gm $\frac{6\,10^{23} \times 5\,10^{-15}}{10^3}$ Nucleotides

$\frac{30 \times 10^{23} \times 10^{-15}}{300\,10^3}$ half genes $= 10^4$ half genes

$$A \frac{\frac{x_{n-1}}{K_1}}{1+\frac{x_{n-1}}{K_1}+\frac{x_n}{K_2}} E_n \quad (\quad) E_{n+1} = \frac{dx_n}{dt}$$

$X_{(n-1)}\ E_n$

4

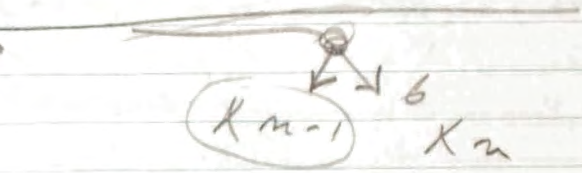
$$a\,\frac{\frac{X_{n-1}}{K_1}}{1+\frac{X_{n-1}}{K_1}+\frac{X_n}{K_2}}\,E_n = \delta(x_n)\ a\,\frac{\frac{X_n}{K}}{1+\frac{X_n}{K}}\,E_{n+1}$$

$$b\,x_{n-1} = E_n$$

$$\frac{\frac{(X_{n-1})^2}{K}}{1+\frac{X_{n-1}}{K}} =$$

$a > b$

$$\boxed{\frac{a\frac{X_{n-1}}{K_1}+b\frac{X_n}{K_2}\quad \cancel{E_n}}{\frac{X_{n-1}}{K_1}+\frac{X_n}{K_2}} - \frac{E_n}{\tau}} = \frac{dE_n}{dt}$$



$$\frac{[E_a]}{[E_b]} = \frac{\frac{X_{n-1}}{K_1}}{\frac{X_n}{K_2}}$$

$$a[E_a] + b[E_b]$$

$$\boxed{[E_a] + [E_b] = 1}$$

$$[E_a] = 1 - [E_b]$$

$$\frac{1}{[E_b]} - \cancel{1} = \frac{X_{n-1}/k_1}{X_n/k_2} + 1 = \frac{X_{n-1}/k_1 + X_n/k_2}{X_n/k_2}$$

$$[E_b] = \frac{X_n/k_2}{X_{n-1}/k_1 + X_n/k_2}$$

May 30 /57

Computation

Of K_{AA} for arginine to enzyme making arg.

3 10^{16} AA molecules made per cc per sec $= \frac{1}{2AK} \rho_E \, f/_{\text{free}}$ fraction)

① or per cell $3\,10^4 \leq N_E f \cdot \cancel{\frac{2AK}{2AK}}$ $= N_E \frac{\rho/K}{1+\frac{\rho}{K}} \frac{2AK}{\cancel{2AK}}$
sec/bact

$$= N_E \frac{1}{1+\frac{\rho}{K}} A\rho$$

$$= N_E \frac{\rho A}{1+\frac{\rho}{K}}$$

$$\sim N_E AK$$

we shall vary N_E

$K_E = 30K$

$$\frac{\rho_E}{K_E} \frac{1}{1+\frac{\rho}{K}} < \left\{\frac{1}{10}\right\}$$

$$\frac{\rho_E}{K} \frac{1}{1+\frac{\rho}{K}} \leq 30 \left\{\frac{1}{10}\right\}$$

② $\frac{10^{12} \times}{6\,10^{23}} \frac{N_E}{K} \frac{1}{1+\frac{\rho}{K}} \leq 30 \times \left\{\frac{1}{10}\right\}$ ~~$N_E = 30\left(\frac{1}{10}\right) K \times (1+\frac{\rho}{K})$~~

$= 10^{12} N_E K = 30\left\{\frac{1}{10}\right\}$

Use = sign

② $N_E = 30\left(\frac{1}{10}\right)\left(1+\frac{\rho}{K}\right) K$

① $3\,10^4 = 30\left(\frac{1}{10}\right) A\rho \times 10^{-12} \times K$

$\{10\}\, 10^3\, 10^{+12}\, 10^{-9} = \rho K$

$\{10\}\, 10^{15-9} = \rho K$

$10^7 = \rho K$

$\boxed{A = 10^9}$

Roberts

Roberts

600 micromol of RNA-tide per gm dry

40S particle Mol weight $\times 10^6$ (50%

Protein, —

Average Mol weight of nucleotide (RNA)
325

0.5 μ mol proline (pool) per gm dry cell

$\frac{1}{2}$ 10^{-6} mol per gm.

$\frac{1}{5}$ $\frac{1}{2}$ 10^{-6} mol/cc = 10^{-7} mol/cc

or 10^{-4} mol/liter proline

when grown on glucose !!

5% of proline in protein —

concentration ratio 1:500

saturation pool 240 μ mol/gm dry

$6\,10^{2}\,10^{-6}$ ~~mol~~ × 325 gm per gm dry

$2\,10^{5}\,10^{-6}$ = 20% of dry weight RNA

Koch and Pretman

2.75 or 4 μMol per 10^{12} B

3×10^{-6} mol/cc or per liter

$3\,10^{-3}$ mol/l

or ~~tetra~~ tri-nucleotide

10^{-3} mol/l

I assume 10^{-5} molar. —

David ②

$$K_1\rho = 3\,10^4\,\frac{1}{30}\{10\}\,\frac{1}{6}\,10^{-8}$$

$$= \frac{1}{60}\{10\}\,10^{-4}$$

~~Was nothing useful!~~

It gives nothing useful!

De Novo

for make thing. a bubble must combine with ~~an~~ a free energy [illegible]

$$N_E \frac{1}{1+\frac{\ell}{K}}\,2AK$$ is rate of Prod.

① $N_E^*\,2AK \geq 3\,10^4$ $\quad K > \frac{3\,10^4/\text{sec}/\text{bact}}{2AN_E^*}$

② $\frac{N_E^*}{K} \leq 30\{\frac{1}{10}\}\times 6\,10^8$ $\quad K > \frac{N_E^*}{30\{\frac{1}{10}\}\,6\,10^8}$

~~$K_{\min} = \frac{3\,10^4}{2AN_E^*} = \frac{N_E^*}{30\frac{1}{10}}$~~

$$6\,10^8\,\frac{1}{2}\left(\frac{1}{10}\right)30\times 3\,10^4 = (N_E^*)^2$$

$A = 10^9$

$$\sim \frac{3\times 3\times 3\,10^3\,\cancel{A}\,10^8}{10^9} \cong 3\,10^3$$

$N_E^* = 50$

H

~~① $3\,10^{4} = N_E A K$~~

~~② $10^{12} / N_E K = 30\{\frac{1}{10}\}$~~ }

~~for $A = 10^{9}$~~

~~① $3\,10^{-5} = N_E K$~~

~~②~~

~~$N_E = 100$ / $A = 10^{9}$ / $K = 3\,\frac{10^{-5}}{100}$~~

① ~~$3\,10^{4} =$~~ $N_E \frac{\rho/k\,AK}{1+\rho/k} \geq 3\,10^{4}$

② $\frac{\cancel{10^{15}}}{6\,10^{23}} \frac{N_E}{K} \frac{1}{1+\rho/k} \leq 30\{\frac{1}{10}\} \times 6\,10^{8}$

~~$k\rho A = \{10\}\frac{1}{30}\,\frac{3\,10^{4}}{6}\;10^{-11}$~~

~~for $A = 10^{9}$ $k\rho = \frac{\{10\}}{10}\,\frac{1}{6}\,10^{-5} \times 10^{-11}$~~

~~② $\frac{N_E}{K}\,\frac{1}{\frac{1+\rho}{K}} \leq 30\{\frac{1}{10}\}\,6\,10^{8}$~~

~~for $N_E = 100$ $N_E\rho\,\frac{1}{1+\frac{\rho}{K}} \leq 3 \times 6\,10^{8}$~~

② $\frac{\rho E}{K}\,\frac{1}{1+\frac{\rho}{K}} < \frac{30}{10} \times \{\frac{1}{10}\}$ ~~$k = \frac{1}{2}\,10^{-7}$ old res.~~

$\rho E = \frac{10^{15}}{6\,10^{23}}\,N_E$

② $\frac{N_E}{K}\,\frac{1}{1+\rho/K} \leq 30\{\frac{1}{10}\}\,6\,10^{8} \equiv$

$N_E \leq 100$ $\rho L K$

$20\,10^{+6} = \frac{1}{K}$

Assume

$$\frac{dE_n}{dt} = \frac{\overset{B_1}{\cancel{\frac{B(n-1)}{K(n-1)}}}\,\frac{\rho(n-1)}{K_1\cancel{(n-1)}} + \overset{B_2}{\cancel{B(n)}}\,\frac{\rho(n)}{K_2\cancel{(n)}}}{\textcircled{1+}\;\frac{\rho(n-1)}{K_1} + \frac{\rho(n)}{K_2}} - \frac{E(n)}{\tau}$$

Antibody ① can be neglected.

