

E-48

May 13 2017

	$\rho$	$\mu$	$k$	$\nu$	$\rho/\mu$	$(\rho/\mu)^{0.4}$	$T$	$\frac{\Delta 0.8}{D}$	
Air	7/30	$3 \times 10^{-4}$	$0.82 \times 10^{-4}$	3.66	0.85	0.94	$6.7 \times 10^{-4}$	300°C	1.15
He(1)	5/4	$3.5 \times 10^{-4}$	$6.3 \times 10^{-4}$	1.9/3.4	0.7	0.87	$0.9 \times 10^{-4}$	300	1.15
He(10)	5/4	$3.5 \times 10^{-4}$	$6.3 \times 10^{-4}$	1.9/3.4	0.7	0.87	$9 \times 10^{-4}$	300	1.15
H <sub>2</sub> O	1	$55 \times 10^{-4}$	$14.5 \times 10^{-4}$	3.8	3.8	1.7	1	50	1.15
Bi	3.6/100	$146 \times 10^{-4}$	4.1/100	0.356	1.3/100	0.175	10	300	1.15

Not given 1/100 of temperature  
heat = kinetic energy

$\Delta T$ (rad)	$v$	$\frac{v^2}{\mu}$	$(\frac{v^2}{\mu})^{0.8}$	$h$	$\overline{\Delta T}$	$\overline{\Delta T} h^{col}$	$kW/m^2$	
Air	300	$7.67 \times 10^3$	$1.7 \times 10^4$	2430	$0.5 \times 10^{-2}$	250	1.2	51
He(1)	300	$1.77 \times 10^4$	$4.55 \times 10^3$	844	$1.2 \times 10^{-2}$	250	3	126
He(10)	300	$1.77 \times 10^4$	$4.55 \times 10^4$	5,325	$7.5 \times 10^{-2}$	250	18.7	785
H <sub>2</sub> O	50	$6.5 \times 10^3$	$1.2 \times 10^6$	73,000	4.65	25	116	4,870
Bi	300	$3 \times 10^3$	$2.5 \times 10^6$	112,000	20.8	150	3120	131,000
for $v =$	1/30	1/20	1/10	1/5	1/4	1/3	1/2	$\times v$ vertical
$f$	1/15	1/12	1/6.3	1/3.6	1/3	1/2.4	1/1.74	

multiply these

1/2 in diameter tube for data

on upper  
side

BR 5-1171

TR 7-5895

Water

0.0013

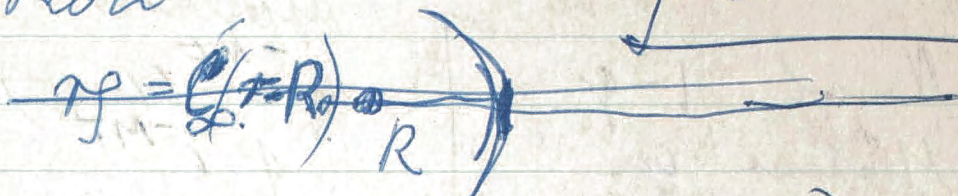
Ether 0.0003

Problems

Nov 13 - 66

Diffusion

$$\rho = 0 \quad r = R$$



for

$$r \rho = \rho_{\infty} (r - R)$$

$$\rho = \rho_{\infty} \left(1 - \frac{R}{r}\right)$$

$$\rho = \rho_{\infty} \left(1 - \frac{R}{r}\right)$$

$$V \rho' = \rho_{\infty} \frac{R}{r^2}$$

$$r^2 \rho' = \rho_{\infty} R$$

$$d \text{ or } r^2 \rho' = D 4\pi \rho_{\infty} R = \text{const}$$

What diffuses in is prop. to  $R$   
time for doubling mass.

$$\frac{A R \rho' t}{\rho_{\infty} R^2} = \frac{4\pi R^3}{R^2} \text{ would go with } R^2$$

if for  $R = \frac{10}{1000}$  min = 24 hours

if mass 1000 times less

$$R = 10 \text{ times less}$$

$$R^2 = 1/100 \text{ time}$$

$$\frac{24 \times 60 \text{ min}}{100} = 15 \text{ min}$$

# Selection of mutants

Normal	$1-q$	after div $e^{-Nt}$	$(1-q)$
Mutant	$q$	$e^{-Mt}$	

$$\begin{aligned}
 \text{Ratio after div.} &= \frac{N(Mt)}{M(Nt)} = \frac{Nq e^{-Mt}}{(1-q) e^{-Nt}} \\
 &= q \frac{e^{(N-M)t}}{1 - q e^{-(N-M)t}}
 \end{aligned}$$

H

Week Apr 25-66

Diffusion in  $4\pi R^2 \rho' = 4\pi \rho R D$

assuming that nitrogen =  $\frac{1}{f}$  of wet weight of algae; if  $N = \frac{1}{5}$  of dry weight and dry weight  $\frac{1}{5}$  of wet weight  $N$  about  $\frac{1}{30}$  ~~biomass~~  $f = 30$

time for doubling from

$$4\pi \rho R D \approx \frac{4\pi R^2 \rho'}{3}$$

$$t \sim \frac{R^2}{D} \frac{1}{3f} \frac{1}{\rho}$$

$$t \text{ day} \approx R^2 \frac{1}{3f} \frac{1}{\rho}$$

for  $D=1$

$$\rho = \frac{30}{1000} \text{ gm/cm}^3 = 3 \cdot 10^{-2} \cdot 10^{-6}$$

$$\text{for } R = \frac{10}{1000} \text{ m} = 10^{-3} \text{ cm}$$

$$t \approx \frac{10^{-6}}{3 \cdot f} \frac{1}{10^8} = \frac{1}{3} \text{ day}$$

②

②

$10^{-8}$

$\frac{3}{100}$

①  
③

④

⑤

10 cm

30 sec

0.34 cm/sec

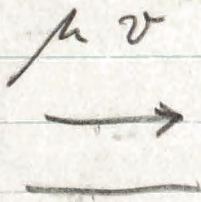


$2 \times 10^5$  cm/sec

$2\sqrt{3} 10^1$  cm/sec

~~$\frac{1}{2} \rho v^2$~~   $\frac{4}{3} \pi R^3$  =  ~~$\rho R$~~   $\frac{L}{\rho}$   ~~$\frac{L}{\rho}$~~   $\frac{L}{\text{sec cm}^2}$

