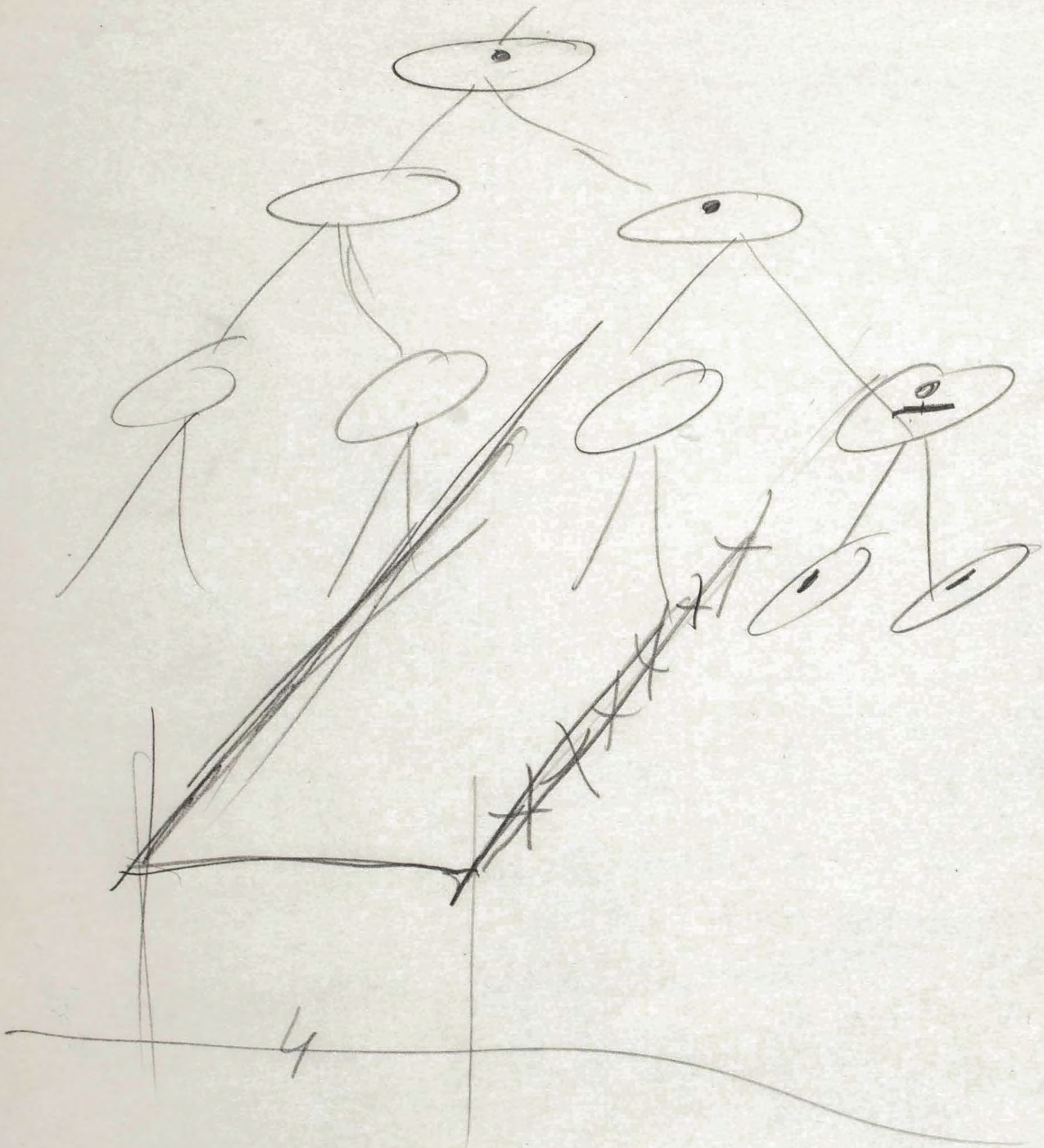
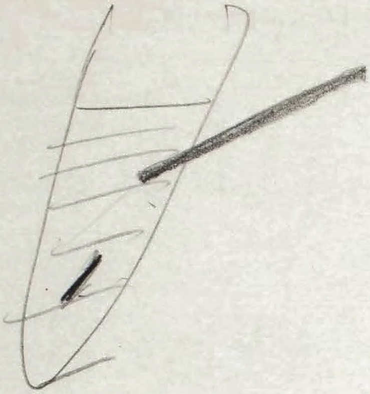


10^8

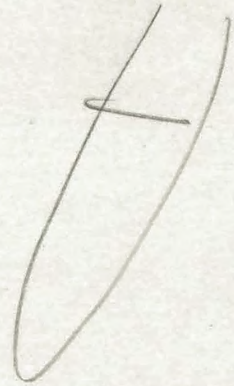
10^4

A B

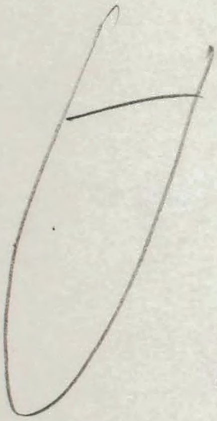
A B A B



10^6

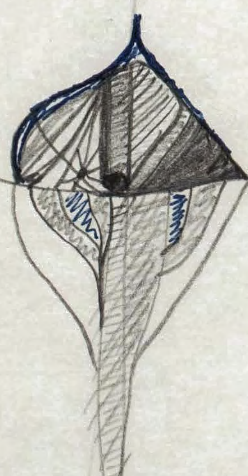


10^6



10^6
10^6
10^6

$3\,10^6$



5×10^{-7}

10^{-5} 10^{-6} gm/cc

$\boxed{\rho\, 4\pi R D}$

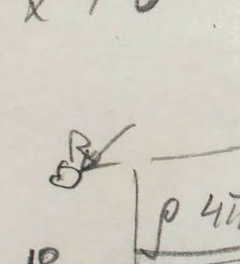
$2\,10^{-18}$ cc $\boxed{R = 10^{-6}}$

10^{-11} gm/cc

40 000

$6 . 10^{23}$

$\frac{4}{6}\, 10^{-19}$ gm



/sec

10^{8}

$5 \times 10^{8} \times 10^{-7} \times 10^{-5} = 5\, 10^{-4}/\mathrm{sec} = \frac{1}{2}\, 10^{-3}/\mathrm{sec}$

H08-1081 Vinden

Alwoff. – Goren DNA synthesis with virulent phage. –

~~now~~ reviewed in Bact. Review (last issue)

Ar + $\sqrt{5}$

T_2 Levinthal (C_y)
am Orbis
E. Coli B Dept. of Physics
Chloromycetin 50 γ/cc
everything stops

at 5 γ/cc stops protein synthesis but DNA continues. how long?

T2 infected **

5 γ/cc Doubles phage D.N.A but then it stops

Transducing   Zinder

Salmonella (Donor)

A phage, virulent,

exponential rise of mature phage in cyanide broken up bacteria

20 min to 36 min (in broth)   birth size 1000

latent period at 30 min

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

$$\frac{dT}{dt} = \alpha[P] = \alpha e^{\beta t}$$

$$P = e^{\beta t}$$

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

hemoglobin

$$\mu = 2 \times 10^{-5} \frac{cm/sec}{V/cm \cdot \Delta pH}$$

for pH grad $0.1\ pH/cm$

$60\ V/cm$

$$u = 2 \times 10^{-5} \times 60 \times 3600 \times 0.1\,x \quad cm/hr$$

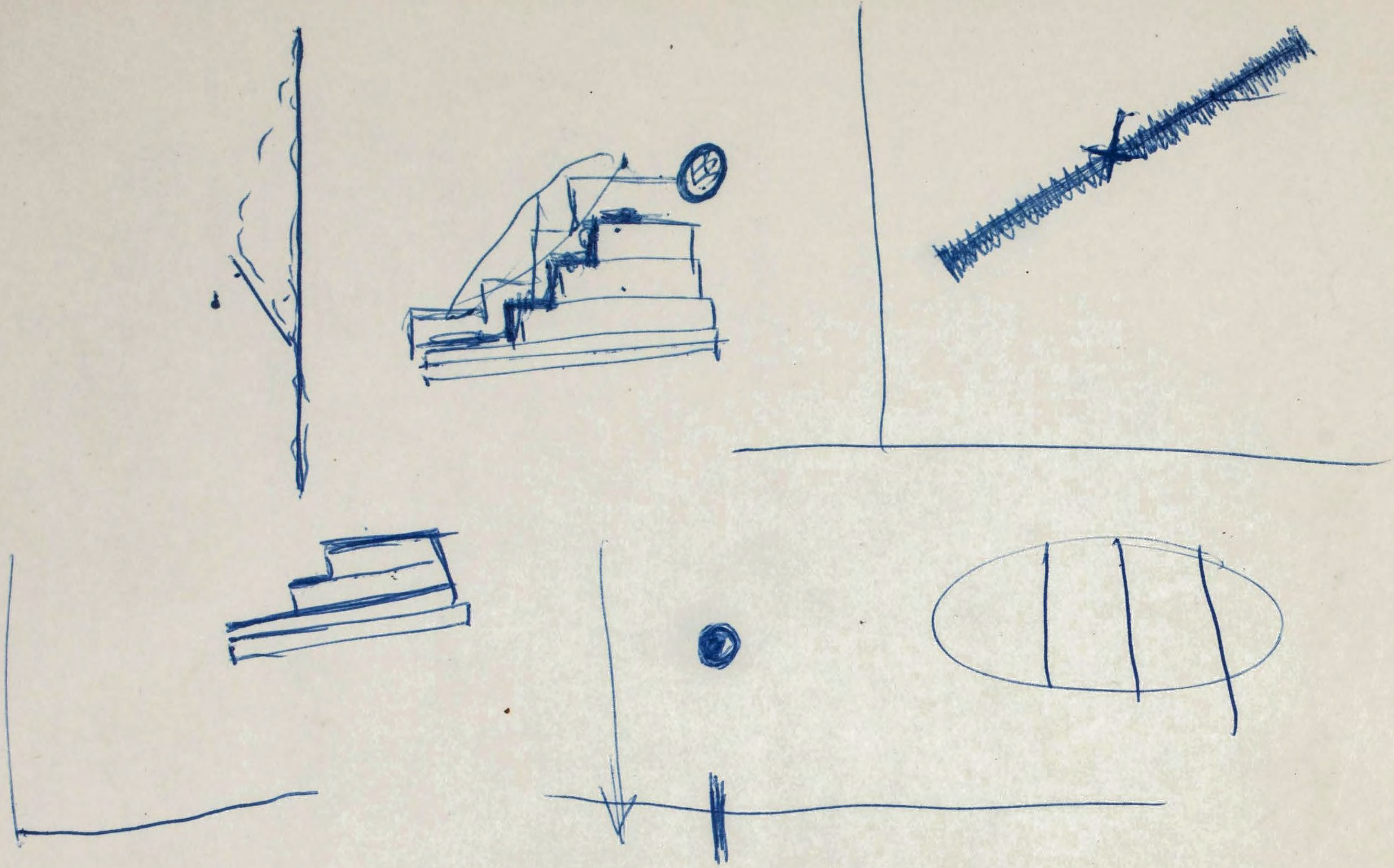
where x is distance fr ~~the~~ isoelectric pt

$$= .36\,x$$

$$t = \int_{x_1}^{x_2} \frac{dx}{0.36\,x} = 6.4(\log_{10} x_2 - \log_{10} x_1)$$

Ray Dr. Ivan Brown
Arch. of Surgery
March /53

~~Jan~~ issue) of Journ of gen Physi.
Ophthal or X-ray of Journ of Lab
~~Exp~~ and Clinical Medicine



Fox 2

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

$$\frac{dp}{dt} = \beta(1-p) - \alpha p$$
$$= \beta - (\alpha+\beta)p$$

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

$$\int_0^\infty t \frac{dp}{dt}^2 \cdot dt$$

$$p = \frac{\beta}{\alpha+\beta}\left(1 - e^{-x}\right) \Bigg| \frac{dx}{\alpha+\beta}$$

$$\cancel{T = \frac{\beta}{\alpha+\beta}\frac{1}{\beta}}$$

$$T_F \quad \frac{x}{\alpha+\beta}$$

~~Fox~~ (1)

$$\frac{dp}{dt} = \beta(1-p) - \alpha p$$

$$= -p(\beta+\alpha) + \beta$$

$$\frac{dp}{\beta - p(\beta+\alpha)} = dt$$

$$-\frac{1}{\beta+\alpha} \ln\left[\beta - p(\beta+\alpha)\right] = t + C$$

~~$\frac{-\beta+\alpha}{-\beta+\alpha}\ d\ln\beta$~~

$$\int \frac{dx}{a+bx} = \frac{1}{b}\ln(a+bx)$$

$$= Ce^{-(\alpha+\beta)t}$$

$$\beta - p(\alpha+\beta) = Ce^{-(\alpha+\beta)t}$$

$$p(\alpha+\beta) = \beta - Ce^{-(\alpha+\beta)t}$$

$$p = \frac{\beta}{\alpha+\beta} - \frac{C}{\alpha+\beta}e^{-(\alpha+\beta)t}$$

Probability of completion in evaporation case between t and t + dt

prob. of completion:

$\beta (p)^{z-1} (1-p)$

$$T = \frac{1}{\beta\, p^{(z-1)} (1-p)}$$

$$T = \frac{1}{\beta} \frac{1}{\left(\frac{\beta}{\alpha+\beta}\right)^{z-1} \cdot \left(\frac{\alpha}{\alpha+\beta}\right) z}$$

$$= \frac{1}{\beta} \frac{1}{\left(\frac{1}{1+\frac{\alpha}{\beta}}\right)^{z-1} \frac{\alpha/\beta}{1+\frac{\alpha}{\beta}} z}$$

$$T = \frac{1}{\beta} \frac{\left(1+\frac{\alpha}{\beta}\right)^{z-1} \left(1+\frac{\alpha}{\beta}\right)}{\frac{\alpha}{\beta} z}$$

$$\frac{1}{\beta} \frac{1 + (z-1)\frac{\alpha}{\beta} + \frac{\alpha}{\beta}}{\frac{\alpha}{\beta} z}$$

$$T \sim \frac{1}{\beta} \left[\frac{\beta}{\alpha} + 1 + (z-1)\frac{\alpha}{\beta} + \cdots\right]$$