Postcursors; 1 is important

~~[illegible]~~ precursors; 1 is not important

H

~~① $K > \frac{3\,10^4}{10^9} = 3\,10^{-5}$~~

~~② $K > \frac{30}{3 \times 6\,10^{+8}} =$~~

① $K > \frac{3\,10^4}{2AN^*}$ | $\frac{3\,10^4}{3\,10^9\,10^2} = 10^{-7}$

② $K > \frac{N^*}{30\left(\frac{1}{10}\right)6\,10^8}$ | $\frac{1.4\,10^2}{3 \times 6\,10^8} \simeq 10^{-7}$

$\frac{3\,10^4}{2A} = \frac{(N^*)^2}{3 \times 6\,10^8}$ | $(N^*)^2 = \frac{3\,10^4\,3 \times 6\,10^8}{2A}$

$= 27\,10^3 \simeq 3\,10^4$

$N^* = 1.4 \times 10^2$

---

②$^{\times}$ $K > \frac{N^*}{30\left\{\frac{1}{100}\right\}6\,10^8}$

① $K > \frac{2\,10^4}{2AN^*}$

$(N^*)^2 = \frac{30\,\frac{1}{100}\,6 \times 10^8\,2\,10^4}{2A}$

$= 1800$

$N^* \simeq 40$

② $\frac{40}{180 \times 10^6} = 2\,10^{-7}$

① $\frac{10^{-5}}{N^*} \simeq 2\,10^{-7}$

~~N~~ $A = 10^9$

Protein

$\frac{0.1\ \text{gm}}{}/\text{cc}$

$AA = \frac{\text{gm}}{200}/\text{cc}$

$\frac{6 \times 10^{23}}{200 \times 00}\ 10^{-12}$ per bact per 30 min

$\frac{6\,10^{23}}{2}\ 10^{-16}$ ~~in 30 min~~

$3\,10^7$ in 30 min

30 × 60

$\frac{1}{6}\,10^5$ /sec

$\boxed{\sim 1.7\,10^4/\text{sec}}$

Discuss Maas

I Histidine does not suppress early enzymes (block at $\overset{E}{(-1)}$) but these start up if histidine limiting Bruce Ames N.I.H. How was this done? Explanation at wild type cause histidine saturates enzymes in statu nascendi:—

~~E(-4)~~ E(-3) — E(-2) — E(-1) — ~~X~~ — $_{Hist}$

II Same as above but block early ~~E(3)~~ — E makes irreversible steps.— all enzymes are made at normal rate when grown on histidine (same as in wild type), fits with above! —

III Acet. Orn $\xrightarrow{E(-2)}$ Orn $\xrightarrow{E(-1)}$ Citr $\xrightarrow{E}$ Arg

Vogel says both W and B strain Arg. inhibits formation of E(-2) — W strain

Werner Maas (mutant ~~E(-2)~~) in chemostat

E(-1) with arginine limitation has 25 times wild type conc ~~of~~ E(-1)

In growth tube arg suppresses E(-1) in W strain but not in B strain (according to Vogel arginine suppresses E(-2) in B strain)

Over the telephone Werner Maas says:

IV B strain mutant blocked at ~~X~~

As far as E(-1) is concerned Arginine does not suppress and Ornithine does not induce. — ! Sat with Arg ~~x~~ even at wild type conc. || Also citrullin may not be good releaser! If O is added C piles up.—

H

τ dependence

$a(\underbrace{1-q}_{\text{empty}}) = \underline{b}\underbrace{q}_{\text{full}}$ b fixed, a varies

$a - aq - bq = 0$

$$\boxed{\frac{a}{a+b} = q}$$

$$\boxed{\frac{ba}{a+b}} = \text{rate of E formation}$$

~~It~~ if a << b this is prop to a

a>>b it is prop. to b
this is usual case

~~and for a = b it falls to 1/2~~

if strongly induced b>>a (production is prop to a; indep of b.

but in between for instance when rate is reduced to $\frac{1}{2}$;

if $a \approx b$ [and a then drops to 1/2]

$$\frac{ba}{a+b} = \frac{b}{1+\frac{b}{a}} = \frac{b}{2} \quad a=b$$

$$= \frac{b}{3} \quad a=\frac{1}{2}b$$

only situation may be that b will change because of regulation.—

other alternatives:

$$a(1-q) = (b_1+b_2)\,q$$

i.e the same except we write $b_1+b_2=b$

a different theory possible if assembly from one end and trigger must sit there

I I dependence

b depends on enzyme level:

II ~~rate of triggering~~ b

$T = \frac{1}{b} + \tau$ (time of killing trap 0)

rate of enzyme prod $\frac{1}{\frac{1}{b} + \tau} = \frac{b}{1 + b\tau}$

f = fraction of time sound trigger

trigger sits on template. —

Experiments: determine arginine enzymes as a function of arg. conc. in chemostat with tryptophane control.

$\cancel{f_1 b_1}$

$\frac{f_1}{f_1}$ rate $= \frac{1}{\frac{1}{f_1 b_1} + 1 + \tau}$

$\frac{b_1}{1 + b_1\tau_0} \; f_1 + f_2 \frac{b_2}{1 + b_2\tau_0}$ arg'

$b_1\tau_0 \gg 1$ $b\tau \ll 1$

?, ~~this~~ is this possible also in theory I,

if production when combined with enzyme in statu nascendi releases trap ?

Histidine

Arginine limitation. — H

ask Hunter!

blocks before Ornit ~~E~~ (-2)

case ~~II~~ III In wild type (W) arginine high enough to repress, when arg. limiting it ~~backs up to~~ maintains an orn. and citrulline conc. which might be better releasers than arginine.

case I if histidine is limiting (block at E!) and precursor better releaser we can explain.—

I τ dependence

$$b(1-N\tau_0)=N$$

$$b-N\tau_0 b=N$$

$$b=N(1+\tau_0 b)$$

$$N=\frac{b}{1+\tau_0 b}$$

Old result!

II τ ~~dependence~~

De Novo

Assume ~~this is triggered N n times per sec and each time it takes [illegible]~~ ~~association~~ association between enzyme and trigger and trigger with template When enzyme high free trigger low. — When AA low. this gives τ independence.

$$\boxed{\begin{aligned}\frac{dx}{dt} &= \frac{1}{1+ay\cancel{c}} - kx\\ \frac{dy}{dt} &= \frac{r}{1+\cancel{ax}} - ky.\end{aligned}}$$

$$\frac{dy}{dt} = \frac{x}{y} - \frac{x}{\tau} + F$$

$$\frac{dy}{dt} = \frac{y}{x} - \frac{y}{\tau} + F$$

$$X = \hat{L}$$

$$\frac{dx}{dt} = A\frac{\frac{x}{a}}{\cancel{1}+\frac{x}{a}+\frac{y}{a}} - \frac{x}{c}$$

$$\frac{dy}{dt} = A\frac{\frac{y}{a}}{\frac{x}{b}+\frac{y}{a}} - \frac{y}{\tau}$$

$\underline{y=0}$

$$\frac{d\ln x}{dt} = A\frac{1}{1+X+\frac{y}{\alpha}} - \frac{1}{\tau} + F$$

$$\frac{d\ln y}{dt} = A\frac{1}{1+\frac{x}{\alpha}+\frac{y}{\gamma}} - \frac{1}{\tau} + F$$

$$\cancel{\frac{d(\ln xy)}{dt} = -\frac{2}{t} + \frac{2A}{1+x+y}}$$

$$\frac{d\ln\frac{x}{y}}{dt} = 0$$

?