dynes  
sec



$3 \times 10^{-6}$   
 $\sqrt{3} 10^{-6}$

$\frac{1}{2} \rho v^2 = N$

$\frac{v}{2} = \frac{1}{\rho}$

$\tau = \frac{\mu}{v}$

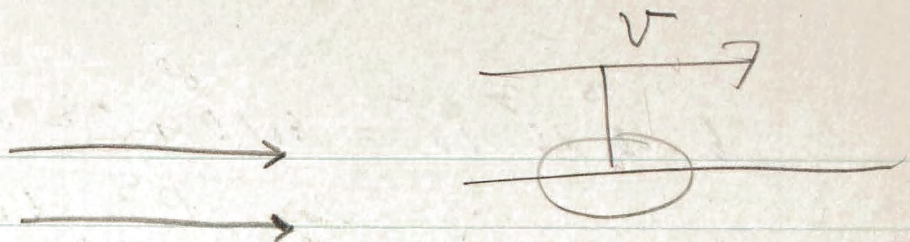
$10 \text{ gm}^{-12}$

$6 \cdot 10^{23}$

$\frac{1}{3} 10^{-23}$

$3 \times 10^{-24}$



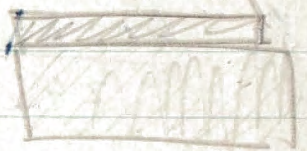


$$\mu = \frac{\text{force}}{\text{cm}^2} = \text{m cm}^{-2} \text{ sec}^{-2}$$

$$\text{m cm}^{-1} \text{ sec}^{-1}$$

$$\frac{54 \times 10^3}{3} v$$

$$= \mu R \frac{v}{\dots}$$



$$\text{m cm}^{-1} \text{ sec}^{-1} \quad \mu \text{ cm}^{-1} \text{ sec}^{-1} \text{ cm} \text{ cm}$$

10  
30

$$\mu \frac{v}{\text{cm}} = \text{force/cm}^2 = \frac{\text{m cm}^{-2} \text{ sec}^{-2}}{\text{cm}^2} = \text{m cm}^{-4} \text{ sec}^{-2}$$

$$\mu \text{ sec}^{-1} = \text{m cm}^{-1} \text{ sec}^{-2} \Rightarrow \mu$$

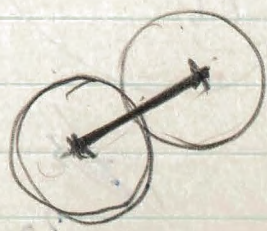
$$\boxed{\mu = \text{m cm}^{-1} \text{ sec}^{-1}}$$

$$10^{-12} \text{ gm } 0.3 = \frac{1}{100} 10^{-4} \text{ N}$$



$$10^{-6} \text{ cm}$$

$$\frac{100}{10^4}$$



$$6 \cdot 10^3 \cdot 10^3 \cdot 10^2 = 6 \times 10^8 \text{ cm} = R$$

$$R^3 = 6 \times 36 \cdot 10^{24}$$

$$R^3 = 2 \cdot 10^{26}$$

$$4 \cdot 10^{27} \text{ pm} = \text{mass}$$

$M \propto R$

$$\frac{40,000 \text{ meter}}{24 \times 68 \times 68} \parallel \frac{400 \times 1000}{24 \times 36} = \frac{100 \times 1000 \text{ cm}}{8 \times 24}$$

$\Rightarrow$  ~~10,000~~

$$\frac{40,000 \times 1000 \times 1000}{24 \times 88 \times 88 \times 36} = \frac{10,000,000,000}{24 \times 9}$$

50,000 cm

$$M \propto R = 4 \cdot 10^{27} \times 5 \cdot 10^4 \times 6 \times 10^8 =$$

$$4 \times 5 \times 6$$

~~10~~

1041

41

26

~~5~~

~~5~~

$\frac{e}{2mc}$

$$\frac{10^{-15}}{10}$$

$$4 \cdot 10^{-10}$$

$$\frac{5 \cdot 10^{-20}}{2 \cdot 1.6 \times 3 \times 10^{24}} = \frac{1}{2} 10^{-4}$$

$$= \frac{1}{2} 10^{-4}$$

$$\frac{e}{2mc} \parallel \frac{5 \cdot 10^{-10}}{2 \cdot 1.6 \cdot 10^{-24} \cdot 3 \cdot 10^{10}}$$



Proposed

Momentum of all protons involved

$$5 \frac{4\pi}{3} (6 \cdot 10^8)^3 \frac{1}{1.6 \cdot 10^{-24}} \frac{1}{2} 10^{-23}$$

$$15 \times 4 \times (6 \times 36 \times 10^{24}) =$$

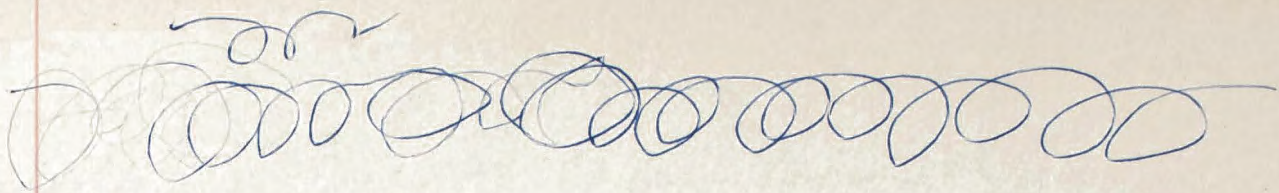
$R^3$

Mass  $4 \times 10^{27}$

$$\frac{e}{m} = \frac{5 \cdot 10^{-10} \cdot 2000}{1.6 \cdot 10^{-24} \cdot 3 \cdot 10^{10}}$$

$$= \frac{10}{5} \cdot 10^7$$

Ratio for protons  $10^4$



Critical length for  $r = 1 \text{ cm}$  75 cm

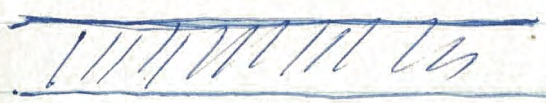
$$r = 2 \frac{\pi r^2}{2\pi r} = \frac{2Q}{F}$$

for slab of 1 cm diameter

$$[r] = \frac{2}{2} = 1$$



Energy is lost in time  $t = \frac{75}{v}$  sec  
for  $v = 15 \text{ cm/sec}$   $\frac{1}{2}$  sec



if wall moves 15 m/sec and  
changes by 10% energy of relative motion  
of  $v = 15$  meter would be lost in ~~time~~  
 $\frac{1}{2} (1 + \frac{1}{10})^2$  ;  $\frac{1}{2} (\frac{1}{10})^2$  longer time