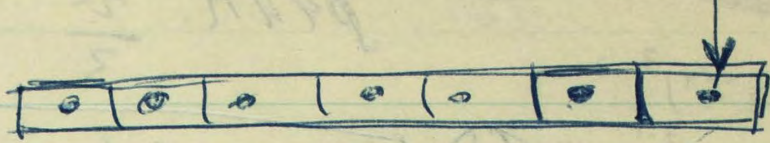
Reasonable assumption

$$T \gg \frac{1}{\alpha+\beta} \qquad T = \frac{1}{\alpha z}\left(1+\frac{\alpha}{\beta}\right)^{z}$$

dt

$e^{-n}\dfrac{n^p}{p!}$

Waterloo 42787



probability of 0

$e^{-\beta t}$

$(1-e^{-\beta t})$ = prob that site is occupied.

probab that z sites occupied

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

Time for this

prob. that all site get occupied between t and t+dt

$$T=\int t\,\beta z\,(f(t))^{z-1}e^{-\beta t}$$

$$\frac{dy}{dt} = \beta z\, f(t)^{z-1}\cdot e^{-\beta t}$$

$$T = ty - \int y\,dt$$

$$T=\int_0^\infty t\,\frac{dy}{dt}$$

$$\int uv' = uv - \int u'v$$

$$\frac{d}{dt}uv = uv' + u'v$$

$$I = \int x e^{-x}(1-e^{-x})^{z-1}\, dx = \int \frac{d}{d\alpha}(1-e^{-\alpha x})^{z-1}\Big|_{\alpha=1}$$

$$\cancel{\alpha x e^{-\alpha x}(1-e^{-\alpha x})^{z-1}}\ d\alpha x$$

$$\rho 4\pi R^2 \frac{v}{3} = 4\pi\, 10^{-16}\, \frac{10^4}{3} =$$

$$\frac{1}{\alpha}\frac{d}{dx}(1-e^{-\alpha x})^z$$

$$z(1-e^{-\alpha x})^{z-1} e^{-\alpha x} x$$

$$\boxed{\rho 4\pi R D} = 4\pi\, 10^{-8} \times 10^{-5}$$

$$= 10^{-12}$$

$$I = \frac{1}{z}\frac{d}{d\alpha}\int \frac{d}{dx}(1-e^{-\alpha x})^{z-1}\, dx$$

$$D = \frac{v\lambda}{3}$$

$$= \frac{1}{z}\frac{d}{d\alpha}(1-e^{-\alpha x})^{z-1}$$

$$10^{-8}\ \text{cm}$$

$$y = 1-e^{-x}$$

$$dy = e^{-x} dx$$

$$y-1 = -e^{-x}$$

$$1-y = e^{-x}$$

$$\ln(1-y) = -x$$

$$10^{-8}\ \text{cm}$$

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

$$v = 10^4$$

$$10^{-5} = 10^4 \frac{\lambda}{3}$$

$$\int_0^1 y^{z-1}\ln(1-y)\, dy$$

$$= -\frac{1}{z}$$

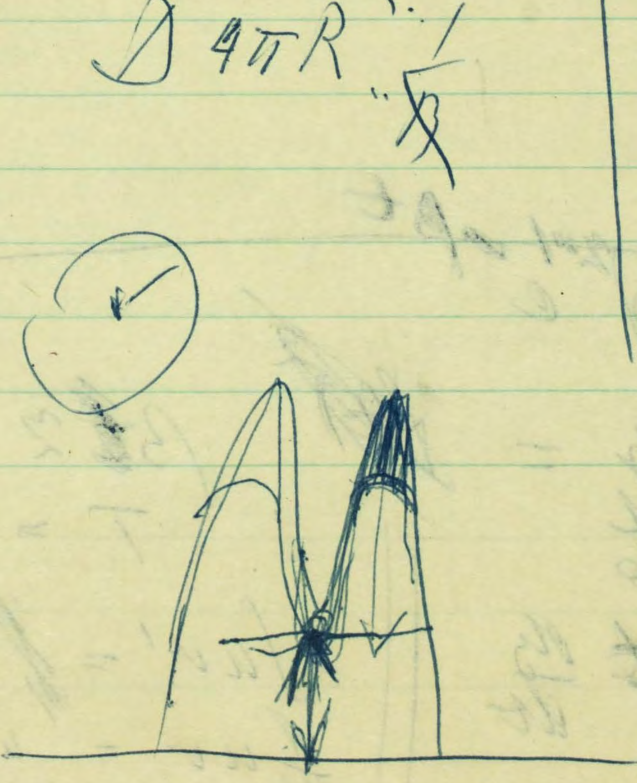
$$3\ 10^{-9}$$

$$-\ln(1-y)\, dy\ y^{z-1}$$

$$D\, 4\pi R^2 \frac{1}{\cancel{3}}$$

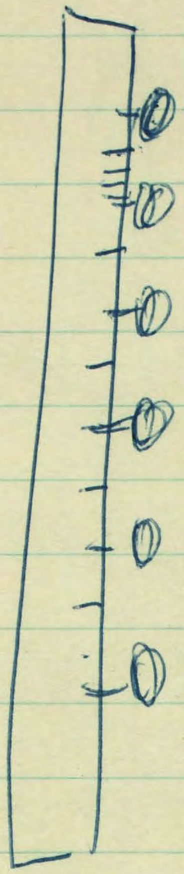
$$\boxed{y = 1-e^{-x}}$$

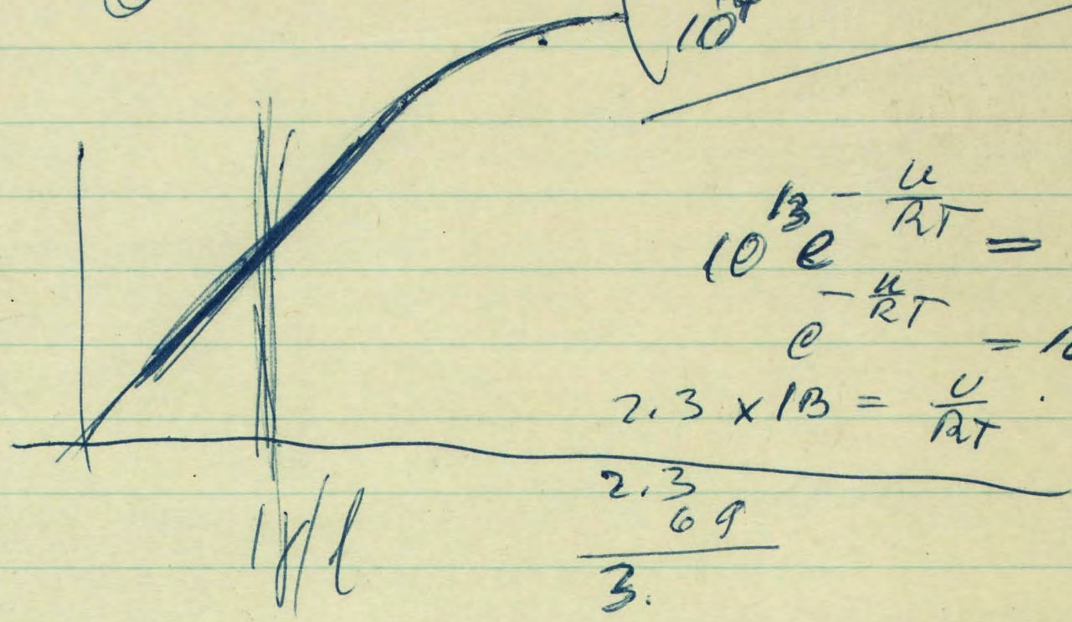
$$y^{z-1}\ln(1-y)\, dy$$



Goldman 169
Watertown
42787

Poisson $e^{-u}\frac{u^p}{p!}$





$$\begin{matrix}10^{13}\\10^{14}\end{matrix} \times e^{-\frac{U}{RT}}$$

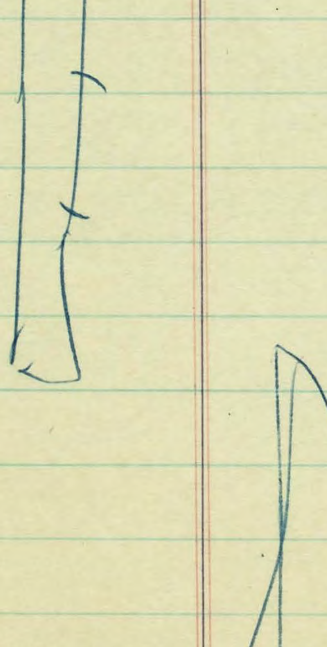
$$10^{13} e^{-\frac{u}{RT}} = 1$$

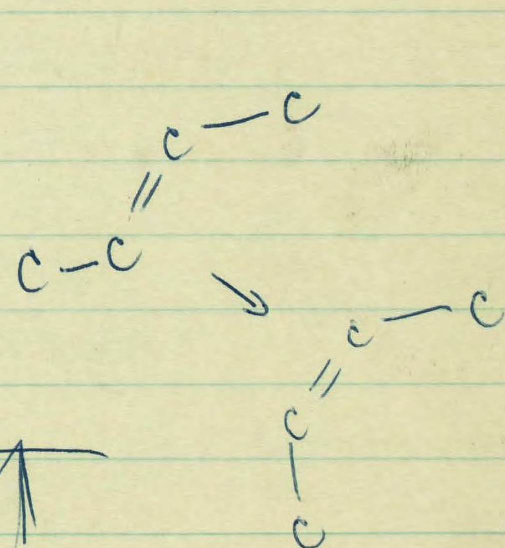
$$e^{-\frac{u}{RT}} = 10^{-13}$$

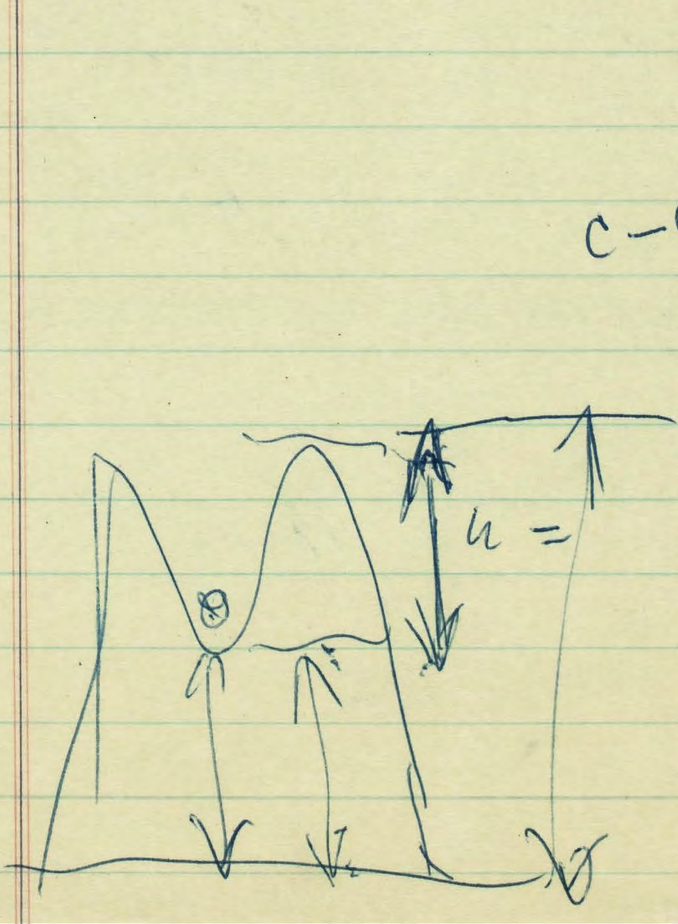
$$2.3 \times 13 = \frac{U}{RT}$$

2.3
69
3.

$$A + B \rightleftarrows AB$$

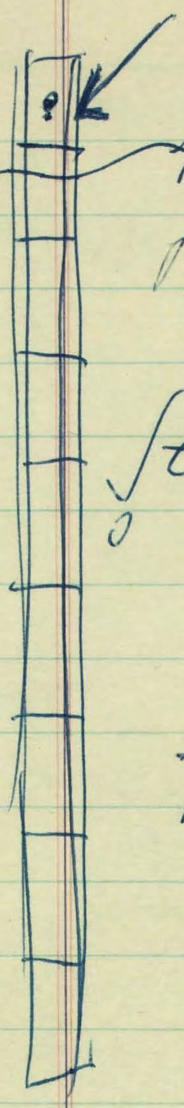






$0 \longrightarrow t$

$\underline{\beta t}$



$$f(t) = \left(1 - e^{-\beta t}\right)^{Z}$$

$$f(x) = \left(1 - e^{-x}\right)^{Z}$$

$$f'(x) = Z\left(1 - e^{-x}\right)^{Z-1}$$

$$\int_0^\infty t\, f'(t)\, dt$$

Z

$$\beta t = x$$

$$T = \frac{x}{\beta} f(x) \cancel{\beta} \frac{dx}{\cancel{\beta}}$$

$$T = \frac{1}{\beta} \int_0^\infty x\, f'(x)\, dx = \frac{1}{\beta} F(Z)$$

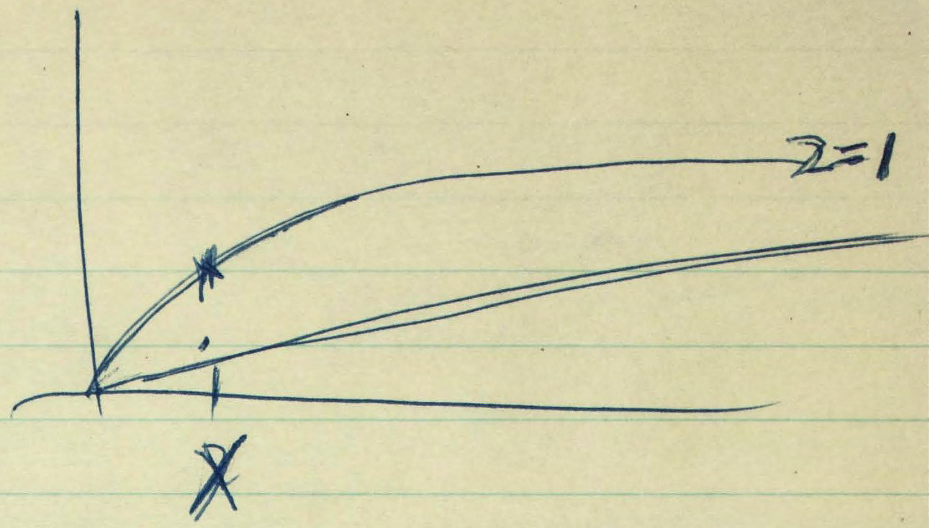
$$\int x$$

$$\left(-\frac{d}{d\alpha} \left(1 - e^{-\alpha x}\right)^{z} = x z \left(1 - e^{-\alpha x}\right)^{z-1}\right.$$