$\ln\frac{x}{y} = \text{const}$

$\frac{x}{y} = \text{const}$

$\underline{x = \frac{1}{\alpha}y}$ $\quad y = \alpha x$

$$\frac{d\ln y}{dt} = \frac{A}{1+y(\frac{1}{\alpha}+1)} - \frac{1}{\tau}$$

~~Trigger — E equilibrium H~~

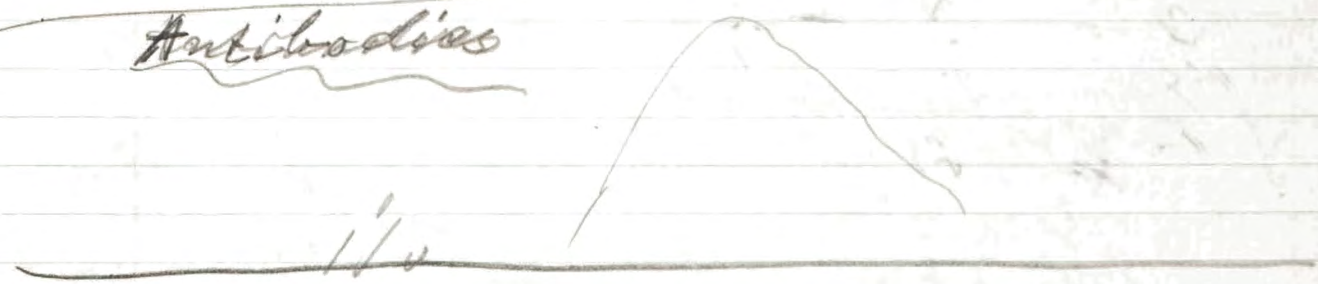
~~{AA − R} = (trig)~~

~~ρ_E for 100 E/cell~~ $= \frac{1}{6\,10^{23}}\,10^{17} = \frac{1}{6}\,10^{-6}$

~~multilinked and convert trig (n)~~

~~differentiation~~

~~Antibodies~~



$$\frac{1}{1+ay_0} - kx_0 = 0$$

$x = x_0 + \varepsilon$ x

$y = y_0 - \varepsilon$

$$\frac{d\varepsilon}{dt} = \frac{1}{1+a(y_0-\varepsilon)} - k(x_0+\varepsilon) = \frac{1}{\cancel{1}+ay_0\left(1-\frac{\varepsilon}{ay_0}\right)} - kx_0 - k\varepsilon$$

$$= \frac{1}{ay_0}\left(1+\frac{\varepsilon}{ay_0}\right) - \cancel{k}x_0 - k\varepsilon$$

$$-\frac{d\varepsilon}{dt} = \frac{1}{1+a(x_0+\varepsilon)} - k(y_0-\varepsilon)$$

$$\frac{d\varepsilon}{dt} = \frac{\varepsilon}{(ay_0)^2} - k\varepsilon = \varepsilon\left[\frac{1}{(ay_0)^2} - k\right]$$

$$-\frac{d\varepsilon}{dt} = \frac{\varepsilon}{(ax_0)^2} + k\varepsilon = \varepsilon\left[\frac{1}{(ay_0)^2} + k\right]$$

$$\frac{dx}{dt} = \frac{A\frac{x}{k}}{1+\cancel{\frac{y}{k}}+\frac{x}{k}} - \frac{x}{\tau}$$

$$\frac{dy}{dt} = \frac{A\frac{y}{k}}{1+\frac{x}{k}+\frac{y}{k}} - \frac{y}{\tau}$$

$$k\frac{dy}{dt} \simeq \frac{Ay}{x+y} - ky$$

$$\int_0^y \frac{1+y}{1-\frac{y^2}{\cancel{k^2}}(1+y)}\,dy = t$$

$$\int_{y_0}^{y} dy\,\frac{x+y}{y}\cdot\frac{1}{1-(x+y)} = \frac{1}{k} = t$$

$$\frac{1-k}{2}$$

$$\frac{1}{k} = 1+\frac{y}{k}+\frac{x}{k}$$

$$\frac{1}{k} = 1+\frac{2x}{k}$$

$$1 = k+2x$$

$$\frac{1-k}{2} = x$$

$$\int_{y_0}^{y(t)} \frac{1+y}{y}\,dy = kt$$

$$\text{L.h.s} = \ln\frac{y(t)}{y_0} + (y-y_0) = kt$$

(T7.) $= kt$

$$\boxed{\begin{aligned} &0 \quad \frac{\frac{x}{k}}{1+\frac{x}{k}} = x \\ &\frac{x}{k} = x + \frac{x^2}{k} \\ &0 = \cancel{x}\left(1-\frac{1}{k}\right) + \frac{x}{k} \\ &0 = k-1+x \\ &x = 1-k \end{aligned}}$$

4

$$\frac{\rho(1)/K}{\cancel{X} \times \frac{\rho(1)}{K} + \frac{\rho_2}{K}}$$

$\frac{8}{K}$

$$\frac{dx}{dt} = A\frac{1}{1+\frac{y}{K}} - \frac{x}{\tau} \quad (x = 1-\tau)$$

$$\frac{x}{\cancel{\quad}} = A\tau \qquad \frac{\quad}{N}$$

$$(1-e^{-\alpha t})$$

$$\frac{dy}{dt} = A\frac{1}{1+\frac{x}{K}} - \frac{y}{\tau} \quad (y = 0)$$

$$0 = A\frac{1}{1+\frac{y_0}{K}} - \frac{x_0}{\tau}$$

$$0 = A\frac{1}{1+\frac{x_0}{K}} - \frac{y_0}{\tau}$$

$$\frac{dx}{dt} = A\frac{1}{1+\frac{1}{\sqrt{K}}} - \frac{x}{\tau}$$

$$0 = \frac{A\tau}{1+\frac{1}{\sqrt{K}}} = X$$

$$\frac{dx}{dt} = A\tau\frac{1}{1+\frac{1}{\sqrt{K}}} - 1$$

Initial cond.

$t = 0 \quad x = x_0$

$y = y_0 + z$

$$\frac{dy}{dt} = \frac{K}{100}$$

$$y = \frac{K}{100}$$

$$\frac{dx}{dt} = A\frac{1}{1+\frac{y_0+z}{K}} - \frac{x_0}{\tau}$$

$$\boxed{\frac{dy}{dt} = K - y}$$

$$K(1-e^{-t})$$

$$\frac{dy}{dt} = A\frac{1}{1+\frac{x}{K}} - \frac{y}{\tau} - \frac{z}{\tau} = 0$$

$$A\frac{1}{1+\frac{x}{K}} = \frac{y}{\tau} + \frac{z}{\tau}$$

$$A = \frac{y+z}{\tau}\left(1+\frac{x}{K}\right) = \frac{y+z}{\tau} + \frac{y+z}{\tau}\frac{x}{K}$$

$$\frac{x}{K} = \frac{A - \frac{y+z}{\tau}}{\quad} = \frac{A}{\frac{y+z}{\tau}} - 1$$

$$\frac{x_0}{K} = \frac{A}{\frac{y}{\tau}} - 1$$

$$x_0 - \cancel{x} = K\left(\frac{A}{\frac{y+z}{\tau}} - \frac{A}{\frac{y}{\tau}}\right) = \frac{K}{y}A\frac{+z}{(y+z)}$$

Contd. +

$$A\tau\left(1 + \frac{y}{K_0}\right) = y\,\frac{x}{K_0}$$

$$A\tau + \left(A\tau \frac{y}{K_0} - \frac{x}{K_0}\right)\frac{y}{K_0} = 0$$

$$\frac{AT}{\frac{x}{K_0} - A\tau} = \frac{y}{K_0}$$

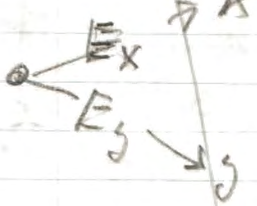
$K_0 = ATK$

$$\frac{1}{\frac{1}{K_0}\frac{x}{AT} - 1} = \frac{y}{K_0}$$

$$\boxed{\frac{1}{\frac{\xi_0}{K_0} - 1} = \frac{y_0}{K}}$$

$k\tau = \boxed{10^4}$ 41

$$\frac{dE_x}{dt} = \frac{A\left(\frac{x}{k}+1\right)}{1+\frac{y}{k}+\frac{x}{k}} - \frac{E_x}{\tau}$$



$$\frac{d\xi}{dt} = BE_x - \frac{\xi}{\mathcal{T}} \qquad \xi = TBE_x$$

$$\frac{d\zeta}{dt} = BE_y - \cancel{\frac{\zeta}{\mathcal{T}}} \qquad \zeta = TBE_y$$