$1 + \frac{2}{10} + \frac{1}{100}$  ;  $\frac{1}{100}$  longer by factor of 21  
or say 20 or 10 second

grounding ~~with~~ 3 cm wall

Energy input every 10 sec  
 $\frac{2}{10}$  of kinetic energy in liquid (at lower  
rat. rate)  
+  $\frac{6}{10}$  kinetic energy (in wall)

or every 10 sec  $\frac{8}{10}$  of kin energy in liquid  
or  $\frac{8}{100}$  of kin energy in liquid goes in  
per second of network  $\frac{6}{8}$  is recoverable

Amount processed 5 cm long sections  
in 30 sec. 1 cm sheet 500 cc and  
in ten layers 5 liters per  $\frac{1}{2}$  minute

Assuming drum 30 cm dia -  
 meter, layer 10 cm liquid  
 (meter long drum = 100 kg weight  
 $\frac{1}{2} 10^5 \text{ gm} (1500)^2 \text{ erg} = \frac{225}{2} 10^9 \approx 100 10^9 = 10^{11} \text{ erg}$

$\approx 10^{10} \text{ erg/sec} = 1000 \text{ Joules} \quad \underline{\underline{1 \text{ kWatt}}}$

Heat cond of water 0.0013  
 other 0.0003

Water for  $v = \frac{65}{30} \text{ m/sec} \approx 2 \text{ m/sec}$

for 25 degree diff.  $\frac{116}{15} \text{ cal/cm}^2 \text{ sec}$

or for 1 degree diff.  $\frac{1}{15} \frac{4.65}{15} \text{ cal} \approx \frac{1}{3} \text{ cal}$

drum:  $\frac{4800 \text{ kW/m}^2}{25} = \frac{250}{25} \frac{4800}{10^4} = 4.8 \text{ cal/cm}^2 \text{ degree}$

say 20 beds in a meter length

5 cm

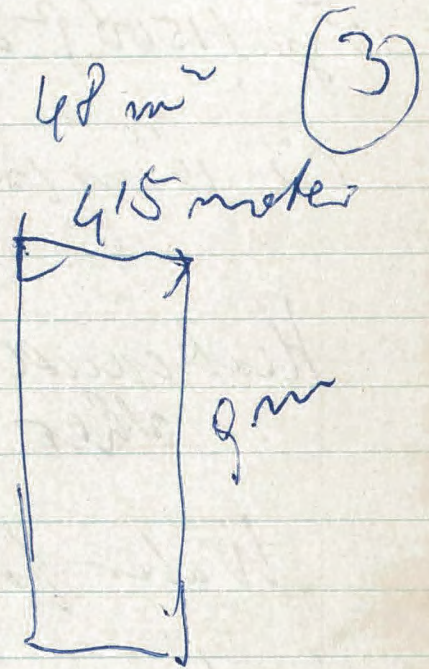
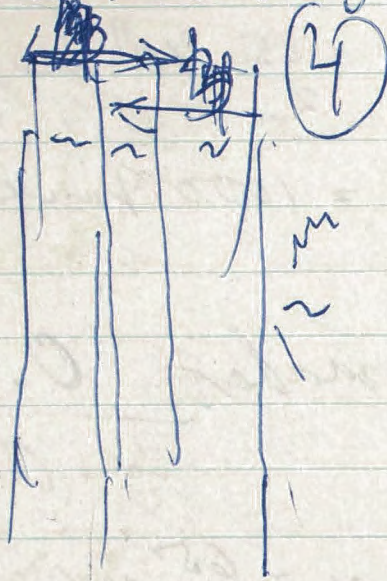
$R = 14 \times 10^{-4}$  for heat

$d = 10^{-5}$

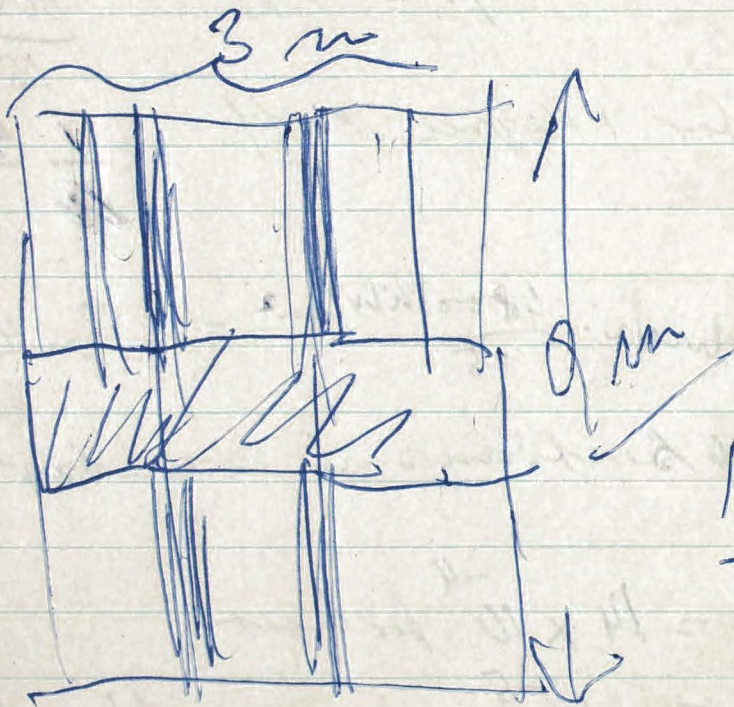
$\sqrt{140} = 12 \text{ } 12$

say it takes **30** sec ~~for~~ for crossing  
 the difference

for 20 m velocity cross section  
20 m<sup>2</sup>



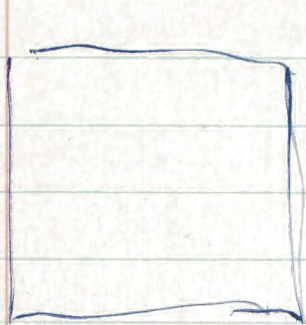
(2)