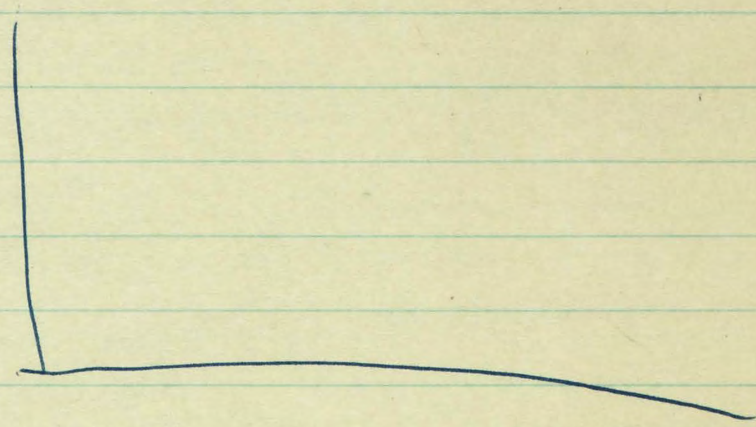
$$T = \frac{z}{\beta} \frac{d}{d\alpha} \int \left[\left(1 - e^{-\alpha x}\right)^{z}\right] dx$$

$$f'(x) = z\left(1 - e^{-x}\right)^{z-1} e^{-x}$$

$$T = \frac{Z}{\beta} \int x \left(1 - e^{-x}\right)^{Z-1} e^{-x}\, dx$$



z=1
X



$$\mathcal{J} = z \sum_{n=0}^{z-1} (-1)^n \binom{z-1}{n} \frac{1}{(n+1)^2}$$

$$f(x) = (1 - e^{-x})^{z}$$

$$\int_0^\infty x\, f'(x)\, \cancel{dx}$$

$$= z \int_0^\infty x e^{-x} (1-e^{-x})^{z-1}\, dx$$

$$(1-e^{-x})^{z-1} = \sum_{n=0}^{z-1} \binom{z-1}{n} (-1)^n e^{-nx}$$

$$\cancel{z \sum_{n=0}^{z-1} \int_0^\infty} = z \sum_{n=0}^{z-1} (-1)^n \binom{z-1}{n} \underbrace{\int_0^\infty x e^{-(n+1)x}\, dx}_{\frac{1}{(n+1)^2}}$$

$$\int_0^\infty x e^{-\alpha x}\, dx = -\frac{d}{d\alpha} \underbrace{\int_0^\infty e^{-\alpha x}\, dx}_{\frac{1}{\alpha}} = \frac{1}{\alpha^2}$$

Goldman - Epstein

$$I = z \int_0^\infty x e^{-x} (1-e^{-x})^{z-1} dx$$

$y = 1 - e^{-x}$ $\qquad dy = e^{-x} dx$

$$I = -z \int_0^1 \log(1-y)\, y^{z-1} dy$$

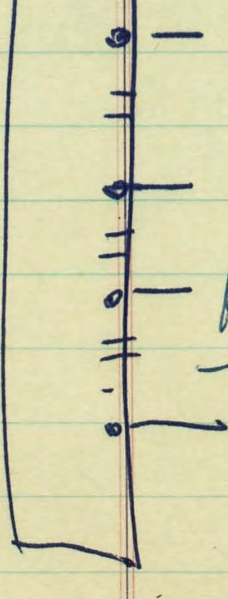
$$= \sum_{n=1}^{z} \frac{1}{n} \qquad (\# \; 865.5)$$

$= \text{Const} + \ln z$

for large z

const $= 0.577$

(Euler Constant)



Arnold Justin
Birmingham
(MIT)

Hicks Cambridge Eng
Attention

Desalting Electrophoresis; Gorin and
Abramson & Moyer

Plane 1

Assuming evaporation of amino-acid from template:

~~After~~ for longest probability of 1 site occupied becomes independent of t. —

mean ~~K~~ life time τ of bound state

probability that all states are occupied $(p)^z$

$$T = \frac{\tau}{(p)^z}$$

$$p = \frac{\text{Const}}{c}$$

More exact:

probability that one site is occupied:

Poisson Formula for n

$$p = p_0(1 - e^{\delta t})$$

put

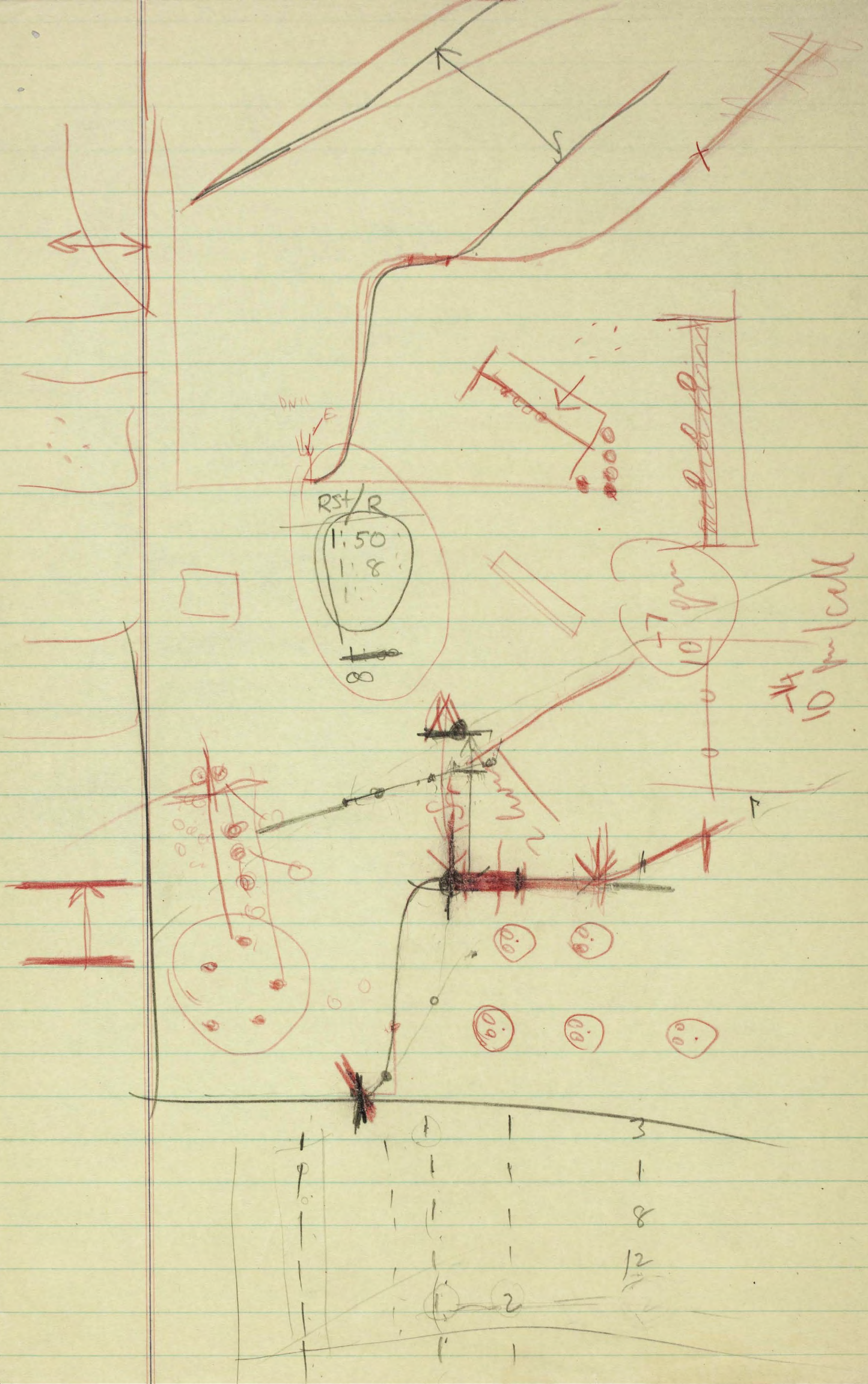
Is this correct?

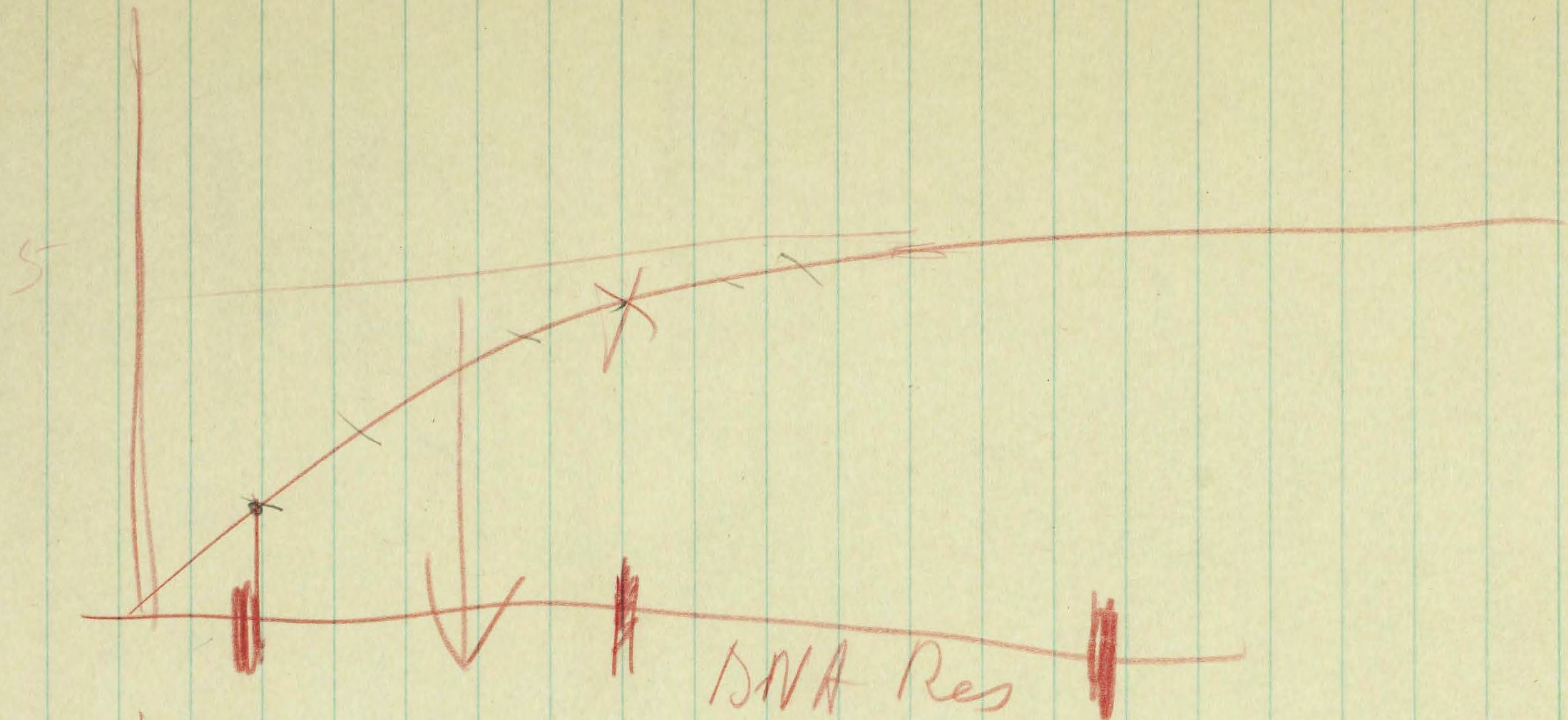
we should assume

For very small time $p(t)$

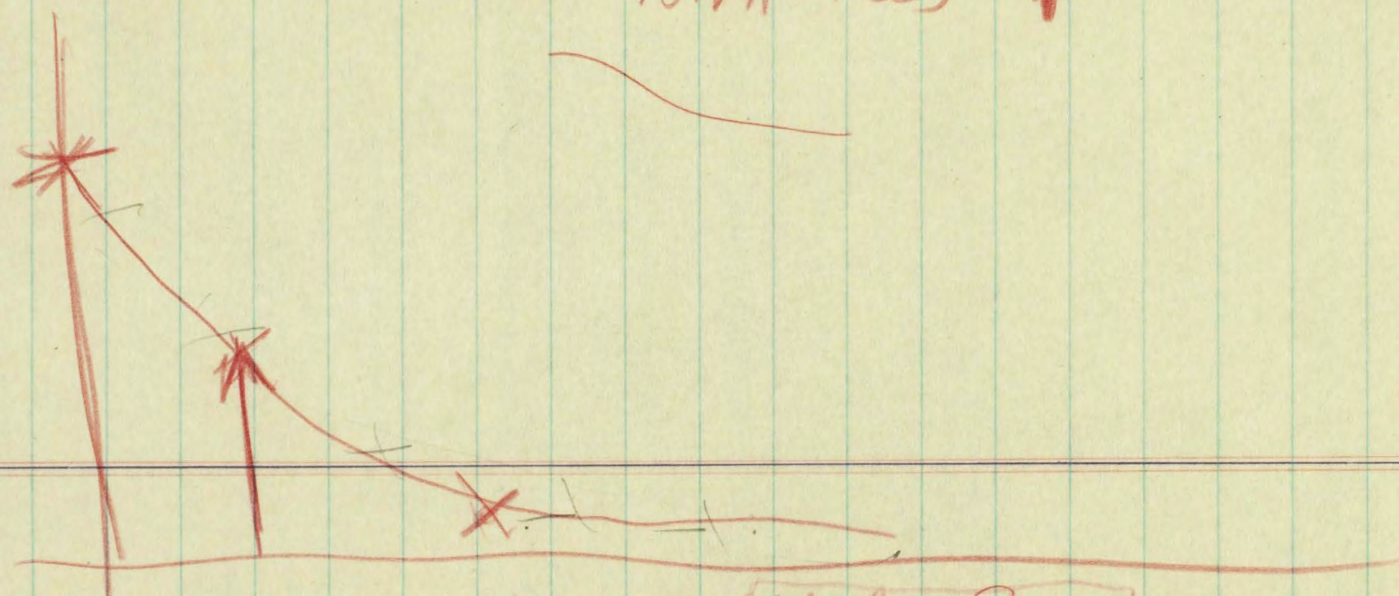
$$\frac{dp}{dt} = \beta - \lambda p$$

$$p_0 \delta e^{\delta t} = \beta - p_0(1 - e^{\delta t})$$


RSt/R
1:50
1:8
3
1
8
12
2



DNA Res



DNA Sens

Plane 2 $\boxed{\text{Assoc Process}}$

If all stick
probably that 1 site
is occupied

$$\frac{dp}{dt} = \beta(1-p) \qquad \boxed{+\beta e^{-\beta t} = \beta(1+\beta e^{-\beta t})}$$

$$p = (1 - e^{-\beta t}) \qquad O.K.$$

with evap.