$x = 10^{-3}$

$k = 10^{-7}$

$$\frac{dE_x}{dt} = \frac{A\left(1+\frac{TBE_x}{k}\right)}{1+\frac{TBE_y}{k}+\frac{TBE_x}{k}} - \frac{E_x}{\tau}$$

$$\boxed{AT\,B\tau = N}$$

III equations

$$\frac{dx}{dt} = \frac{A\left(1+\frac{x}{k}\right)}{1+\frac{y}{k}+\frac{x}{k}} - \frac{x}{\tau}$$

$$\frac{dy}{dt} = \frac{A\left(1+\cancel{\frac{x}{k}}\right)}{1+\frac{y}{k}+\frac{x}{k}} - \frac{y}{\tau}$$

Stationary $0 = \frac{1+\frac{x}{k}}{1+\frac{2x}{k}} - x$

$$0 = 1+\frac{x}{k} - x - \frac{2x^2}{k}$$

$$0 \sim \frac{x-2x^2}{k}$$

$\cancel{X}$

$\frac{dy}{dt} = 0$ for high $\frac{x}{k}$

$$\cancel{\frac{dy}{dt}}\ \frac{A\tau + \frac{E_y}{k}}{1+\frac{1}{A\tau}\frac{E_y}{k}+\frac{1}{A\tau}E_x} - E_y$$

$A\tau k = k_0$

$$0 = A\tau\,\frac{1+\cancel{\frac{E_y}{k_0}}}{1+\frac{E_y}{k_0}+\frac{E_x}{k_0}} - E_y$$

$$\sim A\tau\,\frac{1+\frac{y}{k_0}}{\cancel{x}} - y\cdot\frac{x}{k_0}$$

~~[illegible]~~ controlle

$$\frac{dy}{dt} = \frac{\cancel{A}\left(1+\frac{y}{k}\right) - y - \frac{y}{k} - \frac{xy}{k}}{1+\frac{y}{k}+\frac{x}{k}}$$

$$\frac{dy}{\quad}$$

$$\frac{1+\frac{x}{k}+\frac{y}{k}}{\qquad} \ dy$$

$$\frac{dE_y}{dt} = \frac{\frac{N}{\tau}\left(1 + \frac{Bh}{K} E_y\right)}{1 + \frac{\xi}{K} + \frac{Bh E_y}{K}} - \frac{E_y}{\tau}$$

$$\frac{dE_y}{dt} = \frac{\frac{N}{\tau}\left(1 + \frac{\xi_0}{NK} E_y\right)}{1 + \frac{\xi}{K} + \frac{\xi_0}{NK} E_y} - \frac{E_y}{\tau}$$

$N B h = \cancel{\#}\ \xi_0$

$Bh = \frac{\xi_0}{N}$

$\xi \equiv m\, \xi_0 \qquad m >> 1$

calculate $\boxed{E_y(m)}$ to get $\frac{dE_y}{dt} = 0$

1.) $$\tau \frac{dE_y}{dt} = \frac{N\left(1 + \frac{\xi_0}{KN} E_y\right)}{1 + \frac{m\xi_0}{K} + \frac{\xi_0}{NK} E_y} - E_y$$

$$0 = \frac{N\left(1 + \frac{\xi_0}{KN} y(m)\right)}{1 + \frac{m\xi_0}{K} + \frac{\xi_0}{NK} y(m)} - y(m)$$

$\cancel{m \frac{N\xi_0}{NK}}$

---

② ~~[illegible]~~ $\xi \equiv \xi_0$

$$\tau \frac{dy}{dt} = \frac{N\left(1 + \frac{\xi_0}{KN} y\right)}{1 + \frac{\xi_0}{K} + \frac{\xi_0}{NK} y} - y$$

$t = 0$

$y = y(m)$

~~$y = \frac{N}{4}$~~

$$\int_{y(m)} f(y)\, dy = t$$

$$\boxed{h \ll \tau}$$

$$\frac{d\xi}{dt} = B E_x - \frac{\xi}{h}$$

$$\xi_0 = Bh\,E_x(0) \qquad \boxed{E_x(0) = N}$$

$$\cancel{\xi_0 = Bh\,N}$$

$$\frac{\xi_0}{K} \gg 1$$

$$\frac{dE_x}{dt} = \frac{A\left(1+\frac{\xi}{K}\right)}{1+\frac{\xi}{K}+\frac{\eta}{K}} - \frac{E_x}{\tau} \qquad \boxed{\xi = Bh\,E_x}$$

$$\begin{cases} t=0 \text{ for } \eta \equiv 0 \\ \frac{dE_x}{dt} = 0 \end{cases} \qquad E_x(0) = N \qquad \underline{\xi_0 = A\tau Bh}$$

this determines $A\tau = N$

$$\frac{dE_y}{dt} = \frac{A\left(1+\frac{\eta}{K}\right)}{1+\frac{\xi}{K}+\frac{\eta}{K}} - \frac{E_y}{\tau} \qquad \boxed{\eta = Bh\,E_y}$$

Assume $\xi \equiv m\,\xi_0$ $\qquad m \gg 1$

and $\frac{dE_y}{dt} = 0$ what is $E_y(m)$ $(t = \infty)$ }

Assume $y = g\,y(m)$ for $t=0$ $(\xi \equiv \xi_0)$

$$\boxed{\begin{matrix} E_x = x \\ E_y = y \end{matrix}}$$

$$\begin{cases} \displaystyle\int_{y=y(m)}^{y} f(y)\,dy = t \\ \displaystyle\frac{dE_y}{dt} = \frac{A\left(1+\frac{\eta}{K}\right)}{1+\frac{\xi_0}{K}+\frac{\eta}{K}} - \frac{E_y}{\tau} \end{cases}$$

$2 < g < 20$

$$y = \frac{N}{m}\,\frac{K}{\xi_0}$$

$$\boxed{m \gg 1}$$

$x = E_x$

$$\frac{dx}{dt} = \frac{1}{\tau} \frac{N\left(1 + \frac{\xi_0}{KN} x\right)}{1 + \frac{\xi_0}{NK} \cancel{x} + \frac{\xi_0}{NK} y} - \frac{x}{\tau}$$

$$\frac{dy}{dt} = \frac{1}{\tau} \frac{N\left(1 + \frac{\xi_0}{KN} y\right)}{1 + \frac{\xi_0}{NK} x + \frac{\xi_0}{NK} y} - \frac{y}{\tau}$$

$x = y$

$\frac{dx}{dt} = 0$

$\frac{dy}{dt} = 0$

$$0 = N\left(1 + \frac{\xi_0}{KN} y\right) - y\left(1 + 2\frac{\xi_0}{NK} y\right)$$

$\frac{\xi_0}{kN} \gg 1$ λ

Hmo!

$N\lambda = 1 + 2\lambda y$ ~~[illegible]~~

$\frac{N\lambda - 1}{2\lambda} = y$

$N\lambda \gg 1$

$\frac{N}{2} \approx y(\text{max})$

~~$N \frac{\xi_0}{KN} = 1 + \frac{m\xi_0}{K} + \frac{\xi_0}{NK} y(m)$~~

~~$y(m) = N = \frac{KN}{\xi_0} + mN + y(m)$~~

~~$y(m) = N - mN$~~

$$\frac{N\lambda}{1 + \frac{m\xi_0}{K} + \lambda y} - 1 = 0$$

$N\lambda = 1 + \frac{m}{K}\xi_0 + \lambda y$

$N\lambda - 1 - \frac{m\xi_0}{K} = \lambda y$

$N\lambda - 1 - mN\lambda = \lambda y$

$$\boxed{y \cong \frac{N}{2}}$$

put $x = mN$ and find $y(m)$

$$0 = \frac{N(1+\lambda y)}{1+\lambda m N+\lambda y} - y$$

$$N(1+\lambda y) = y + \lambda m N y + \lambda y^2$$

$$N+\lambda N y = y + \lambda m N y + \lambda y^2$$

$$\lambda y^2 + y(1+\lambda mN-\lambda N) - N = 0$$

$$y = \frac{-(1+\lambda mN-\lambda N) + \sqrt{(1+\lambda mN-\lambda N)^2 + 4\lambda N}}{2\lambda}$$

$$(1+\lambda mN-\lambda N)\sqrt{1+\frac{4\lambda N}{(\quad)^2}}$$

$$\left(1+\frac{1}{2}\frac{4\lambda N}{(\quad)^2}\right)$$

$$y(m) = \frac{2\lambda N}{2\lambda(1+\lambda MN-\lambda N)} = \frac{1}{\lambda m} = \boxed{\frac{N}{m}\frac{k}{\xi_0}}$$