18 m<sup>2</sup>



Apr 6/14/47 20 m<sup>2</sup> for 13 kg  
H



1 m

10 meters/sec

$$v = 10^3$$

$$10^4 \times 10^3$$

10<sup>4</sup> liter

10<sup>4</sup> · 1.3 gm

~~10<sup>4</sup> liter~~ 10<sup>7</sup> 1.3 gm/sec

10<sup>7</sup> 1.3 gm/sec

$$m = v Q \cdot 1.3$$

$$m v = v^2 Q \cdot 1.3$$

will support 13 kg

~~work in 1/2 meter~~

$$v^2 v Q \cdot 1.3 = \frac{10^6 \cancel{10^3} 10^4 \cdot 1.3}{2} =$$

$$= 10^{13} \times 0.6 \text{ erg/sec or } \cancel{10^6} \times 0.6 \text{ joule}$$

$$10^6 \times 0.6 \text{ joule}$$

100 kWatt  
500 kWatt

Wk 13 kg = 1300 gm  $\frac{10^6}{2} = \cancel{5.6} 10^9$

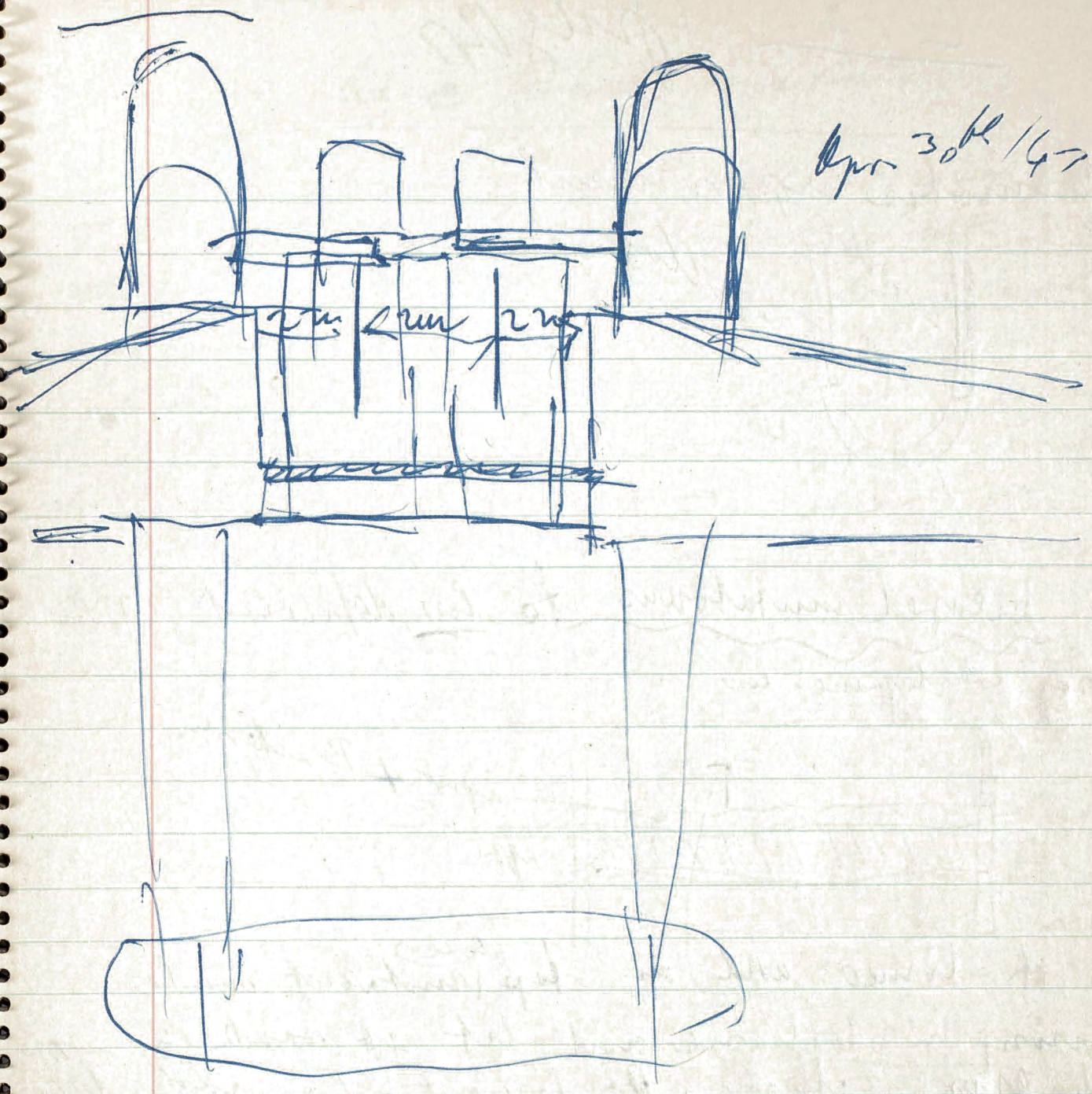
600 Watt

600 joule

0.6 kW  $\approx$  LIPS

$$\frac{6 \cdot 10^9}{0.6 \times 10^{10}}$$

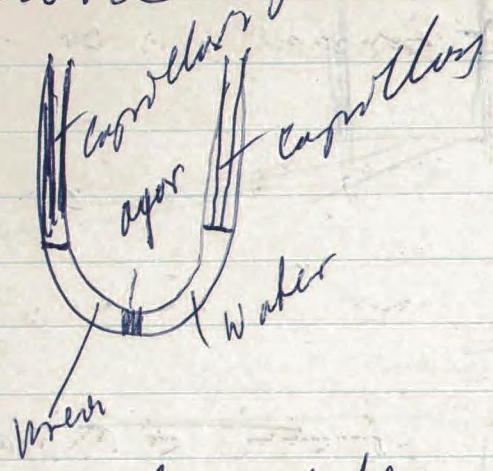
Apr 30<sup>th</sup> / 47



1

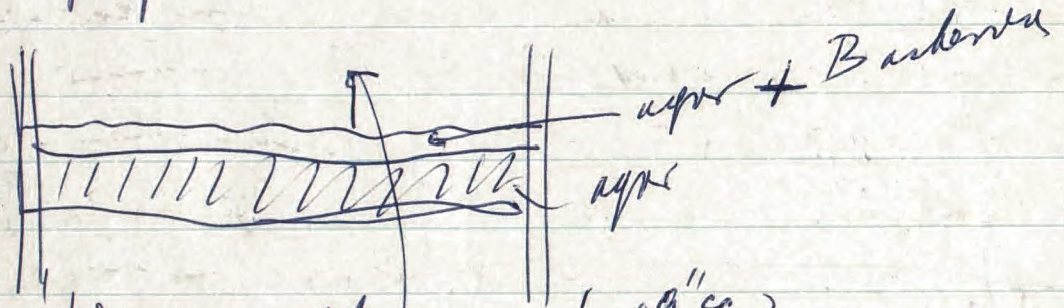
L.S. July 4/47

### Osmotic experiment



belayed mutabrous to less dependent type

say tryptophane-less



at time add on top <sup>"a"cc</sup> (nutrient carrier) -  
 ring tryptophane and let it soak in  
 by ~~agar~~ osmotic method. At time  $t \geq t_0$  add "b"cc  
 (osmotic) minimal medium and let  
 it soak in by osmotic method. -  
 after allow new colonies to grow in  
 minimal medium and see how  
 many appear.

(2) One there back mutations?