$$\frac{dp}{dt} = \beta(1-p) - \alpha p$$

$$\cancel{p = p_0(1 - e^{-\gamma t})}$$

$$\cancel{+p_0\gamma e^{\gamma t} = \beta + (\ldots)}$$

$$\cancel{(\alpha+\beta)\,p_0(1-e^{\gamma t}) = \beta}$$

$$\gamma p_0 e^{-\gamma t} = \beta(1-p_0) + p_0\beta e^{-\gamma t} - \alpha p_0 + \alpha p_0 e^{-\gamma t}$$

$$\alpha p_0 = \beta(1-p_0)$$

also

$$\gamma p_0 = p_0(\alpha+\beta)$$

$p_0 < 1$

$$\cancel{p = (p_0 - e^{-\beta t}) + \ldots}$$

$$\int x \frac{d}{dx}\left[(1-e^{-x})^{z}\right] dx$$

$$= +\frac{d}{d\alpha} \int \frac{d}{dx}\left[\left[\frac{1-e^{-\alpha x}}{\cancel{e^{\alpha x}}}\right]^{z+1} \int dx, \frac{e^{\alpha x}}{z+1}\right]_{\alpha=1}$$

$$= \int (\cancel{z}) \frac{(z+1)}{z+1} (1-e^{-\alpha x})^{z} (+x) e^{-\alpha x}$$

$$= \frac{1}{z+1}\frac{d}{d\alpha} \int d\left[1-e^{-\alpha x}\right]^{z+1} = \frac{1}{z+1}\left[(1-e^{-\alpha x})^{z+1}\right]_0^{\infty}$$

$$= \frac{1}{z+1}\left[(1-e^{-\infty})^{z+1} - (1-e^{-0})^{z+1}\right]$$

$$= \frac{1}{z+1}\frac{d}{d\alpha} 0 = 0$$

$$\int x z (1-e^{-x})^{z-1} e^{-x} (1) dx$$

$$= z \int x (1-e^{-x})^{z-1} dx$$

$$= z \frac{\partial}{\partial z} \int (1-e^{-x})^{z}$$

$$\frac{d}{d\alpha} \int \frac{1}{z+1} \frac{d}{dx}\left[1-e^{-\alpha x}\right]^{z+1}$$

$$\int \qquad x = \ln y$$

$$dx = \frac{dy}{y}$$

L ML M H VH

(1) Final

$$\frac{dp}{dt} = \beta(1-p)$$

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

That 2 sites all occupied

$$f(t) = p^2 = (1 - e^{-\beta t})^2$$

$$T = \int_0^\infty t \; f'(t) \, dt$$

$$\beta t = x \qquad t = \frac{x}{\beta}$$

$$T = \int_0^\infty \frac{x}{\beta} \frac{df}{dx} \frac{dx}{dt} \, dt$$

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

$$T = \frac{1}{\beta} \int_0^\infty 2 \, x e^{-x} (1 - e^{-x})^{2-1} \, dx$$

To compare with evaporation Formula

$$\frac{dp}{dt} = \beta(1-p) - \alpha p = \beta - (\alpha+\beta) p$$

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

$$f(t) = p^2 = \left[\frac{\beta}{\alpha+\beta}\right]^2 \left(1 - e^{-(\alpha+\beta)t}\right)^2$$

$$(\alpha+\beta) t = x$$

(2). Final

$$T = \frac{1}{\alpha+\beta}\left[\frac{\beta}{\alpha+\beta}\right]^2 \int_0^\infty x \frac{df}{dx}\, dx$$

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

only difference with evaporation is that

$$\frac{T(\text{evap})}{~~\text{(shocking)}~~} = \frac{1}{\alpha+\beta}\frac{\beta^2}{(\alpha+\beta)^2}$$

for $\beta \ll \alpha$

(β is proportional to concentration)

(and for $\alpha \ll \beta$

$T = \frac{1}{\beta}$

$$T_{evap} = \frac{1}{\alpha}\, \frac{1}{1+\frac{\beta}{\alpha}}\, \frac{\left[\frac{\beta}{\alpha}\right]^2}{\left[1+\frac{\beta}{\alpha}\right]^2}$$

production rate for
low conc: $t = \infty$

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

$$\cdot \left(\frac{\beta}{\alpha+\beta}\right)^{Z-1} \left(1 - e^{-(\alpha+\beta)t}\right) \qquad t = \infty$$

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

$$T = \frac{(\alpha+\beta)^Z}{\beta^Z \times \alpha Z}$$

for $\beta \ll \alpha$

$$T \approx \frac{\alpha^Z}{\alpha Z \beta^Z} = \frac{1}{\alpha Z} \frac{\alpha^Z}{\beta^Z}$$

for $\frac{\alpha}{\beta}$ small

$$T = \frac{\beta^Z}{\beta^Z} \left(1 + \frac{\alpha}{\beta}\right)^Z \frac{1}{\frac{\alpha}{\beta} Z} \frac{1}{\beta} \frac{1}{Z}$$

=

~~Check Evap case~~

$$\cancel{\frac{dp}{dt} = \beta - (\alpha+\beta)p}$$

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

~~OK.~~

$\tau = \frac{1}{\alpha}$

Read Molly

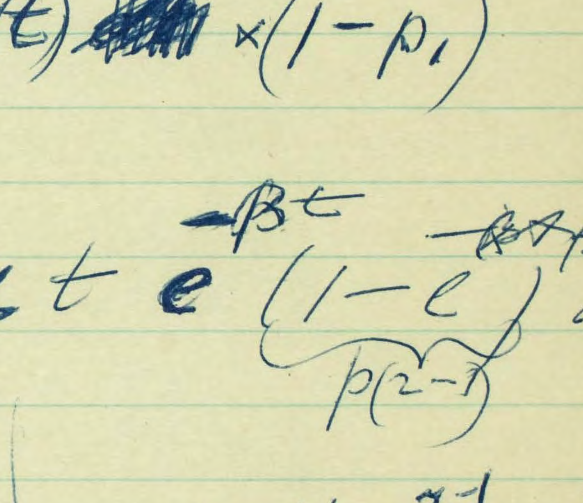
probable of $z-1$ killed

$$T = \beta \int t\, z\, p_{z-1}(t) \times (1 - p_1)$$

$$T = \beta \int z\, t\, e^{-\beta t} \underbrace{\left(1 - e^{-\beta t}\right)^{z-1}}_{p(z-1)} dt$$

In evap. case

$$T = \beta \int z\, t \left[\frac{\alpha}{\alpha+\beta} + \frac{\beta}{\alpha+\beta} e^{-(\alpha+\beta)t}\right] \left(\frac{\beta}{\alpha+\beta}\right)^{z-1} \left(1 - e^{-(\alpha+\beta)t}\right)^{z-1} dt$$



$$1 - p_1 = 1 - \frac{\beta}{\alpha+\beta} + \frac{\beta}{\alpha+\beta} e^{-(\alpha+\beta)t}$$

In symp. case:

$$T = \beta \int z t \left[\frac{\alpha}{\alpha+\beta} + \frac{\beta}{\alpha+\beta} e^{-(\alpha+\beta)t} \right] \times$$

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

$$T = \frac{1}{\beta}\left(\frac{\beta}{\alpha+\beta}\right)^{z-1} z \int \frac{\alpha}{\alpha+\beta}\, x \left(1-e^{-x}\right)^{z-1} dx$$

$$+ \frac{1}{\beta}\left(\frac{\beta}{\alpha+\beta}\right)^{z-1} z \int \frac{\beta}{\alpha+\beta}\, x\, e^{-x} \left(1-e^{-x}\right)^{z-1} dx$$

$$\lim_{t=0} \frac{\int_0^{t} f(t)\, dt}{\int_0^{x} f(x)\, dx}$$

Denominator:

$$\text{Den} = \beta \int z\, p_{z-1}(t)(1-p)\, dt$$

$$\text{Den} = \int z\, p_{z-1}(x)(1-p(x))\, dx$$

(1) Monod V^th

(Fox) ~~Lactose Baxine~~
~~Lactose~~
~~temperature~~
~~Supply of maltose system~~
~~Induced by maltose (Boscah)~~

~~Mo~~ Mol

ara Mutants inducable
Lactose ; T.M.G
not P.G ; galactose
grows on Galactose.
Parent was Gal− but inducable with lactose fermentation with Gal and P.G.
Model: Gal + strain takes Gal ~~to~~ to Gal 1P. ⇒ Glucos 1P.
Gal− piles up Gal 1P ⇸
Gal 1 P inducer for Beta galactosidase

(2) Monod V

Cryptic Mutants

enzyme is formed [β galactosidase] but inactive in vivo against lactose.
(substitutes)

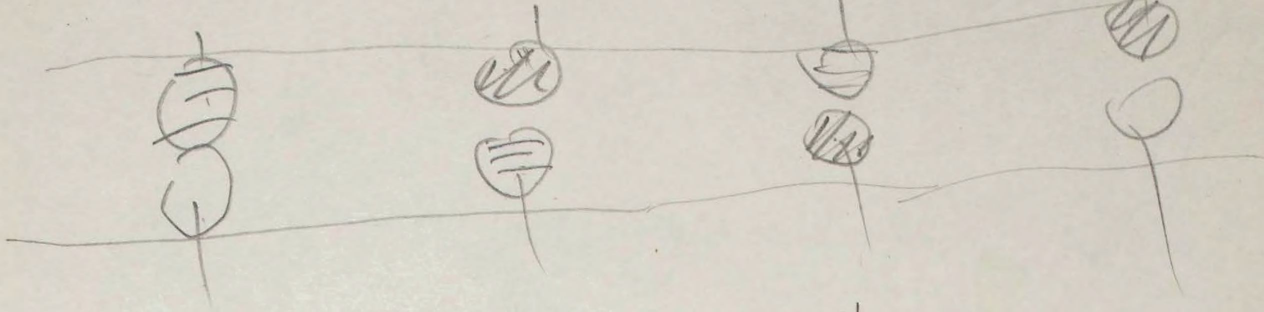
1.) Lactose can not get in?
Rickenberg (Howard) Dave
Brunner. Lactose gets into cell

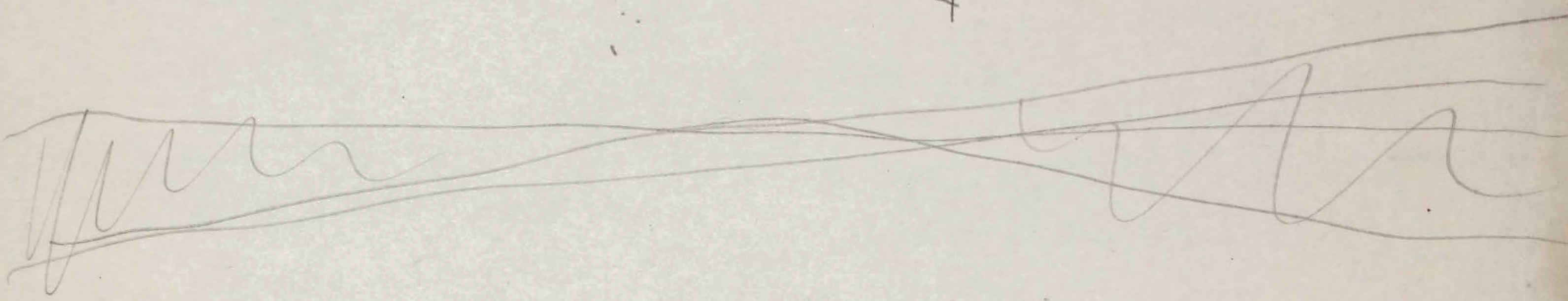
Holland thinks it is competitive inhibitor made of lactose

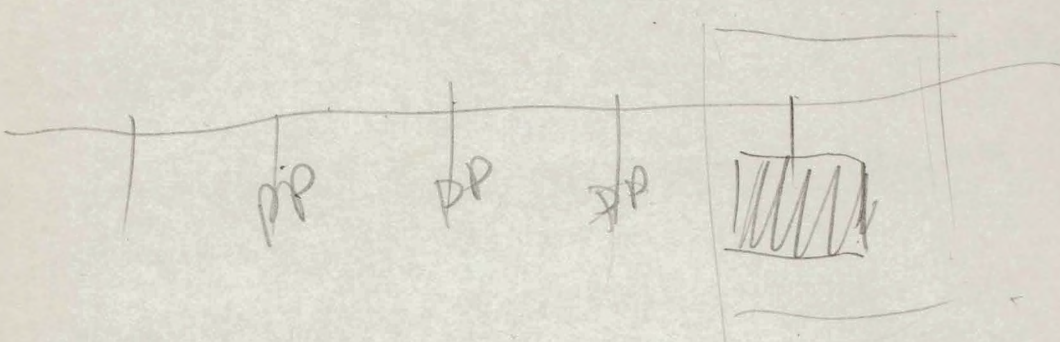
Change in affinity of enzyme to substrate

never observed but did they look for it?