$=$

$$\lambda y^2 + \lambda mN y - N = 0$$

$$y = \frac{-\lambda mN + \sqrt{\lambda^2 m^2 N^2 + 4N\lambda}}{2\lambda} = \frac{1}{2\lambda}\left[-\lambda mN + \lambda mN\sqrt{1+\frac{4N\lambda}{\lambda^2 m^2 N^2}}\right.$$

$$\frac{1}{2\lambda}\left[-\lambda mN + \lambda mN\left(1+\frac{2}{\lambda N m^2}\right)\right]$$

$$\frac{1}{2\lambda}\frac{2\lambda mN}{\lambda N m^2} = \frac{1}{\lambda m}$$

From scratch again

H

$$\frac{dE_x}{dt} = \frac{A(1+\frac{\xi}{K})}{1+\frac{\xi}{K}+\frac{\eta}{K}} - \frac{E_x}{\tau} \qquad \frac{d\xi}{dt} = BE_x - \frac{\xi}{h} \qquad h \ll \tau$$

$$\xi = hBE_x$$

$$\frac{d\eta}{dt} = BE_y - \frac{\eta}{h}$$

$$\eta = hBE_y$$

for $\eta = 0$ $E_x(0) = A\tau = N$

$$\boxed{\xi(0) = hBA\tau = hBN}$$

$$\tau\frac{dE_x}{dt} = \frac{N(1+\frac{\xi}{K})}{1+\frac{\xi}{K}+\frac{\eta}{K}} - E_x$$

$$\xi = \frac{\xi_0}{N}E_x$$

$$\eta = \frac{\xi_0}{N}E_y$$

$$\tau\frac{dE_y}{dt} = \frac{N(1+\frac{\eta}{K})}{1+\frac{\xi}{K}+\frac{\eta}{K}} - E_y$$

$x = E_x$

$y = E_y$

$$\tau\frac{dx}{dt} = \frac{N(1+\frac{\xi_0}{NK}x)+cy}{1+\frac{\xi_0}{NK}x+\frac{\xi_0}{NK}y} - x$$

$$\tau\frac{dy}{dt} = \frac{N(1+\lambda y)+cx}{1+\lambda x+\lambda y} - y$$

$$\frac{\xi_0}{NK} = \lambda$$

$N \gg 1$

$N\lambda \gg 1$

---

middle solution.

$$N(1+\lambda y) = y(1+2\lambda y)$$

$$N + N\lambda y = y + 2\lambda y^2$$

$$N + (N\lambda-1)y - 2\lambda y^2 = 0$$

$$-2\lambda y^2 + (N\lambda+1)y + N = 0$$

$$y = \frac{+(N\lambda+1) \pm \sqrt{(N\lambda-1)^2+8\lambda N}}{+4\lambda}$$

~~$\boxed{\tau = 1}$~~

4

τ dependence

$a(1-q) = bq$ = rate

$a - aq - bq = 0$

$q = \frac{a}{a+b}$

$$\boxed{\tau_a + \tau_b = \tau_0}$$

$\frac{\kappa b}{\kappa + \frac{b}{a}}$ = rate

$\frac{1}{\frac{1}{a} + \frac{1}{b}}$ = rate

$$\frac{\frac{x}{k}}{1 + \frac{x}{k} + \frac{s}{k}}$$

2AK ~~10 sec~~ $10^{13} e^{-\frac{18000}{600}}$

$10^{-\frac{30}{2.3}}$

1 sec

1,400

Ap = 100 sec

2AK = ~~20 sec~~ $\frac{1}{20}$ sec

$10^{-13} e^{+18000}$

4 × 1,400 $\frac{1}{20}$

$\frac{20}{2\ 10^5}$

$\ln g m = \alpha t$

$\ln g = \alpha t - \ln m$

$g = e^{\alpha t - \ln m}$

$-\ln \frac{1}{g} + \log m = \alpha t - \frac{\alpha}{\beta}$

$\ln \frac{1}{g} = \ln m - \alpha t$

$e^{\frac{1}{g}} = e^{\ln m - \alpha t} = m e^{-\alpha t}$

$\frac{1}{g} = m e^{-\alpha t}$

$\frac{1}{mg} = e^{-\alpha t}$

~~$t = \frac{1}{\alpha}$~~

Probable $\quad e^{-\frac{1}{g}} = \frac{e^{\alpha t}}{m}$

Prob $= \frac{e^{\alpha t}}{m}$

Up to $e^{\alpha t} = m$

$\alpha t = \log m$

$t = \frac{x}{\alpha}$

$dx = \alpha\, dt$

$dx = \alpha\, dt$

$\alpha t = x = \ln m$

$$\frac{\int_0 \frac{t e^{\alpha t}}{m} dt}{\int \frac{e^{\alpha t}}{m} dt} = \frac{\left(\frac{1}{\alpha}\right)^2 \int_0 x e^{x} dx}{\frac{1}{\alpha} \int e^{x} dx}$$

$$= \frac{1}{\alpha}\left[\quad - \quad m - 1 \right]$$

$\boxed{\overline{\tau}_1 \text{ De Novo}}$

$$\zeta^*(t) = \frac{\alpha}{\beta-\alpha}\left[\frac{\beta}{\alpha}e^{-\alpha t} - e^{-\beta t}\right]$$

$$\left[1-\zeta^*(\tau)\right]^m = e^{-\frac{1}{g}} = \frac{1}{e^{\frac{1}{g}}}$$

$1-\frac{1}{g}$

$$1-\zeta^*(\tau) = e^{-\frac{1}{gm}} = \cancel{\frac{1}{gm}}$$

$$\zeta^*(\tau) = \frac{1}{gm}$$

$$gm = \frac{1}{\zeta^*(\tau)}$$

$$\ln gm = \ln\frac{\beta-\alpha}{\alpha} + \log\frac{1}{\frac{\beta}{\alpha}e^{-\alpha t} - e^{-\beta t}}$$

$$= \ln\frac{\beta-\alpha}{\alpha} - \ln\left(\frac{\beta}{\alpha}e^{-\alpha t} - e^{-\beta t}\right)$$

$$\ln\frac{\beta-\alpha}{\beta} - \ln\frac{\beta}{\alpha}e^{-\alpha t}\left(1-\frac{e^{-\beta t}}{\frac{\beta}{\alpha}e^{-\alpha t}}\right)$$

$$= \ln\frac{\beta-\alpha}{\alpha} - \ln\frac{\beta}{\alpha} + \alpha\tau - \ln\left(1-\frac{1}{\frac{\beta}{\alpha}e^{(\beta-\alpha)\tau}}\right)$$

$$\ln gm = \alpha\tau + \cancel{\frac{1}{\frac{\beta}{\alpha}e^{(\beta-\alpha)\tau}}} - \cancel{\frac{\alpha}{\beta}}$$

$$1 + \ln m = \alpha\overline{\tau}$$

make $e^{-\frac{1}{g}} =$ [illegible]

$$e^{-\frac{1}{3}} = \frac{1}{\sqrt[3]{e}}$$

$1 + \frac{1}{2!} + \frac{1}{3!} + \frac{1}{4!}$

$u = t^2$

$\boxed{g \approx e}$

v

$$\overline{\tau}_1 = \int_0 t(1-\zeta^*)^m\,dt$$

$$\int\frac{d\,uv}{dt} = \int\frac{du}{dt}v + \int u\frac{dv}{dt}$$

$[uv] = 1 +$

Antibodies.

B.S.A takes longer for primary || it should also take longer to develop secondary response. —

H

$$u\frac{dv}{dx} \qquad \frac{du}{dx}v$$

$$\int x e^x dx = [u v] - \int e^x$$

$$[x e^x] = \frac{\ln m - (m-1)}{(m-1)}$$

$$\boxed{\tilde{\sigma} \qquad =} \frac{m}{m-1}\ln m - 1$$

$$\ln p = m \log(1-S^*)$$

$$1-S^* = \frac{\alpha}{\beta-\alpha}\left[\frac{\beta}{\alpha}e^{-\alpha t} - e^{-\beta t}\right] =$$

$$\ln(1-S^*) = \ln\frac{\alpha}{\beta-\alpha} + \ln\frac{\beta}{\alpha}e^{-\alpha t}\left(1 - \frac{e^{-\beta t}}{\frac{\beta}{\alpha}e^{-\alpha t}e^{+\beta t}}\right)$$

$$\ln(1-S^*) = \underbrace{\ln\frac{\alpha}{\beta-\alpha} + \ln\frac{\beta}{\alpha}}_{\ln\frac{\beta}{\beta-\alpha} \approx \ln\frac{1}{1-\frac{\alpha}{\beta}} \approx \frac{\alpha}{\beta}} - \alpha t - \frac{\alpha}{\beta}\frac{1}{e^{(\beta-\alpha)t}}$$

$$= \frac{\alpha}{\beta}\left(1 - e^{-(\beta-\alpha)t}\right) - \alpha t$$

$$\ln(1-S^*) \sim \frac{\alpha}{\beta} - \alpha t$$

$$(1-S^*) \sim e^{\alpha/\beta}e^{-\alpha t}$$

$$1-S^* \sim \left(1+\frac{\alpha}{\beta}\right)e^{-\alpha t}$$

$$(1-S^*)^m \sim \left(1+\frac{\alpha}{\beta}\right)^m e^{-\alpha t m}$$

$$p \sim$$

$$\frac{\beta}{\alpha} =$$

$$(1-s^*)^{m} = e^{-\frac{1}{gm}}$$

$$1 - s^* = 1 - \frac{1}{gm}$$

$$s^* = \frac{1}{gm}$$

$$1 - y^* \approx 1 - e^{-at}$$

$$P = (1-y^*)^m \sim 1 - me^{-\alpha t}$$

$$\tilde{t} = \frac{\int_T^\infty t \frac{dP}{dt}\, dt}{\int_T^\infty \frac{dP}{dt}\, dt}$$

$$\frac{dP}{dt} = \alpha m e^{-\alpha t}$$

$$T = \frac{\log m}{\alpha}$$

$$\frac{\int_T^\infty t e^{-\alpha t}\, dt}{\int_T^\infty e^{-\alpha t}\, dt}$$

$\frac{\alpha}{\beta} << 1$

for all t for which

$$e^{\log m - \alpha t} \leq 1$$

T defined by

$$e^{\log m - \alpha T} = 1$$

$$T = \frac{\log m}{\alpha}$$

$$\int_T^\infty t e^{-\alpha t}\, dt = -\frac{d}{d\alpha} \int_T^\infty e^{-\alpha t}\, dt$$

$=$

Bolus

$P = (1-y^*_{(t)})^m$ $\quad$ $y^* = \frac{\alpha}{\beta-\alpha}\left[\frac{\beta}{\alpha}e^{-\alpha t} - e^{-\beta t}\right]$

$1-y^* = 1-\left\{\frac{\beta}{\beta-\alpha}e^{-\alpha t} - \frac{\alpha}{\beta-\alpha}e^{-\beta t}\right]$

$\boxed{1-\left\{\frac{1}{1-\frac{\alpha}{\beta}}e^{-\alpha t} - \frac{\alpha}{\beta}e^{-\beta t}\right\}}$

$\boxed{(1-y^*) = \left\{1-\left\{\left(1+\frac{\alpha}{\beta}\right)e^{-\alpha t} - \frac{\alpha}{\beta}e^{-\beta t}\right\}\right\}}$

$\ln[1-y^*_{(t)}] = e^{-\frac{1}{\rho m}} = 1-\frac{1}{\rho m}$ $\qquad$ $\rho m >> 1$

$\ln \rho m = \alpha t + \frac{1}{\quad} - \frac{\alpha}{\beta}$

$\rho m = e^{-\frac{\alpha}{\beta}} e^{\alpha t}$

$\frac{1}{\rho m} = e^{\frac{\alpha}{\beta}} e^{-\alpha t}$

$(1-y^*) = 1 - e^{\frac{\alpha}{\beta}} e^{-\alpha t}$ $\qquad$ O.K.

$1-y^* = 1-\frac{\alpha}{\beta-\alpha}\left[\frac{\beta}{\alpha}e^{-\alpha t} - e^{-\beta t}\right]$

$\left(1+\frac{\alpha}{\beta}\right) \approx e^{\frac{\alpha}{\beta}}$ $\qquad$ $1-\frac{\beta}{\beta-\alpha}e^{-\alpha t} + \frac{\alpha}{\beta-\alpha}e^{-\beta t}$

$+e^{-\beta t}$ $\quad$ $-e^{-\beta t}$

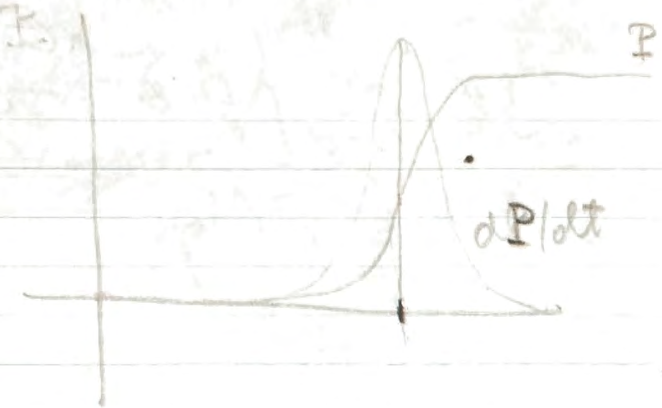
$\boxed{1-y^* = 1 - \left(1+\frac{\alpha}{\beta}\right)e^{-\alpha t} - \frac{\alpha}{\beta}e^{-\beta t} =}$

$= 1 - e^{\alpha/\beta}e^{-\alpha t} - e^{\alpha/\beta}e^{-\beta t} + e^{-\beta t}$

$= 1 - e^{\alpha/\beta}(e^{-\alpha t} - e^{-\beta t}) + e^{-\beta t}$ $\qquad$ $1-e^{\alpha/\beta}(1-1)$

$\ln P = \int_0^\infty t\frac{d}{dt}(1-e^{-t})^{300}dt$

$\int_0^\infty t\frac{d}{dt}(1-Ae^{-t})^{300}dt$ $\quad\|\quad A = e^{\frac{1}{5}}$



H12-702D] ~~Dr.~~ Applied . Science

→ Blackburn

Knapp – #10 Bill Teck

WE 57-2084

→ WE 5-7284

→

#15 /

aaa
aab
aba
aba

true value of $\quad P(T) - P(0)$

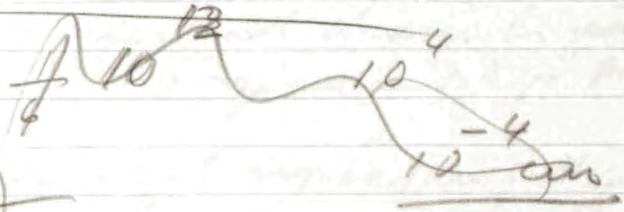
$$\curvearrowright \int_0^T t \frac{dP}{dt} dt \Big/ \int_0^T \frac{dP}{dt} dP$$

with appr. $$\int_T^\infty t \frac{dP}{dt} dt \Big/ \int_0^T \frac{dP}{dt} dt$$

$$T = \frac{\log m}{\alpha}$$

$\rho = 6\,10^{+13}/cc$

$\frac{1}{6} 10^{-13}$



$10^{-14} =$

$$\boxed{\frac{1}{5} 10^{-4} \text{ cm}}$$

$\sqrt{Dt} = \text{cm} = \boxed{\frac{1}{5} 10^{-4}}$ ~~cm~~

$\sqrt{10^{-5} t} = \frac{1}{5} 10^{-4}$ cm

$10^{-5} t = \frac{1}{25} 10^{-8}$ cm $\quad$ 100

10^{-6} cm

$t = \frac{1}{25} 10^{-3}$ sec

$t = 1\,0_{\cdot}^{-4}$ sec

$\frac{20}{15\,10^{-5}}$

$\frac{5\,10^{3} \cdot R\,3\,10^{-8}}{26}$

$\Delta\rho = \frac{~~6\,10^{23}~~ \rho\, v\, \sigma \rho\, \beta}{4\pi D \; ~~R \rho \rho~~ \; \beta} = \frac{~~10^{3}~~\, 6 \times 5\, 10\; R\; ~~\rho~~}{~~30~~\, 10^{26}\, 3\, 10^{-8}}$

30

$4\pi D R \rho\, \beta$

Amino acids

Georges Cohen   500fold concentration

$5\,10^{-7}$ M valine inhibits wildtype

$2.5\,10^{-4}$ M in middle [illegible]

$2.5\,10^{-4}$ molar should be order of magn of valine in wildtype

Crick and Watson   Proc Roy Soc   1957

p. 86   The distance between successive ch atoms in a fully extended chain is ~~[illegible]~~ about 7 Å (10 x 7 = 70 gives 10 Å radius 34 A pitch

Pauling   fundamental repeating distance in polypeptide chain 7.27 Å

Rich   polyadenyl - polyuridyl ~~to~~ double strand can take a polyuridylic strand

---

Georges N. Cohen & Howard V. Rickenberg Annal de l'Institut Pasteur 91 1956

p693.