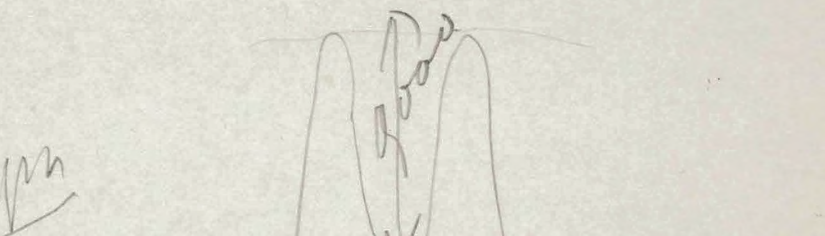
Kux ①







10^{-9} μm



9,2:3 x.6

18
2.7

20.7 x 6

12 000

$10^{13} \,/\!/\; e^{-\frac{12000}{600}} = 10^{13-20}$

$\frac{20}{213} =$

$= 10^{4}$

$3 \quad 10^{12} = \frac{10^{-9} \cdot 6\,10^{23}}{200}$

$36\,cm$

$\frac{36\,cm^2}{6 \cdot 10^{23}} \quad 10^{12}/4 \quad \frac{10^4}{3}$

$\left(\frac{200}{6 \cdot 10^{23}}\right)^{\frac{2}{3}} \quad 10^{12} \quad \frac{10^4}{3}$

$\cancel{10^{-12}}$

$\frac{200}{60} \quad \frac{10^{-12}}{21} \quad \frac{1}{3}\left(\frac{200}{60}\right)^{2/3}\left(\frac{1}{10^{24}}\right)^{2/3} 3\,10^{12} \quad 10^{4}$

$\boxed{10^{12}/sec} \quad \frac{3\,(4\pi)}{3}$

$\overline{10^{-16} \times 10^{12} \; 10^{4}}$

p

$1-p$

$(2-1) \quad 1$

$\beta\, 2\, p^{2-1}(1-p)$

$\beta\, dt =$

$\beta \left[\frac{\beta}{\alpha+\beta}\right]^{2-1} \frac{\alpha}{\alpha+\beta} \; 2$

$I = \frac{1}{\beta}\, \frac{\alpha+\beta}{\alpha} \left[\cdots\right] \frac{2-1}{R\, dt}$

$\sqrt[4]{e}$

PR O

4000

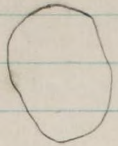
$e^{\frac{1}{4}}$

$e^{-\frac{3000}{800}}$

$\boxed{e^{+\frac{4000}{600}\frac{\Delta T}{T}}}$

$e^{\frac{4000}{18000}}$

ATP + E



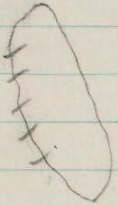
leucine*

Zamencnick

$ATP^{*} + E \rightarrow EP + ADP^{*}$

$E-\overset{O}{\overset{\|}{C}}-C-NH_2$

$E \sim P$



~~In the meantime~~
and in the meantime take
~~for~~ a leave of absence
without pay ~~pending~~

When I called on you in
September I told you that
~~I shall take for the time~~
~~being I shall take a leave~~
~~of abs without pay~~
~~I planned to ... with~~
~~you to make certain proposal~~
~~to you concerning~~

~~I was concerned about~~
~~devising some relation~~

because of the impending
disappearance of the Inst of
R.

When it became clear that at best
the Inst of R an B is going
~~to~~ retrench and at worst ~~to~~ disappear
I called on you in Sept
to discuss with you ~~what~~
how to make the best of a
bad situation. I

Transformation

Streptomycin resistance

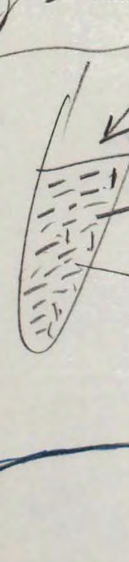
10^{-14} gm per transformed cell

~~$1000 \times 4 \times 10^{6}$~~

1000 × 4 million ~~Molek~~ weight molekule.

2×10^{-15} gm DNA / cell [5 times less than what is needed]

Donor lyse with Desoxycholate



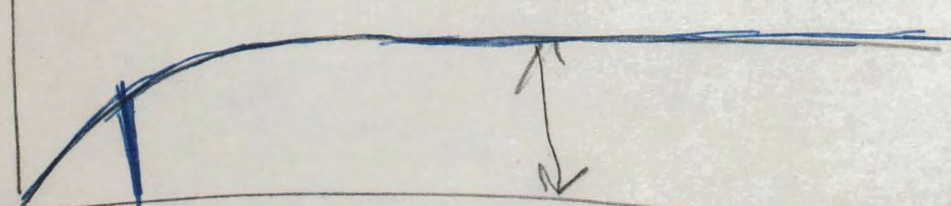
DNA

after 5 min, you can add DNAase!

10^{6}/cc

10 sensitive (capsule)

100 " strepton res.



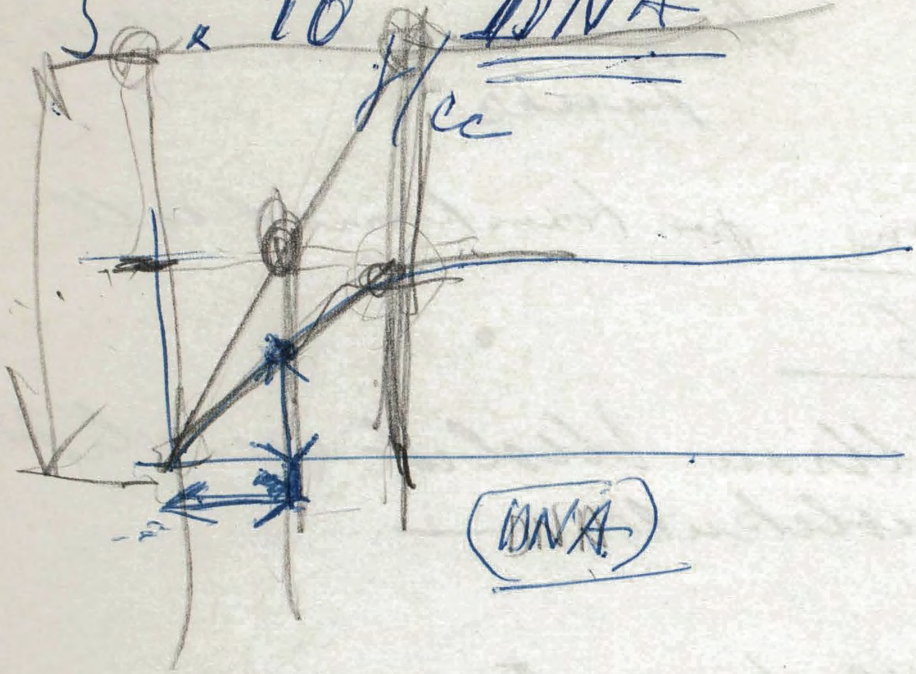
Type D best to transform

10^{10}/cc O.K.

Paul Doty molekular weight

5×10^{-2} DNA γ/cc

10^{8}/cc



DNA

10^{-8} γ DNA / per transformed cell

10^{4}

10^{-4} γ/cc DNA

for Sidland

Gen Hugh B. Hester
friend of in albert Greenfield
in Philadelphia

6 β Bacteriological Reviews

Sa (β) Mar 1952

Vol 16 p. 31

Robert Austrian

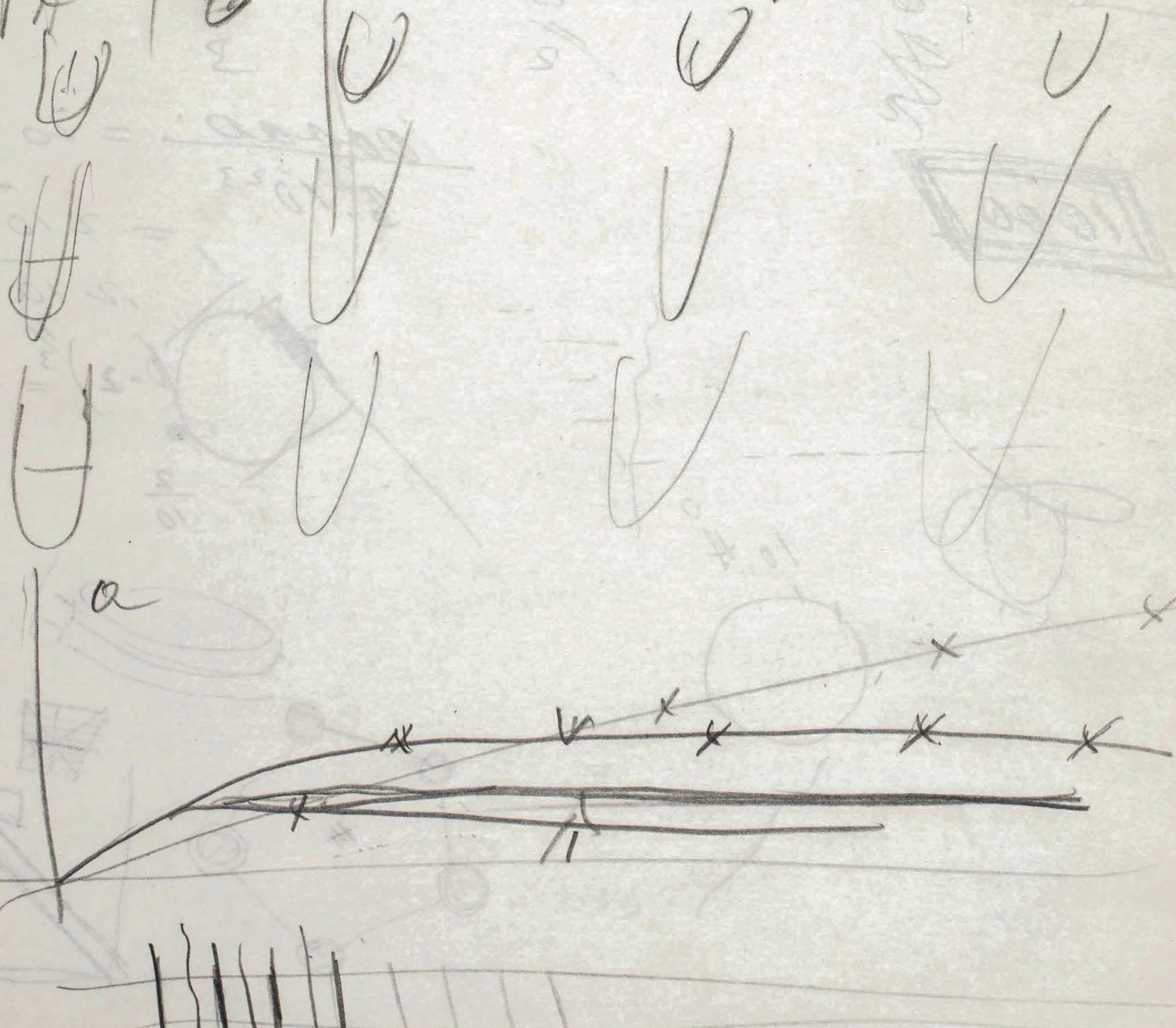
Biol. Div.

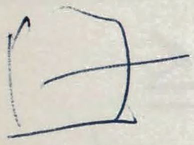
Dept of Med. Rd

Johns Hopkins

ANA | a

ANA | b





0

1/2

0

1/2

0

3

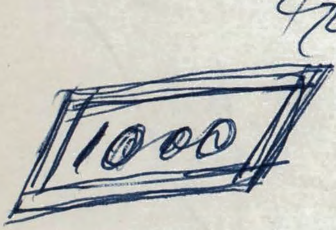
$$\frac{100000}{8 \cdot 10^{23}} = 20\ 10^{-20}$$