④ 14 x ㊿

$K'' = 3 \times 10^{-6}$ M

effect Table 5   for $5\,10^{-6}$ valine

occurs for $\left\{ \begin{array}{l} 5\,10^{-7}\ \text{L-isoleucine} \\ 10^{-6}\ '' \end{array} \right.$

$$1 - \frac{\beta}{\beta-\alpha} e^{-\alpha t} + \frac{\alpha}{\beta-\alpha} e^{(\alpha-\beta)t} e^{-\alpha t}$$

$$1 - \left[\frac{\beta}{\beta-\alpha} e^{-\alpha t} - \frac{\alpha}{\beta-\alpha} e^{-\alpha t} e^{(\alpha-\beta)t}\right]$$

$$1 - e^{-\alpha}$$

$$1 - e^{-\alpha t}\left(\frac{\beta}{\beta-\alpha} - \frac{\alpha}{\beta-\alpha}\left[1 + \frac{(\alpha-\beta)t^{n}}{n!}\right]\right)$$

$$\left[1 - \frac{t\alpha(\alpha-\beta)^{n-1} t^{n-1}}{n!}\right]$$

Tenki

$$\frac{m}{1-\frac{\alpha}{\beta}} = e^{\alpha t} \rightarrow 1 + (\alpha-\beta)t$$

$$m = e^{\alpha t}\left[\cancel{1-\frac{\alpha}{\beta}} + \frac{1}{\beta} e^{(\alpha-\beta)t} + \left(1-\frac{\alpha}{\beta}\right) e^{(\alpha-\beta)t} + \left[(\alpha-\beta)t\right]^2\right. \qquad \alpha\left(\beta - \frac{\alpha}{\beta}\right)$$

$$t = \frac{1}{\alpha}\ln\frac{m}{1-\frac{\alpha}{\beta}} = \frac{1}{\alpha}\ln m\left(1+\frac{\alpha}{\beta}\right) = \boxed{\frac{1}{\alpha}\ln m + \frac{1}{\beta}}$$

σ_1 again

H

$$1 - \zeta^* = 1 - \frac{\alpha}{\beta-\alpha}\left[\frac{\beta}{\alpha} e^{-\alpha t} - e^{-\beta t}\right]$$

$$1 - \frac{\beta}{\beta-\alpha} e^{-\alpha t} + \frac{\alpha}{\beta-\alpha} e^{-\frac{\beta}{\alpha}\alpha t}$$

$$1 - \cancel{\frac{\beta}{\beta-\alpha}} \cancel{\frac{1}{1-\frac{\alpha}{\beta}}} \left(1+\frac{\alpha}{\beta}\right) e^{-\alpha t} +$$

$$\int_0^\infty t \frac{d}{dt}\left(1 - e^{-t}\right)^{300}$$

$$e^{-t} = 299\left(1 - e^{-t}\right)$$

$$\left(1 - e^{-t}\right)^{300} \quad \Big\| \quad m\left(1 - e^{-t}\right)^{(m-1)} \times e^{-t}$$

$$0 = m(m-1)\left(1 - e^{-t}\right)^{m-2} \cancel{e^{-t}} e^{-t} - \cancel{e^{-t}}\, m\left(1 - e^{-t}\right)^{m-1}$$

$$m(m-1)\left(1 - e^{-t}\right)^{m-2} \times e^{-t} = m\left(1 - e^{-t}\right)^{m-1}$$

$$\cancel{m}(m-1)\, e^{-t} = \cancel{m}\left(1 - e^{-t}\right)$$

$$m e^{-t} - e^{-t} = 1 - e^{-t}$$

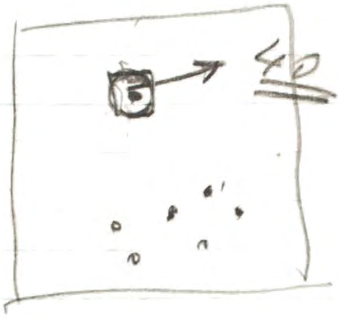
$$\cancel{m}(m-1)\left(1 - e^{-t}\right)^{m-2} e^{-t}\, \cancel{e^{-t}} = \cancel{m}\left(1 - e^{-t}\right)^{(m-1)} \cancel{e^{-t}}$$

$$\cancel{(m-1)}\, \frac{e^{-t}}{m} - \frac{e^{-t}}{e} = 1 \qquad \left(1 - e^{-t}\right)$$

Triplets

~~80~~ **40** triplets in sample $P(r) = e^{-2} \frac{(n)^r}{r!}$

A $1 - P(0) - P(1) =$



$n = 2$

$1 - (e^{-2} + 2e^{-2})$

$1 - 3e^{-2} = \underline{0.6}$

8000

~~$1 - 3e^{-\frac{3}{100}}$~~

$\frac{240}{8000}$

$1 - (e^{-\frac{3}{100}} + \frac{3}{100} e^{-\frac{3}{100}})$

$1 - (1 - \frac{3}{100} + \frac{9}{2\,10^4} + \frac{3}{100}(1 - \frac{3}{100})$

$\frac{3}{100} - \frac{3}{10^4})$

$\frac{1}{2} \frac{9}{10^4} \times 8000 = \underline{3.5}$

red red
red black
blue red
blue black

$\Delta F = \log 2$

$W = e^{-\Delta F}$

Lerman

~~Functional~~ gene

Functional

M

$1100/2 = \underline{550}$

Rocket ~~Kegle~~ Kirzort 800 = 1600 / nucleotides

300 000 to $5 \cdot 10^5$ 2

☐ molekular weight of gene (double strand)

10^4

336 = M/Nucleotide

10

Lerman (and T.) says 10^7 nucleotides per cell pneumococcus.

Fox says $\frac{1}{4}\,10^7$ "

2000 Amoeba gene one bit 8[a]

$\underline{\underline{20}}$ 180 $\boxed{60}$ 5.5

$\boxed{\underline{\underline{30}}}$

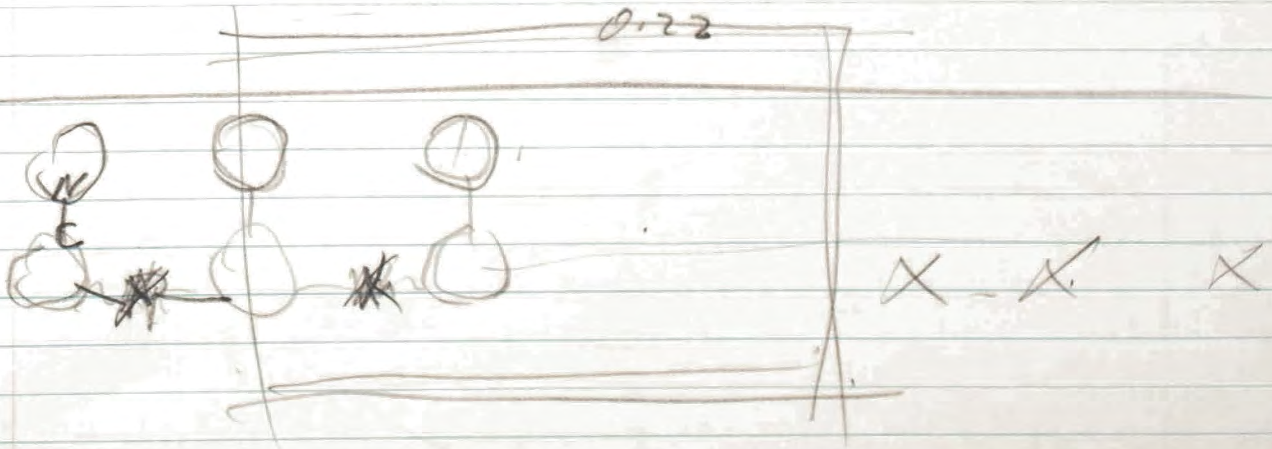
$$1 - 2e^{-1.5} - e^{-1.5}\,1.5 = 0.445$$