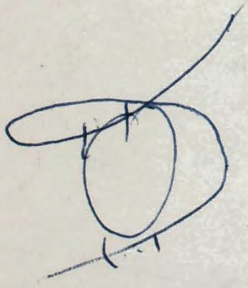
$$= 2\ 10^{-19}\ \text{cm}$$

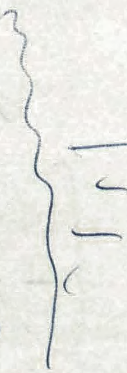
$$2\ 10^{-18}$$

$$(0.2)^{1/3} = 10^{-6}\ \text{cm}$$

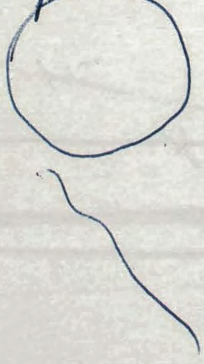
$$\frac{2}{10}$$

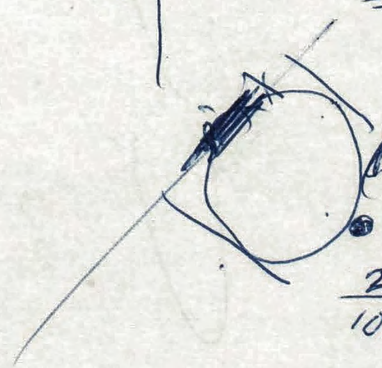


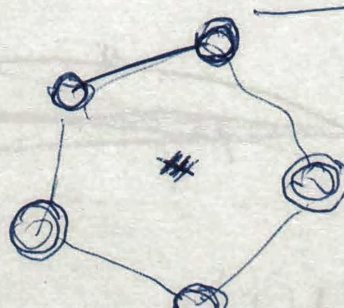


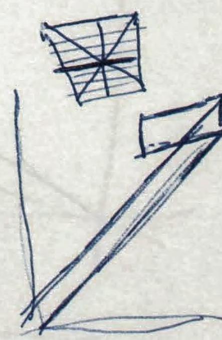


10^{40}

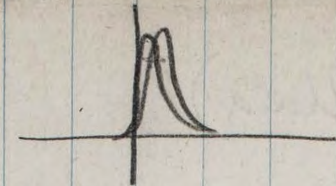


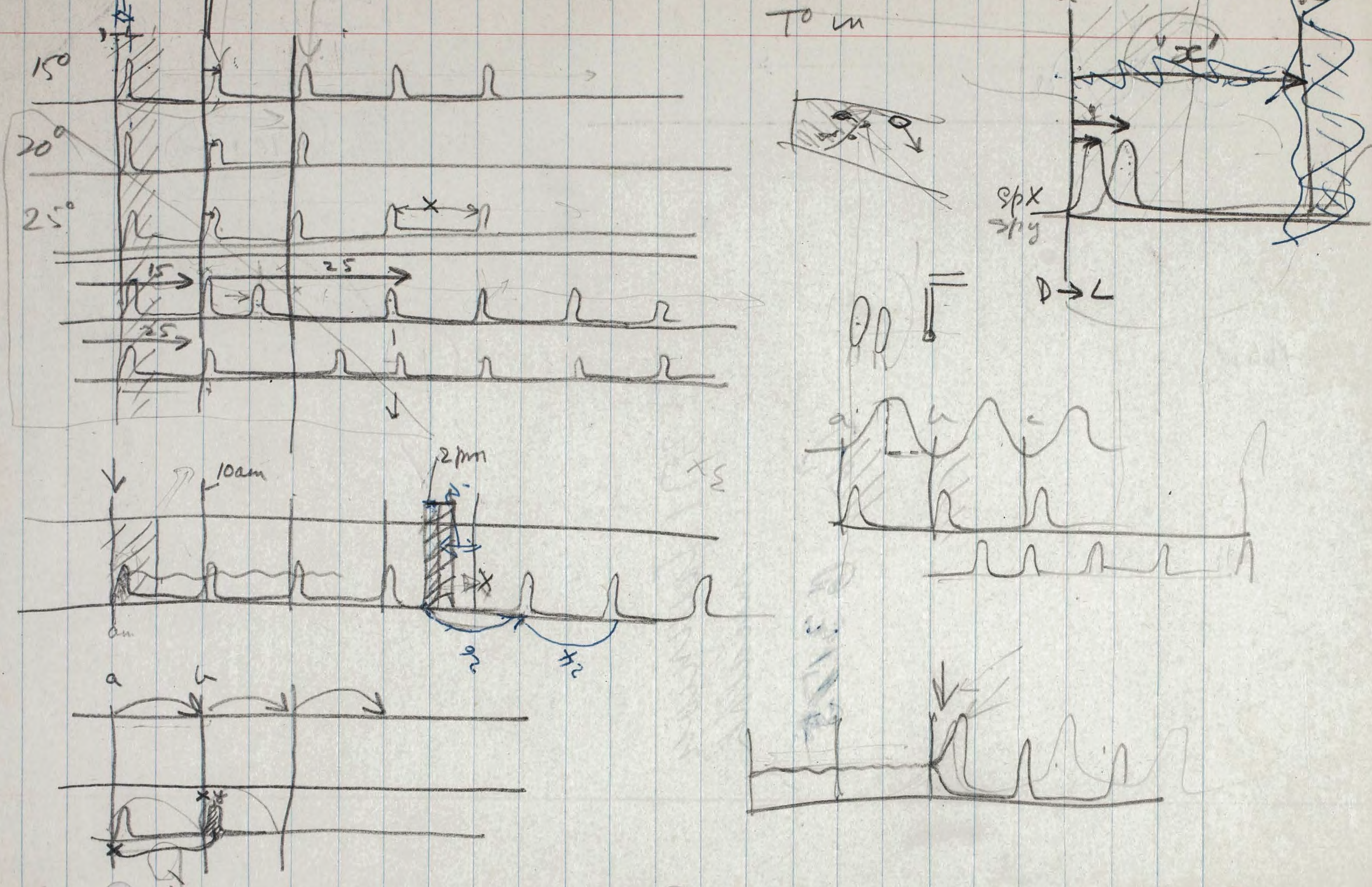




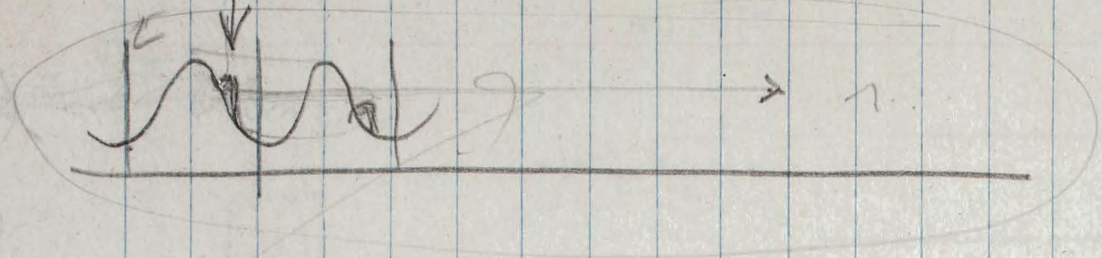


light – shade





6° – 30° Grav (Mea)

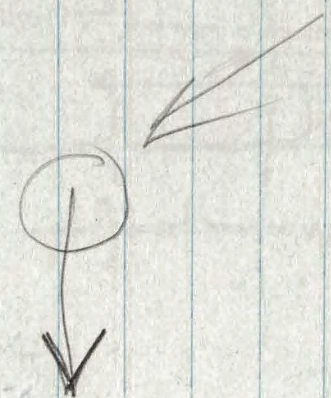


24 | 28.76

1.3

4

1.10 mins



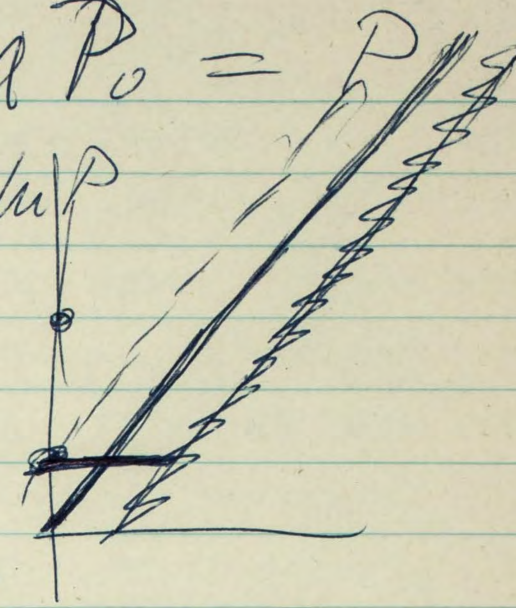
Mu

371 Commonwealth

Co 63175

$$E = E_0 + K(P - P_0)$$

$$\frac{E_0 e^{\alpha t} - E_0}{K} + P_0 = P$$



$$\frac{E_0}{K} e^{\alpha t} - \frac{E_0}{K} + P_0 = P$$

$$\frac{E_0}{K} = \Pi_0$$

$$\Pi_0 e^{\alpha t} - \Pi_0 + P_0 = P$$

$$\Pi_0 e^{\alpha t} = P_0$$

$$e^{\alpha t} = \frac{P_0}{\Pi}$$

$$t = \frac{1}{\alpha} \ln \frac{P_0}{\Pi_0}$$

$$\cancel{\tau \times 2,3 \times \log^{10} \frac{P_0}{\Pi_0}}$$

lag $= T_0$

$$\Pi_0 e^{\alpha(t + T_0)} - \Pi_0 + P_0 = P_0 e^{\alpha t}$$

$$\Pi_0 e^{\alpha T_0} e^{\alpha t} - \Pi_0 + P_0 = P_0 e^{\alpha t}$$

$$\Pi_0 e^{\alpha T_0} = P_0$$

$$T_0 = \tau \ln \frac{P_0}{\Pi_0}$$

It can not be completely lacking otherwise lag would be infinite

Lederberg Exp

Take an arginineless/T5 mutant and grow it in presence of tryptophane until ~~all~~ arginine ~~out~~ is exhausted, then add tryptophaneless strain which exhausts tryptophane (now lyse with T5) now add arginine and determine lag.

Lag should be enormous because now trypt store is exhausted.

log

repeat

$$E = E_0 + K(P - P_0)$$

$$\frac{dE}{dt} = K\frac{dP}{dt}$$

$$\frac{1}{P}\frac{dP}{dt} = \frac{\alpha}{K}\frac{E}{P}$$ [illegible]

$q(t)$

$$\frac{dP}{dt} = \frac{\alpha}{K}q(t)E$$

$\frac{10 \text{ mg}}{600 \text{ mg}}$ ~~60,000~~ lamp

$\frac{10}{1000}$

amino acid:

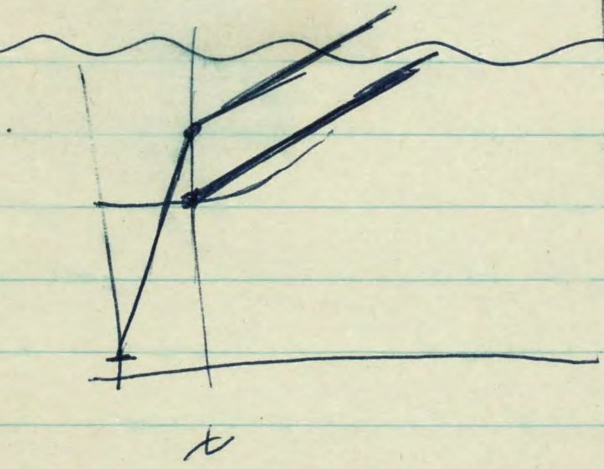
2 mg per 600 mg

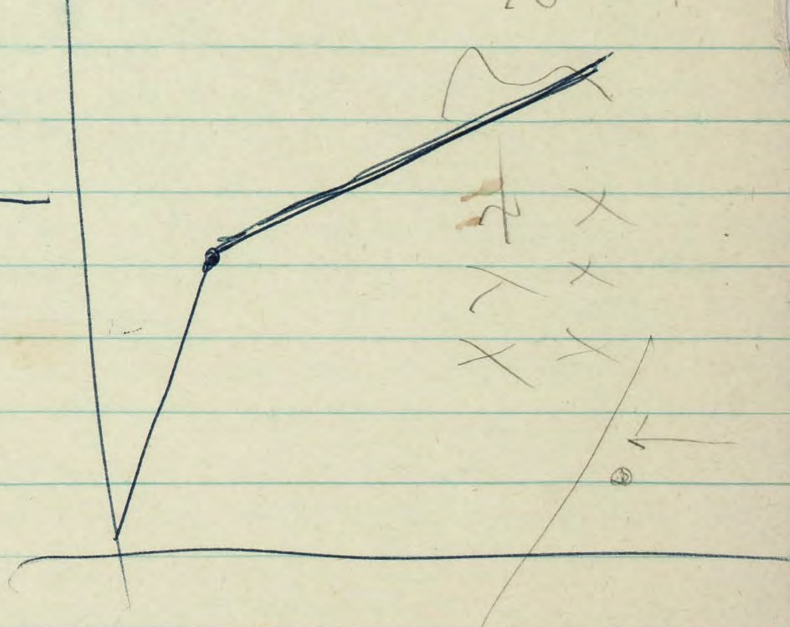
$\frac{1}{3}$ % or 3 gm/liter

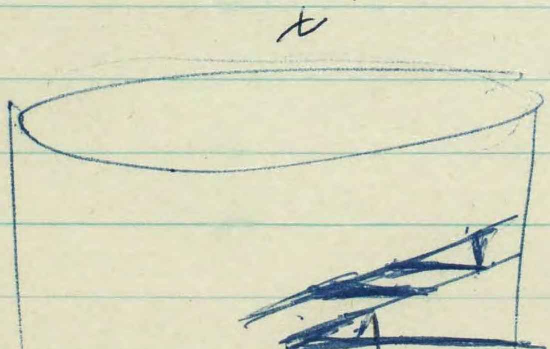
in absence of penicillin

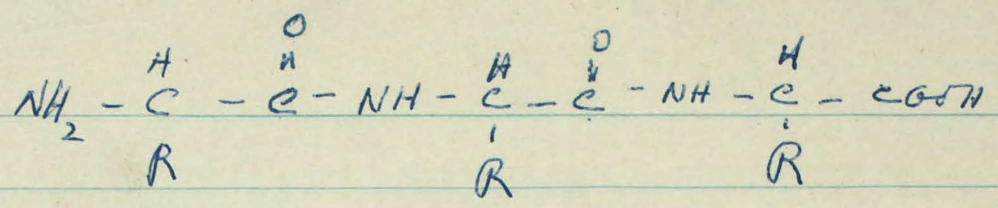
50 times less

J.T. Park
p. 897
877
885
J.B.C. 194
1952









$$E + ATP^{*} \rightleftharpoons E{\sim}PP + AMP^{*}$$

$$E{\sim}PP + \text{pantoate} \rightleftharpoons E{\sim}\text{pantoate} + PP^{*}$$

$$E{\sim}\text{pantoate} + \beta\text{-alanine} \rightleftharpoons \text{pantothenate} + E$$