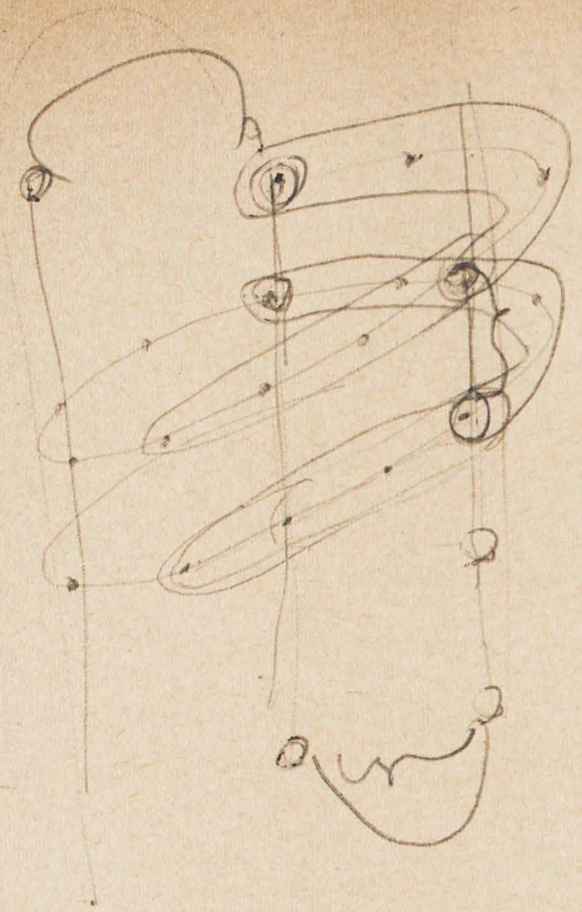
$$1 - 2.5e^{-1.5}$$

$0.445 \times 20 = \underline{\underline{9}}$

$e\sqrt{e}$

$2.7 \times 1.65 = 4.5$





[illegible]

$$P(r) = \underline{N}\, e^{-n} \frac{(n)^r}{r!}$$

P(r) is expected number of spaces containing r units

$\underline{(n)}$ P(r)

Randomness

~~N = 40~~

$1 - \frac{340}{}$

(0.7)

$$e^{-2} \frac{2^2}{2} = 2 \cdot e^{-2}$$

(0.135)

$$1 - \left(e^{-2} + e^{-2} \times 2\right) = 0{\cdot}6 \quad \boxed{0.270}$$

$1 - 3e^{-2}$ 135 3 1 $\underline{0.45}$ (9)

$20 \times 0.6 = \underline{12}$

(9 or (12))

80

30

$$1 = e^{-1} e^{-\frac{1}{2}} (2.5) =$$

$\frac{1}{e} \cdot \frac{1}{\sqrt{e}}$ 2.5

68

(20)

1.65 x 2.72

4.5 5.5

0.22 x .25

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~~Inh~~ Inhibition of enzyme itself [Umbarger, Harvard]

Coli isoleucine inhibits activity of enzyme which converts (in vitro) threonine to α-keto-glutarate. —

Pardee (Berkeley) found ~~in~~ in cells cytidylic acid inhibits in vitro enzyme converting ~~carbamyl~~ one of early enzymes in its synthesis. —

---

mutant requires histidine

Histidine in ~~neurospora~~ Bruce Ames [N.I.H.]

Here Histidine ~~does~~ does not suppress two early enzymes but when we grow on limiting histidine these enzymes shoot up

How can any enzyme be made if His is exhausted?

block at ~~last~~ last step i.e last enzyme not functional.

$~~E_4~~ E_3 \rightarrow E_2 \rightarrow \cancel{E_1} \rightarrow$ Histidine

$\cancel{E_4} \rightarrow E_3 \rightarrow E_2 \rightarrow E_1 \rightarrow$ histidine

wild type grown on minimal.

or this mutant when grown on histidine [E_1 makes ~~an~~ an irreversible step! or intermediates are absent] yet E_3 and E_2 ~~and E_1~~ ~~are made~~ and E_1 or are ~~the~~ made] have same enzyme levels as in wild type.

Werner says may be ~~induction~~ ~~is~~ ~~po~~
Inducer of β-galactoside combines ~~at~~ with an enzyme which makes an inhibitor this enzyme

mouse ⁺ₓ 3 years life span. — H

30 r /week permissible from point of view of quadratic effect

(Life lengthening in mice up to 10% at 25 r single dose [decreased mortality at early ages but no extension of life span])

How about 3 r/week for a year?

Isogenic strains of Jackson: C57 L
Hybrids live [illegible] longer C57 Black
Freher believes shape does not change C3H
A
~~Bla~~ BALB albino

Experiment: take inbred strains (isogenic mice) irradiate them and breed them ~~appr~~ apart; how long does it take to make them different skin transplant - wise. —

Freher ⁺ₓ A B (double break)

Experiment: metabolic rate of human tumor growing in rate is it like rat tumor?

Werner Maas | ~~AMP OH CO~~$_2$

4

Arginine

$\xrightarrow{\text{Acetyl O}} E_3 \xrightarrow{\text{Or.}} E_2 \xrightarrow{\text{Citr}} E_1 \rightarrow \text{Arg}$

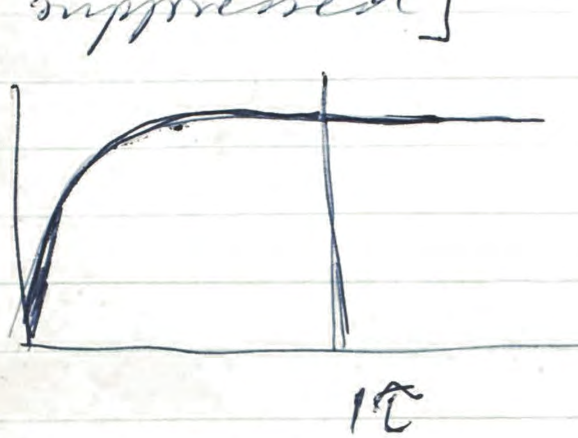
Vogel says ~~E3~~ ~~[illegible]~~ synthesis of E_3 inhibited by Arg
→ in W strain and B strain

Werner says about E_2:

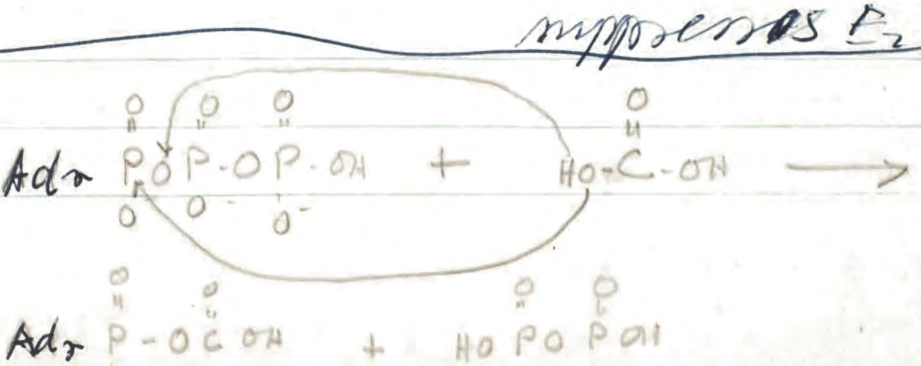
in W strain in chemostat (mutant lacking E_3) growing on Arg limitation gives very high E_2 125 times wild type (growing without Arg)

~~[illegible]~~

in wild type arginine suppresses (growth-tube) E_2 [it does not do this in B strain but according to Vogel E_3 is suppressed]



Wild type (W) grown in A and then transferred to Arg free medium; shows that arginine came of wild type grown in minimal med suppresses E_2 formation



$\text{Ado P-OP-OP-OH} + \text{HO-C-OH} \longrightarrow$

$\text{Ado P-OC OH} + \text{HO PO P OH}$

precedes β-galactosidase in natural sequence ×

$\frac{4x}{1x}$ $\frac{4y}{}$ $\frac{1}{}$

Moos.

Umberger & La Mer

J. A. Chem Soc.

67, 1099, (1945).