Log: repeat

$k < 1$

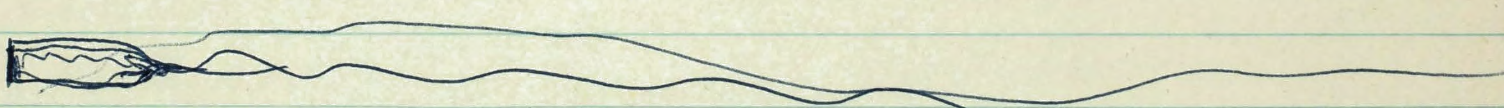
$$E = E_0 + K(P - P_0)$$

$$\frac{1}{P}\frac{dP}{dt} = \frac{\alpha}{K}\frac{E}{P}\left[\cancel{1+q_0}\left(1 - k\frac{E}{P}\right)\right.$$

$$\frac{1}{P}\frac{dP}{dt} = \frac{\alpha}{K}\frac{E}{P} + q_0\frac{\alpha}{K}\frac{E}{P}\left(1 - \frac{1}{k}\frac{E}{P}\right)$$

$$\frac{dP}{dt} = \frac{\alpha}{K}E + q_0\frac{\alpha}{K}E\left(1 - \frac{1}{k}\frac{E}{P}\right)$$

$$\frac{dE}{dt} = K\frac{dP}{dt}$$

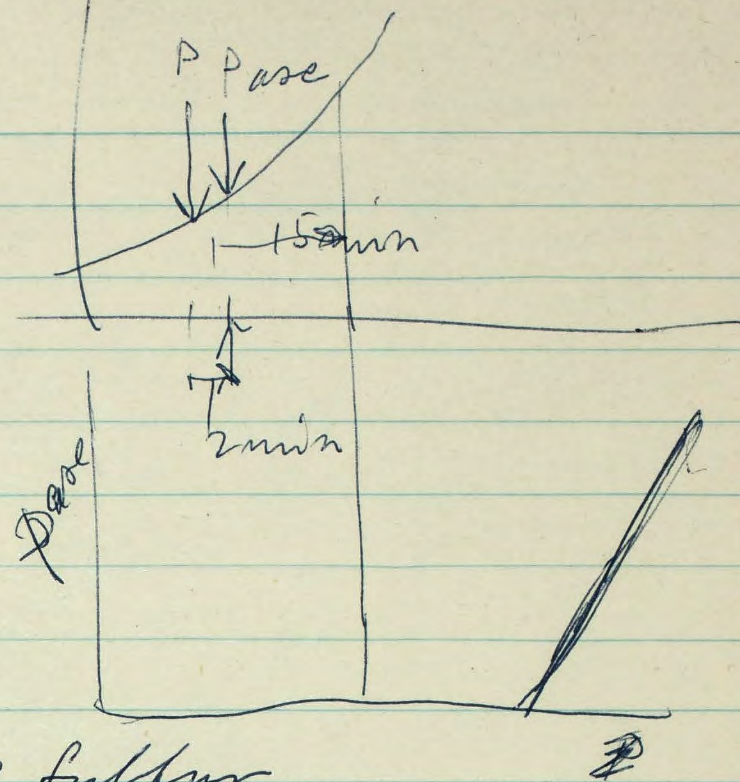


Hotchkiss

(1)

Monod No 3

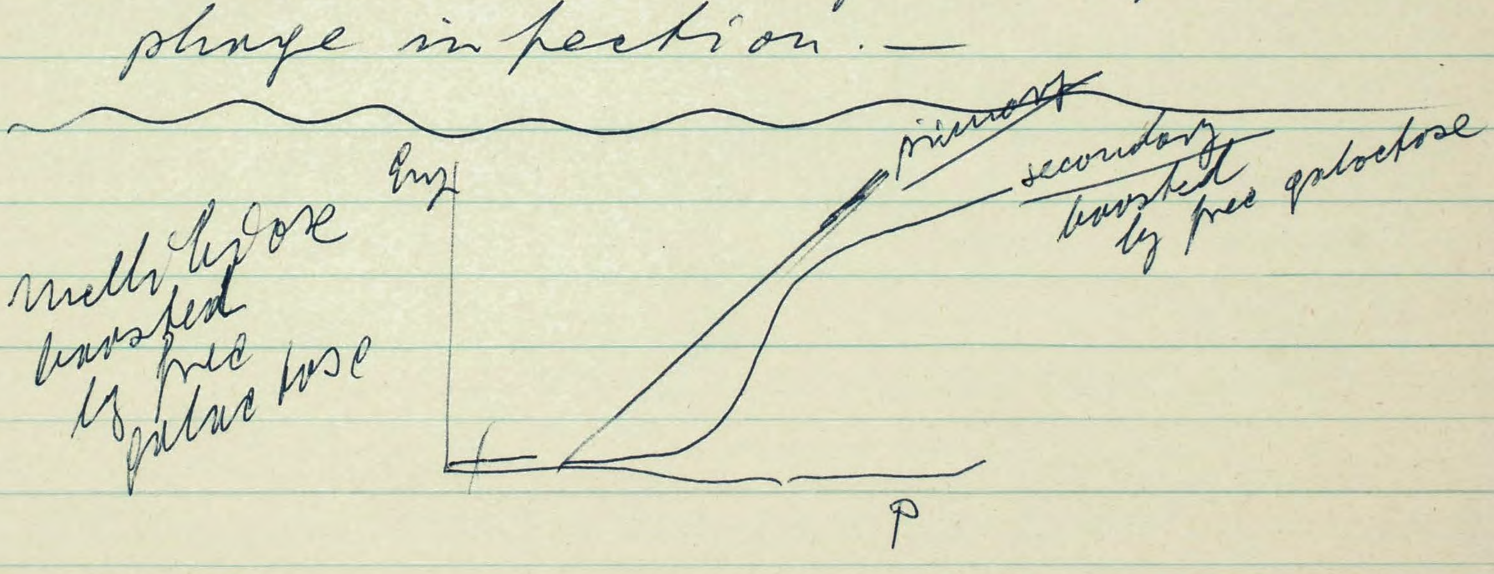
Pollock & Torkani
B cereus
10^{-8} Molar



Saturation at 80 Sulfur atoms (Penicillin) per cell
Mol weight of Penicillinase 30,000

In some experiments 40 Penicillinase molekules or more are formed per penicillin fixed.—

Other Question
"adapted" cell, can it continue to make exo-enzyme after phage infection.—



(2.)

Monod No 3

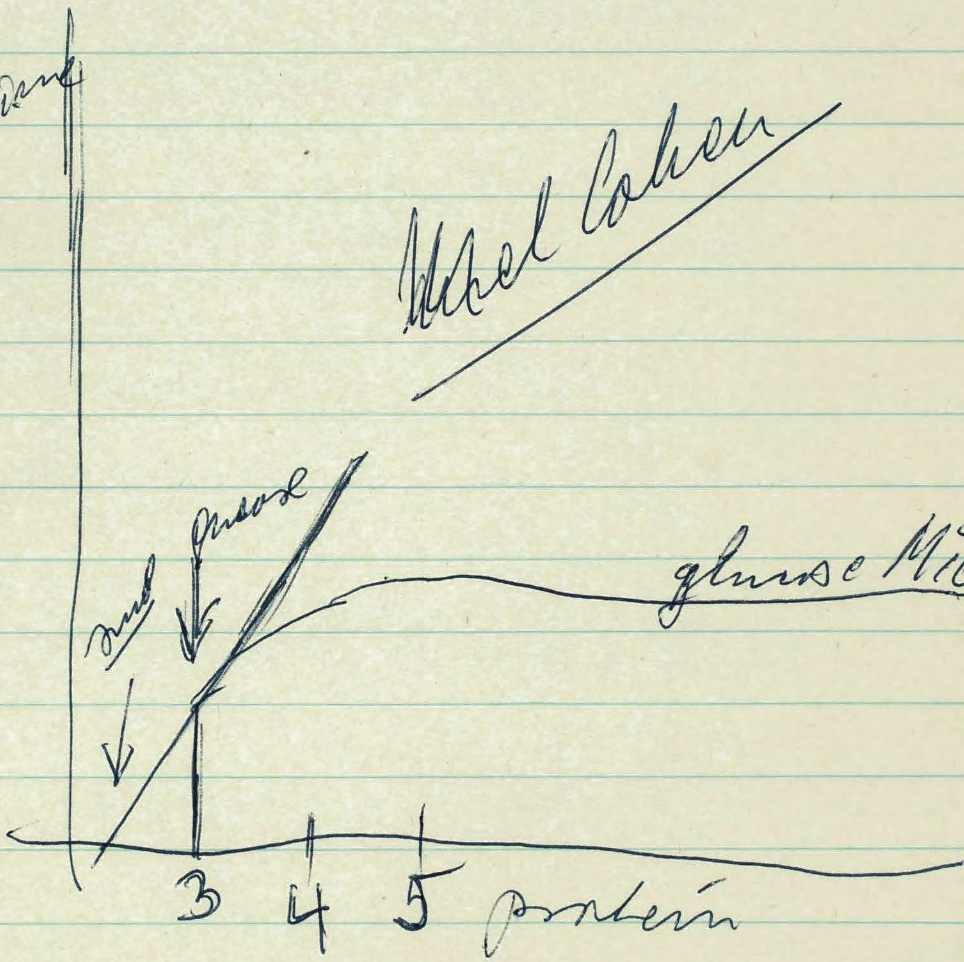
There are mutants which do not respond to secondary inducers. – they respond to primary inducers. –

Inhibitions

a.) diauxic inhibition
b.) specific "

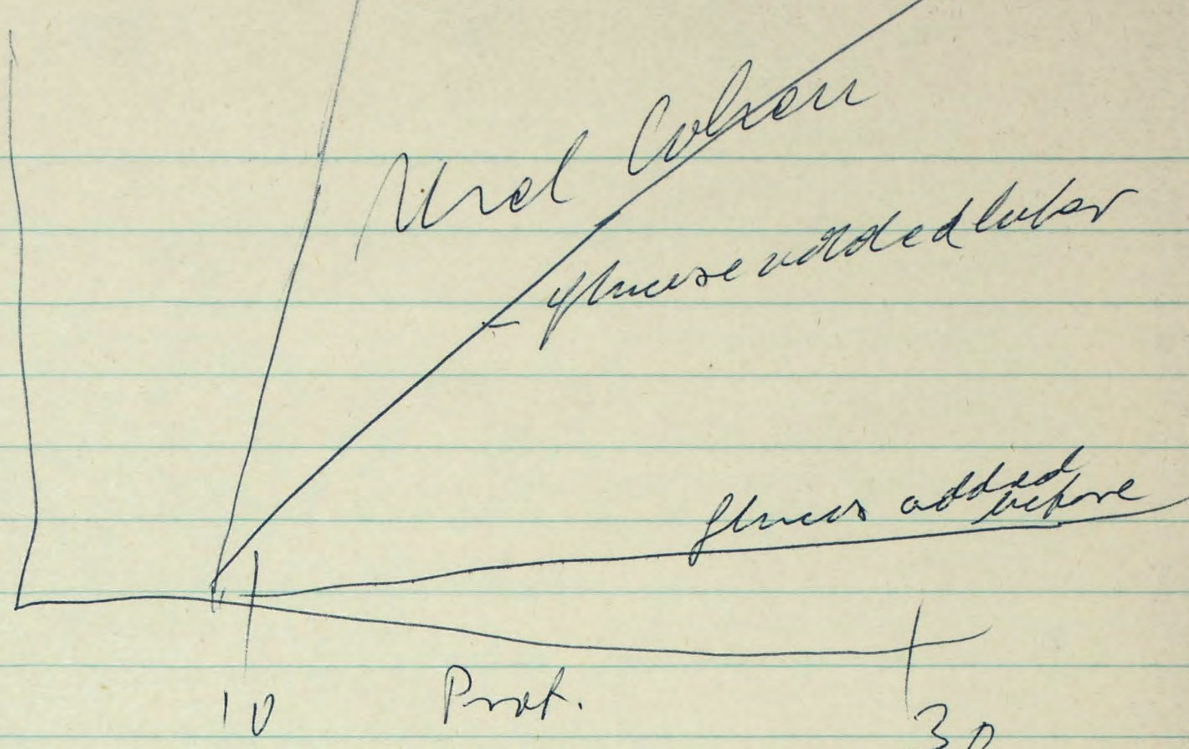
a) A
glucose
mannose
fructose

B
maltose
lactose
xylose

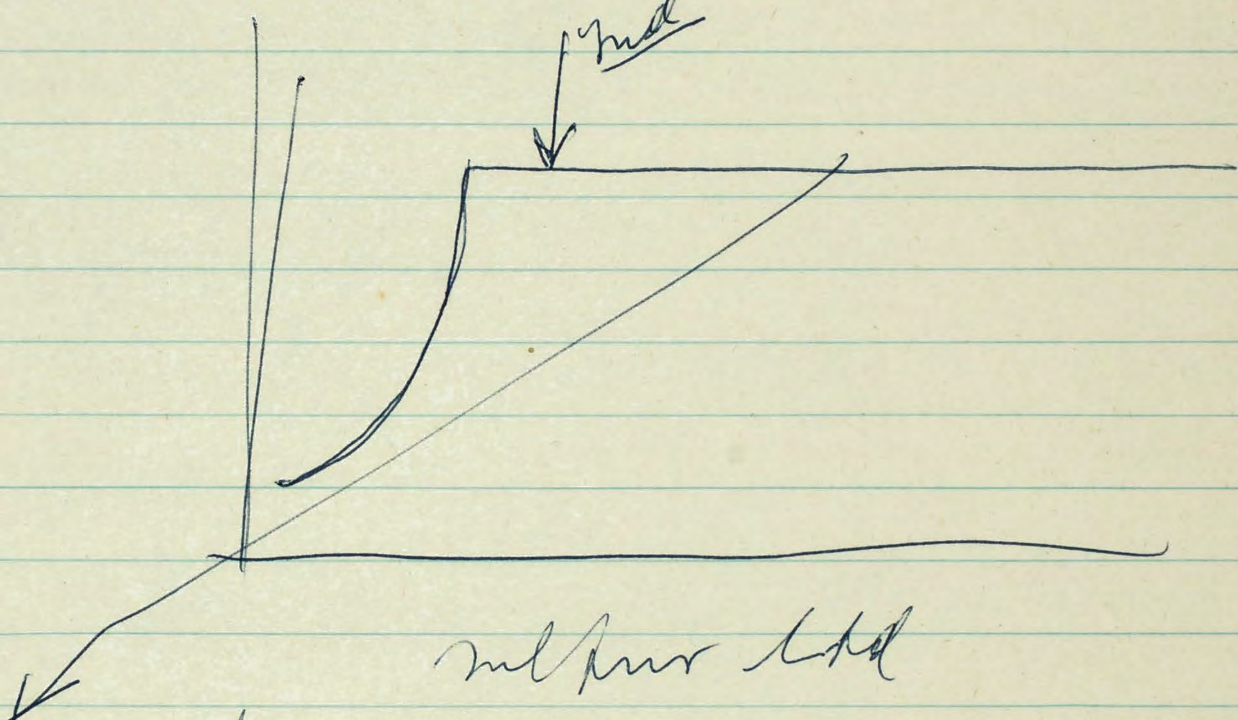


Michel Cohen

(3) Monod Nr 3

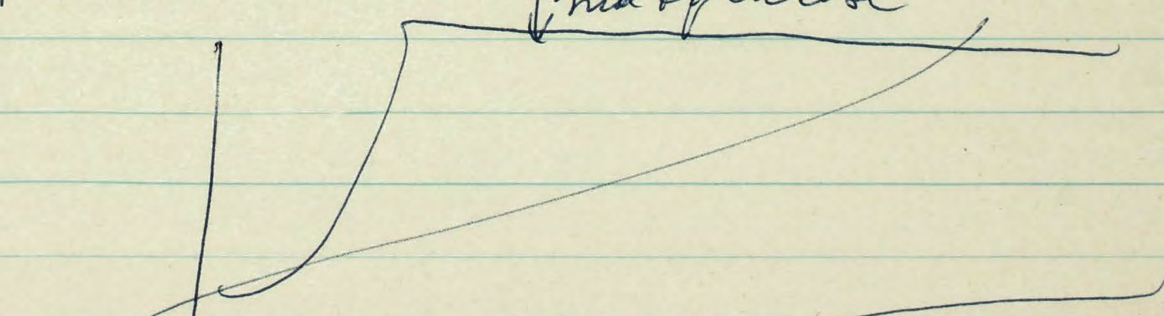


Glucose added before or after inducer is added.



sulfur ltd

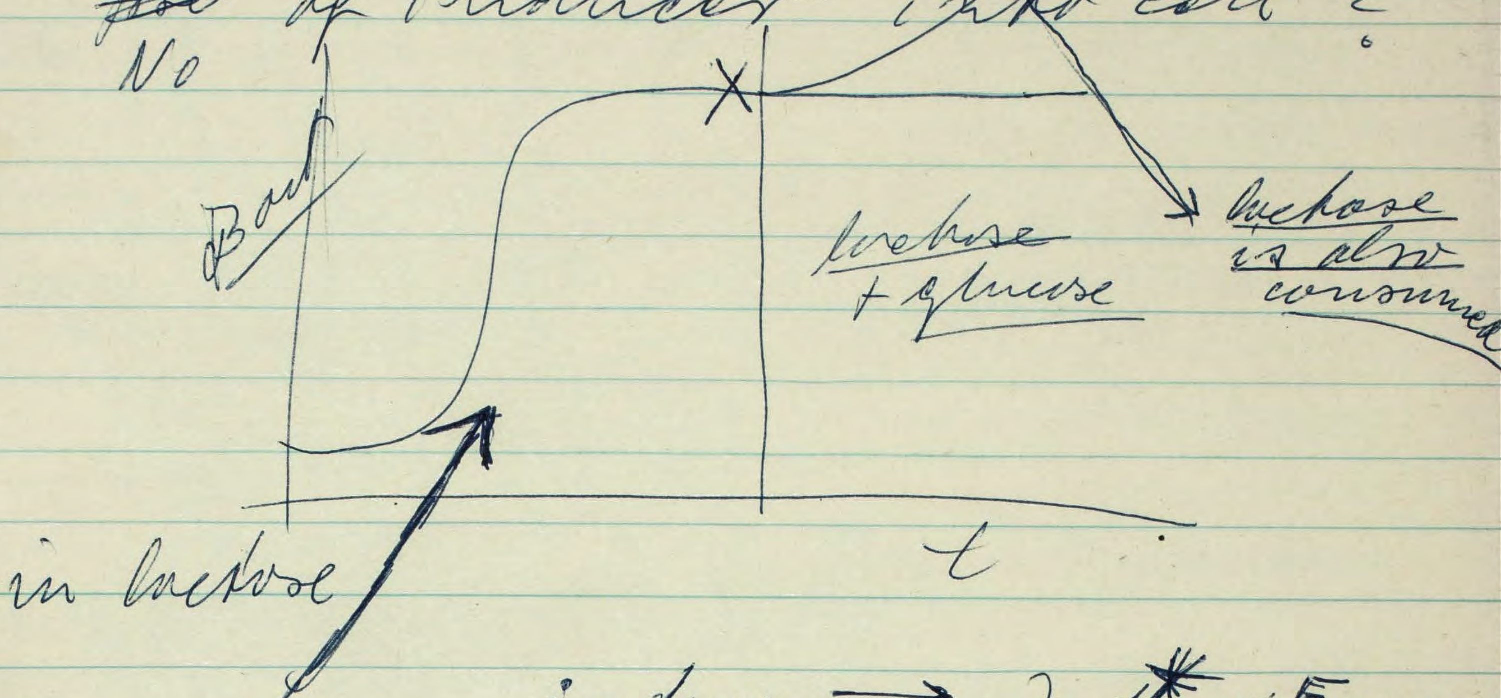
If transferred into sulfur want



← transferred in Sulf and glucose

Monod No3

Does glucose prevent the entry ~~of~~ of inducer into cell?
No



inducer ⇄ Ind* + Enz. forming system

Does the inducer bring information to the cell about the structure of the enzyme

— Thio-β-phenyl galactoside T.P.G.
no inducer

TMG good inducer

Question: does it matter which you add first?

No

assumption: (Possible objection)
may be even ~~any~~ primary inducers are first transformed and that here is the site of inhibition exerted by T.P.G.

Bonnie Davis;
Rosenberg
Lilian Recant

Eder (Harvard)

New Scheme:

1 o ← metabolite working to induce enzyme 2

2 o

3 o

4 o

5 o

↓ Meth

Diffusion model:
Assume: 400 enzymes per gene. —

Rate of diffusion to cell

1/sec must ~~make~~ transfer 400 molecules of Tryptophane (or any other A.A)

$\rho \, 4\pi D R$

$10^{13} e^{\frac{U}{RT}} \; N_1$

$N_2 R \, 4\pi D \rho$

$10^{12} \; 4\pi \; 10^{-5} \; 10^{-8}$

1/sec

5% of protein rather than $\frac{1}{1000}$ goes
50 times as much or 40,000

3% of wet weight DNA

$\frac{3\,10^{-12}}{100}$ gm = $3\,10^{-14}$ gm DNA/Bact

weight ~~mol weight~~ of one molecule $\frac{2,000,000}{6 \cdot 10^{23}} = \frac{1}{3}10^{-17}$

would give 10,000 genes

How many enzymes per gene are made in one generation on average?

$\approx 20 \times 3\cancel{0} = \boxed{600}$

$\left(\frac{M_{DNA}}{M_{Enz}}\right)$ 3%

and maximally if 5% of protein is made by one gene

$30\left(\frac{P}{DNA}\right)$ Total No of genes 10^4 | $\boxed{500 \times 600}$ 300,000

" " " " 10^3 | $\boxed{50 \times 600}$ 30,000

$$\frac{\frac{5}{100}}{\frac{1}{10^4}} = \frac{5\,10^4}{100} = 500$$

At conc of hypophosphate of 10^{-9} one has

3×10^{12}/cc ~~...~~ $D\,4\pi \times R =$

$\approx 3\,10^{12}\ 10^{-5} \times 10 \times R = 3$/sec diffusing to one site on DNA if all stick

one can make 30,000 enzymes on that site in 10,000 seconds or 3 hours

At what rate is ~~an ew~~ proteinda growing if Amino acid conc. 10^{6} gm/cc

600 enzyme molekules for each step. ~~...~~. One ~~step~~ ~~..~~ made 3×600 ≈ 2000 times per sec

assuming 1000 × 600 enzymes have to be made of ~~100~~,000 molecules each composed of 500 Amino acids time needed [if 50 of one kind] $\frac{50 \times 600 \times 1000}{2000}$ seconds = 300×50 seconds

= 5 × 3000 seconds = ~~4 hours~~ = 250 min

Therefore for such an amino acid we assume that 6000 Enzymes are available (not 600) (gen time 25 min.)

For amino acid synthesis total number of enzyme ~~molekules~~ species may be 200 leaving 800 unassigned other ~~any~~ enzyme species.

$\cancel{e^{+\frac{U}{RT}} = \frac{99}{100}}$ mol/sec $= 10^{13} e^{-20} = 10^{13} 10^{-\frac{20}{2.3}}$

1cc has 10^{-9} gm

$RT \ln 10^{9}$

$RT\,2.3 \times 9 = 600 \times$

2.3×5.4

11.5

map/sec. from one spot =

$$= 10^{13} (10^{-14}) e^{-20} = 10^{+13} \times 10^{-\frac{20}{2.3}} =$$

$$= 10^{13}\, 10^{-8.7} \simeq 10^{4} \text{ map } (10^{5})$$

$$\frac{20}{2.3} = 8.7$$

$$\frac{16}{2.3} \quad \text{hits} = 10^{-16}\ cm^2\ 3\ 10^{12} \times \frac{10^4}{3}$$

= 1/sec

not enough hits!!

~~100 mg~~ 1 gm / liter compound of amino acid

What about stability of polypeptides ????

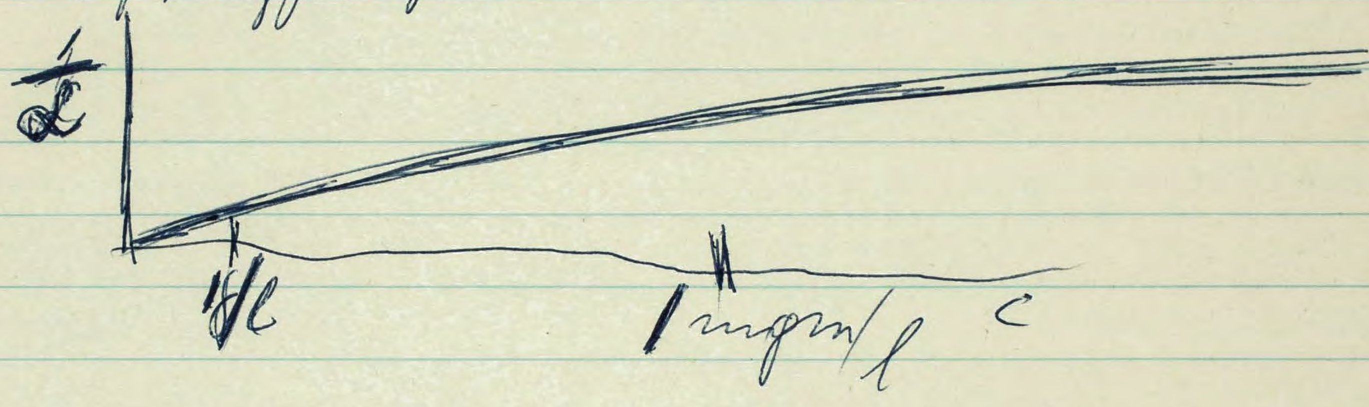
Basic exp:

Use B/1t ~~strain~~ in chemostat;
take out;
add excess of methionine (labeled)
and tryptophane for 1½ "enzymes"
~~Labeled~~ Wash with methionine
look for label on RNA or DNA

this exp. will bog down if there is an amino-acid "pool" of "bound" acid. –

Sutland exp. on amino acid pool

If amino acids compete for Uracil, then in the presence of all amino acid ~~growth – concen~~ for B/1t 2 hr generation time should correspond to much higher concentration of tryptophane



Sutland; Bacterial regulation (outpouring of precursor) arginineless + tryptophaneless strain – in chemostat

Make this strain B/1/15

1.) Stop chemostat when ~~tryptophane~~ methionine limited, then exhaust trypt by adding a B/1t

No good

Lag theory with "adaptation"

Amino acid A made by Enz from "precursor" which is present. E Enzyme E starts out $E(0) = E_0$

Stationary value of $\frac{E(\infty)}{P_0} = \frac{E_\infty}{P_0}$

E can make A q times ~~faster~~ faster than the normal growth

a.) $\frac{dE}{dt} = \beta \frac{dP}{dt}$ $\qquad q = 1$

$$\frac{1}{P}\frac{dP}{dt} = \frac{E/P}{E_\infty/P_\infty}\,\alpha$$

$$\frac{E_\infty}{P_\infty} = \beta$$

$$\frac{1}{P}\frac{dP}{dt} = \frac{E}{\cancel{P}}\,\frac{\alpha}{\beta}$$

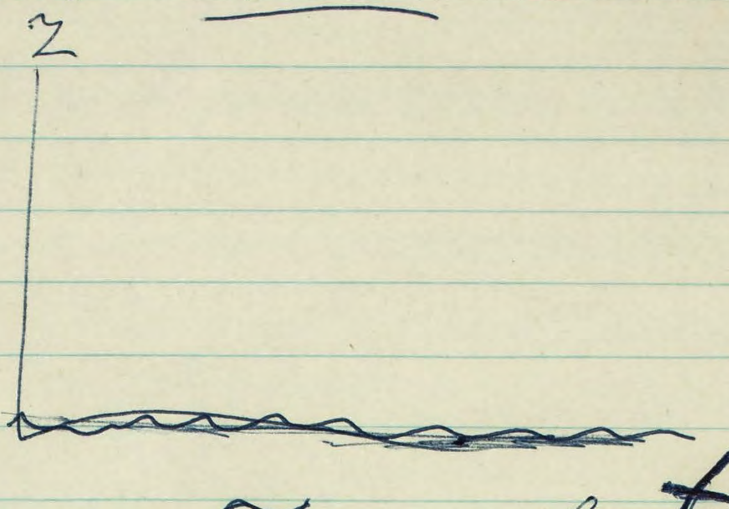
b.) $$\frac{dP}{dt} = \frac{\alpha}{\beta} E$$

$$\frac{dE}{dt} = \alpha E$$

$$E = E_0 e^{\alpha t}$$

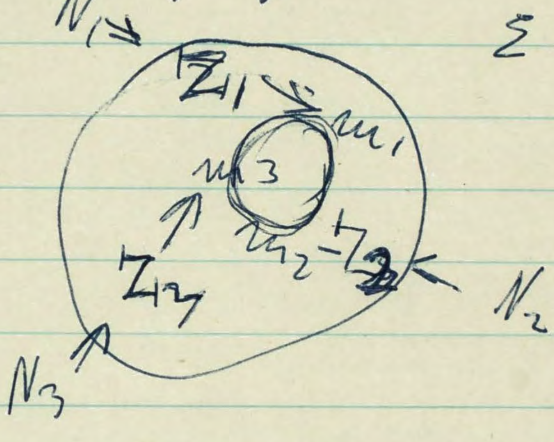
$$P = P_0 e^{\alpha t}$$

Unusual No 2 lactose



Benzer; T_2; only "adapted" cells will lyse with lactose as carbon source in a heterogeneous population. —

$\Sigma Z_i = X$



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

Concentration

$M = 10^{-4}$ gives half of maximum synthetic rate