Take Kir strain showing segregation  
Take wild type ~~W1~~ ~~W2~~ ~~W3~~ ~~W4~~ ~~W5~~ ~~W6~~ ~~W7~~ ~~W8~~ ~~W9~~ ~~W10~~ ~~W11~~ ~~W12~~ ~~W13~~ ~~W14~~ ~~W15~~ ~~W16~~ ~~W17~~ ~~W18~~ ~~W19~~ ~~W20~~ ~~W21~~ ~~W22~~ ~~W23~~ ~~W24~~ ~~W25~~ ~~W26~~ ~~W27~~ ~~W28~~ ~~W29~~ ~~W30~~ ~~W31~~ ~~W32~~ ~~W33~~ ~~W34~~ ~~W35~~ ~~W36~~ ~~W37~~ ~~W38~~ ~~W39~~ ~~W40~~ ~~W41~~ ~~W42~~ ~~W43~~ ~~W44~~ ~~W45~~ ~~W46~~ ~~W47~~ ~~W48~~ ~~W49~~ ~~W50~~ ~~W51~~ ~~W52~~ ~~W53~~ ~~W54~~ ~~W55~~ ~~W56~~ ~~W57~~ ~~W58~~ ~~W59~~ ~~W60~~ ~~W61~~ ~~W62~~ ~~W63~~ ~~W64~~ ~~W65~~ ~~W66~~ ~~W67~~ ~~W68~~ ~~W69~~ ~~W70~~ ~~W71~~ ~~W72~~ ~~W73~~ ~~W74~~ ~~W75~~ ~~W76~~ ~~W77~~ ~~W78~~ ~~W79~~ ~~W80~~ ~~W81~~ ~~W82~~ ~~W83~~ ~~W84~~ ~~W85~~ ~~W86~~ ~~W87~~ ~~W88~~ ~~W89~~ ~~W90~~ ~~W91~~ ~~W92~~ ~~W93~~ ~~W94~~ ~~W95~~ ~~W96~~ ~~W97~~ ~~W98~~ ~~W99~~ ~~W100~~ ~~W101~~ ~~W102~~ ~~W103~~ ~~W104~~ ~~W105~~ ~~W106~~ ~~W107~~ ~~W108~~ ~~W109~~ ~~W110~~ ~~W111~~ ~~W112~~ ~~W113~~ ~~W114~~ ~~W115~~ ~~W116~~ ~~W117~~ ~~W118~~ ~~W119~~ ~~W120~~ ~~W121~~ ~~W122~~ ~~W123~~ ~~W124~~ ~~W125~~ ~~W126~~ ~~W127~~ ~~W128~~ ~~W129~~ ~~W130~~ ~~W131~~ ~~W132~~ ~~W133~~ ~~W134~~ ~~W135~~ ~~W136~~ ~~W137~~ ~~W138~~ ~~W139~~ ~~W140~~ ~~W141~~ ~~W142~~ ~~W143~~ ~~W144~~ ~~W145~~ ~~W146~~ ~~W147~~ ~~W148~~ ~~W149~~ ~~W150~~ ~~W151~~ ~~W152~~ ~~W153~~ ~~W154~~ ~~W155~~ ~~W156~~ ~~W157~~ ~~W158~~ ~~W159~~ ~~W160~~ ~~W161~~ ~~W162~~ ~~W163~~ ~~W164~~ ~~W165~~ ~~W166~~ ~~W167~~ ~~W168~~ ~~W169~~ ~~W170~~ ~~W171~~ ~~W172~~ ~~W173~~ ~~W174~~ ~~W175~~ ~~W176~~ ~~W177~~ ~~W178~~ ~~W179~~ ~~W180~~ ~~W181~~ ~~W182~~ ~~W183~~ ~~W184~~ ~~W185~~ ~~W186~~ ~~W187~~ ~~W188~~ ~~W189~~ ~~W190~~ ~~W191~~ ~~W192~~ ~~W193~~ ~~W194~~ ~~W195~~ ~~W196~~ ~~W197~~ ~~W198~~ ~~W199~~ ~~W200~~ ~~W201~~ ~~W202~~ ~~W203~~ ~~W204~~ ~~W205~~ ~~W206~~ ~~W207~~ ~~W208~~ ~~W209~~ ~~W210~~ ~~W211~~ ~~W212~~ ~~W213~~ ~~W214~~ ~~W215~~ ~~W216~~ ~~W217~~ ~~W218~~ ~~W219~~ ~~W220~~ ~~W221~~ ~~W222~~ ~~W223~~ ~~W224~~ ~~W225~~ ~~W226~~ ~~W227~~ ~~W228~~ ~~W229~~ ~~W230~~ ~~W231~~ ~~W232~~ ~~W233~~ ~~W234~~ ~~W235~~ ~~W236~~ ~~W237~~ ~~W238~~ ~~W239~~ ~~W240~~ ~~W241~~ ~~W242~~ ~~W243~~ ~~W244~~ ~~W245~~ ~~W246~~ ~~W247~~ ~~W248~~ ~~W249~~ ~~W250~~ ~~W251~~ ~~W252~~ ~~W253~~ ~~W254~~ ~~W255~~ ~~W256~~ ~~W257~~ ~~W258~~ ~~W259~~ ~~W260~~ ~~W261~~ ~~W262~~ ~~W263~~ ~~W264~~ ~~W265~~ ~~W266~~ ~~W267~~ ~~W268~~ ~~W269~~ ~~W270~~ ~~W271~~ ~~W272~~ ~~W273~~ ~~W274~~ ~~W275~~ ~~W276~~ ~~W277~~ ~~W278~~ ~~W279~~ ~~W280~~ ~~W281~~ ~~W282~~ ~~W283~~ ~~W284~~ ~~W285~~ ~~W286~~ ~~W287~~ ~~W288~~ ~~W289~~ ~~W290~~ ~~W291~~ ~~W292~~ ~~W293~~ ~~W294~~ ~~W295~~ ~~W296~~ ~~W297~~ ~~W298~~ ~~W299~~ ~~W300~~ ~~W301~~ ~~W302~~ ~~W303~~ ~~W304~~ ~~W305~~ ~~W306~~ ~~W307~~ ~~W308~~ ~~W309~~ ~~W310~~ ~~W311~~ ~~W312~~ ~~W313~~ ~~W314~~ ~~W315~~ ~~W316~~ ~~W317~~ ~~W318~~ ~~W319~~ ~~W320~~ ~~W321~~ ~~W322~~ ~~W323~~ ~~W324~~ ~~W325~~ ~~W326~~ ~~W327~~ ~~W328~~ ~~W329~~ ~~W330~~ ~~W331~~ ~~W332~~ ~~W333~~ ~~W334~~ ~~W335~~ ~~W336~~ ~~W337~~ ~~W338~~ ~~W339~~ ~~W340~~ ~~W341~~ ~~W342~~ ~~W343~~ ~~W344~~ ~~W345~~ ~~W346~~ ~~W347~~ ~~W348~~ ~~W349~~ ~~W350~~ ~~W351~~ ~~W352~~ ~~W353~~ ~~W354~~ ~~W355~~ ~~W356~~ ~~W357~~ ~~W358~~ ~~W359~~ ~~W360~~ ~~W361~~ ~~W362~~ ~~W363~~ ~~W364~~ ~~W365~~ ~~W366~~ ~~W367~~ ~~W368~~ ~~W369~~ ~~W370~~ ~~W371~~ ~~W372~~ ~~W373~~ ~~W374~~ ~~W375~~ ~~W376~~ ~~W377~~ ~~W378~~ ~~W379~~ ~~W380~~ ~~W381~~ ~~W382~~ ~~W383~~ ~~W384~~ ~~W385~~ ~~W386~~ ~~W387~~ ~~W388~~ ~~W389~~ ~~W390~~ ~~W391~~ ~~W392~~ ~~W393~~ ~~W394~~ ~~W395~~ ~~W396~~ ~~W397~~ ~~W398~~ ~~W399~~ ~~W400~~ ~~W401~~ ~~W402~~ ~~W403~~ ~~W404~~ ~~W405~~ ~~W406~~ ~~W407~~ ~~W408~~ ~~W409~~ ~~W410~~ ~~W411~~ ~~W412~~ ~~W413~~ ~~W414~~ ~~W415~~ ~~W416~~ ~~W417~~ ~~W418~~ ~~W419~~ ~~W420~~ ~~W421~~ ~~W422~~ ~~W423~~ ~~W424~~ ~~W425~~ ~~W426~~ ~~W427~~ ~~W428~~ ~~W429~~ ~~W430~~ ~~W431~~ ~~W432~~ ~~W433~~ ~~W434~~ ~~W435~~ ~~W436~~ ~~W437~~ ~~W438~~ ~~W439~~ ~~W440~~ ~~W441~~ ~~W442~~ ~~W443~~ ~~W444~~ ~~W445~~ ~~W446~~ ~~W447~~ ~~W448~~ ~~W449~~ ~~W450~~ ~~W451~~ ~~W452~~ ~~W453~~ ~~W454~~ ~~W455~~ ~~W456~~ ~~W457~~ ~~W458~~ ~~W459~~ ~~W460~~ ~~W461~~ ~~W462~~ ~~W463~~ ~~W464~~ ~~W465~~ ~~W466~~ ~~W467~~ ~~W468~~ ~~W469~~ ~~W470~~ ~~W471~~ ~~W472~~ ~~W473~~ ~~W474~~ ~~W475~~ ~~W476~~ ~~W477~~ ~~W478~~ ~~W479~~ ~~W480~~ ~~W481~~ ~~W482~~ ~~W483~~ ~~W484~~ ~~W485~~ ~~W486~~ ~~W487~~ ~~W488~~ ~~W489~~ ~~W490~~ ~~W491~~ ~~W492~~ ~~W493~~ ~~W494~~ ~~W495~~ ~~W496~~ ~~W497~~ ~~W498~~ ~~W499~~ ~~W500~~ ~~W501~~ ~~W502~~ ~~W503~~ ~~W504~~ ~~W505~~ ~~W506~~ ~~W507~~ ~~W508~~ ~~W509~~ ~~W510~~ ~~W511~~ ~~W512~~ ~~W513~~ ~~W514~~ ~~W515~~ ~~W516~~ ~~W517~~ ~~W518~~ ~~W519~~ ~~W520~~ ~~W521~~ ~~W522~~ ~~W523~~ ~~W524~~ ~~W525~~ ~~W526~~ ~~W527~~ ~~W528~~ ~~W529~~ ~~W530~~ ~~W531~~ ~~W532~~ ~~W533~~ ~~W534~~ ~~W535~~ ~~W536~~ ~~W537~~ ~~W538~~ ~~W539~~ ~~W540~~ ~~W541~~ ~~W542~~ ~~W543~~ ~~W544~~ ~~W545~~ ~~W546~~ ~~W547~~ ~~W548~~ ~~W549~~ ~~W550~~ ~~W551~~ ~~W552~~ ~~W553~~ ~~W554~~ ~~W555~~ ~~W556~~ ~~W557~~ ~~W558~~ ~~W559~~ ~~W560~~ ~~W561~~ ~~W562~~ ~~W563~~ ~~W564~~ ~~W565~~ ~~W566~~ ~~W567~~ ~~W568~~ ~~W569~~ ~~W570~~ ~~W571~~ ~~W572~~ ~~W573~~ ~~W574~~ ~~W575~~ ~~W576~~ ~~W577~~ ~~W578~~ ~~W579~~ ~~W580~~ ~~W581~~ ~~W582~~ ~~W583~~ ~~W584~~ ~~W585~~ ~~W586~~ ~~W587~~ ~~W588~~ ~~W589~~ ~~W590~~ ~~W591~~ ~~W592~~ ~~W593~~ ~~W594~~ ~~W595~~ ~~W596~~ ~~W597~~ ~~W598~~ ~~W599~~ ~~W600~~ ~~W601~~ ~~W602~~ ~~W603~~ ~~W604~~ ~~W605~~ ~~W606~~ ~~W607~~ ~~W608~~ ~~W609~~ ~~W610~~ ~~W611~~ ~~W612~~ ~~W613~~ ~~W614~~ ~~W615~~ ~~W616~~ ~~W617~~ ~~W618~~ ~~W619~~ ~~W620~~ ~~W621~~ ~~W622~~ ~~W623~~ ~~W624~~ ~~W625~~ ~~W626~~ ~~W627~~ ~~W628~~ ~~W629~~ ~~W630~~ ~~W631~~ ~~W632~~ ~~W633~~ ~~W634~~ ~~W635~~ ~~W636~~ ~~W637~~ ~~W638~~ ~~W639~~ ~~W640~~ ~~W641~~ ~~W642~~ ~~W643~~ ~~W644~~ ~~W645~~ ~~W646~~ ~~W647~~ ~~W648~~ ~~W649~~ ~~W650~~ ~~W651~~ ~~W652~~ ~~W653~~ ~~W654~~ ~~W655~~ ~~W656~~ ~~W657~~ ~~W658~~ ~~W659~~ ~~W660~~ ~~W661~~ ~~W662~~ ~~W663~~ ~~W664~~ ~~W665~~ ~~W666~~ ~~W667~~ ~~W668~~ ~~W669~~ ~~W670~~ ~~W671~~ ~~W672~~ ~~W673~~ ~~W674~~ ~~W675~~ ~~W676~~ ~~W677~~ ~~W678~~ ~~W679~~ ~~W680~~ ~~W681~~ ~~W682~~ ~~W683~~ ~~W684~~ ~~W685~~ ~~W686~~ ~~W687~~ ~~W688~~ ~~W689~~ ~~W690~~ ~~W691~~ ~~W692~~ ~~W693~~ ~~W694~~ ~~W695~~ ~~W696~~ ~~W697~~ ~~W698~~ ~~W699~~ ~~W700~~ ~~W701~~ ~~W702~~ ~~W703~~ ~~W704~~ ~~W705~~ ~~W706~~ ~~W707~~ ~~W708~~ ~~W709~~ ~~W710~~ ~~W711~~ ~~W712~~ ~~W713~~ ~~W714~~ ~~W715~~ ~~W716~~ ~~W717~~ ~~W718~~ ~~W719~~ ~~W720~~ ~~W721~~ ~~W722~~ ~~W723~~ ~~W724~~ ~~W725~~ ~~W726~~ ~~W727~~ ~~W728~~ ~~W729~~ ~~W730~~ ~~W731~~ ~~W732~~ ~~W733~~ ~~W734~~ ~~W735~~ ~~W736~~ ~~W737~~ ~~W738~~ ~~W739~~ ~~W740~~ ~~W741~~ ~~W742~~ ~~W743~~ ~~W744~~ ~~W745~~ ~~W746~~ ~~W747~~ ~~W748~~ ~~W749~~ ~~W750~~ ~~W751~~ ~~W752~~ ~~W753~~ ~~W754~~ ~~W755~~ ~~W756~~ ~~W757~~ ~~W758~~ ~~W759~~ ~~W760~~ ~~W761~~ ~~W762~~ ~~W763~~ ~~W764~~ ~~W765~~ ~~W766~~ ~~W767~~ ~~W768~~ ~~W769~~ ~~W770~~ ~~W771~~ ~~W772~~ ~~W773~~ ~~W774~~ ~~W775~~ ~~W776~~ ~~W777~~ ~~W778~~ ~~W779~~ ~~W780~~ ~~W781~~ ~~W782~~ ~~W783~~ ~~W784~~ ~~W785~~ ~~W786~~ ~~W787~~ ~~W788~~ ~~W789~~ ~~W790~~ ~~W791~~ ~~W792~~ ~~W793~~ ~~W794~~ ~~W795~~ ~~W796~~ ~~W797~~ ~~W798~~ ~~W799~~ ~~W800~~ ~~W801~~ ~~W802~~ ~~W803~~ ~~W804~~ ~~W805~~ ~~W806~~ ~~W807~~ ~~W808~~ ~~W809~~ ~~W810~~ ~~W811~~ ~~W812~~ ~~W813~~ ~~W814~~ ~~W815~~ ~~W816~~ ~~W817~~ ~~W818~~ ~~W819~~ ~~W820~~ ~~W821~~ ~~W822~~ ~~W823~~ ~~W824~~ ~~W825~~ ~~W826~~ ~~W827~~ ~~W828~~ ~~W829~~ ~~W830~~ ~~W831~~ ~~W832~~ ~~W833~~ ~~W834~~ ~~W835~~ ~~W836~~ ~~W837~~ ~~W838~~ ~~W839~~ ~~W840~~ ~~W841~~ ~~W842~~ ~~W843~~ ~~W844~~ ~~W845~~ ~~W846~~ ~~W847~~ ~~W848~~ ~~W849~~ ~~W850~~ ~~W851~~ ~~W852~~ ~~W853~~ ~~W854~~ ~~W855~~ ~~W856~~ ~~W857~~ ~~W858~~ ~~W859~~ ~~W860~~ ~~W861~~ ~~W862~~ ~~W863~~ ~~W864~~ ~~W865~~ ~~W866~~ ~~W867~~ ~~W868~~ ~~W869~~ ~~W870~~ ~~W871~~ ~~W872~~ ~~W873~~ ~~W874~~ ~~W875~~ ~~W876~~ ~~W877~~ ~~W878~~ ~~W879~~ ~~W880~~ ~~W881~~ ~~W882~~ ~~W883~~ ~~W884~~ ~~W885~~ ~~W886~~ ~~W887~~ ~~W888~~ ~~W889~~ ~~W890~~ ~~W891~~ ~~W892~~ ~~W893~~ ~~W894~~ ~~W895~~ ~~W896~~ ~~W897~~ ~~W898~~ ~~W899~~ ~~W900~~ ~~W901~~ ~~W902~~ ~~W903~~ ~~W904~~ ~~W905~~ ~~W906~~ ~~W907~~ ~~W908~~ ~~W909~~ ~~W910~~ ~~W911~~ ~~W912~~ ~~W913~~ ~~W914~~ ~~W915~~ ~~W916~~ ~~W917~~ ~~W918~~ ~~W919~~ ~~W920~~ ~~W921~~ ~~W922~~ ~~W923~~ ~~W924~~ ~~W925~~ ~~W926~~ ~~W927~~ ~~W928~~ ~~W929~~ ~~W930~~ ~~W931~~ ~~W932~~ ~~W933~~ ~~W934~~ ~~W935~~ ~~W936~~ ~~W937~~ ~~W938~~ ~~W939~~ ~~W940~~ ~~W941~~ ~~W942~~ ~~W943~~ ~~W944~~ ~~W945~~ ~~W946~~ ~~W947~~ ~~W948~~ ~~W949~~ ~~W950~~ ~~W951~~ ~~W952~~ ~~W953~~ ~~W954~~ ~~W955~~ ~~W956~~ ~~W957~~ ~~W958~~ ~~W959~~ ~~W960~~ ~~W961~~ ~~W962~~ ~~W963~~ ~~W964~~ ~~W965~~ ~~W966~~ ~~W967~~ ~~W968~~ ~~W969~~ ~~W970~~ ~~W971~~ ~~W972~~ ~~W973~~ ~~W974~~ ~~W975~~ ~~W976~~ ~~W977~~ ~~W978~~ ~~W979~~ ~~W980~~ ~~W981~~ ~~W982~~ ~~W983~~ ~~W984~~ ~~W985~~ ~~W986~~ ~~W987~~ ~~W988~~ ~~W989~~ ~~W990~~ ~~W991~~ ~~W992~~ ~~W993~~ ~~W994~~ ~~W995~~ ~~W996~~ ~~W997~~ ~~W998~~ ~~W999~~ ~~W1000~~ ~~W1001~~ ~~W1002~~ ~~W1003~~ ~~W1004~~ ~~W1005~~ ~~W1006~~ ~~W1007~~ ~~W1008~~ ~~W1009~~ ~~W1010~~ ~~W1011~~ ~~W1012~~ ~~W1013~~ ~~W1014~~ ~~W1015~~ ~~W1016~~ ~~W1017~~ ~~W1018~~ ~~W1019~~ ~~W1020~~ ~~W1021~~ ~~W1022~~ ~~W1023~~ ~~W1024~~ ~~W1025~~ ~~W1026~~ ~~W1027~~ ~~W1028~~ ~~W1029~~ ~~W1030~~ ~~W1031~~ ~~W1032~~ ~~W1033~~ ~~W1034~~ ~~W1035~~ ~~W1036~~ ~~W1037~~ ~~W1038~~ ~~W1039~~ ~~W1040~~ ~~W1041~~ ~~W1042~~ ~~W1043~~ ~~W1044~~ ~~W1045~~ ~~W1046~~ ~~W1047~~ ~~W1048~~ ~~W1049~~ ~~W1050~~ ~~W1051~~ ~~W1052~~ ~~W1053~~ ~~W1054~~ ~~W1055~~ ~~W1056~~ ~~W1057~~ ~~W1058~~ ~~W1059~~ ~~W1060~~ ~~W1061~~ ~~W1062~~ ~~W1063~~ ~~W1064~~ ~~W1065~~ ~~W1066~~ ~~W1067~~ ~~W1068~~ ~~W1069~~ ~~W1070~~ ~~W1071~~ ~~W1072~~ ~~W1073~~ ~~W1074~~ ~~W1075~~ ~~W1076~~ ~~W1077~~ ~~W1078~~ ~~W1079~~ ~~W1080~~ ~~W1081~~ ~~W1082~~ ~~W1083~~ ~~W1084~~ ~~W1085~~ ~~W1086~~ ~~W1087~~ ~~W1088~~ ~~W1089~~ ~~W1090~~ ~~W1091~~ ~~W1092~~ ~~W1093~~ ~~W1094~~ ~~W1095~~ ~~W1096~~ ~~W1097~~ ~~W1098~~ ~~W1099~~ ~~W1100~~ ~~W1101~~ ~~W1102~~ ~~W1103~~ ~~W1104~~ ~~W1105~~ ~~W1106~~ ~~W1107~~ ~~W1108~~ ~~W1109~~ ~~W1110~~ ~~W1111~~ ~~W1112~~ ~~W1113~~ ~~W1114~~ ~~W1115~~ ~~W1116~~ ~~W1117~~ ~~W1118~~ ~~W1119~~ ~~W1120~~ ~~W1121~~ ~~W1122~~ ~~W1123~~ ~~W1124~~ ~~W1125~~ ~~W1126~~ ~~W1127~~ ~~W1128~~ ~~W1129~~ ~~W1130~~ ~~W1131~~ ~~W1132~~ ~~W1133~~ ~~W1134~~ ~~W1135~~ ~~W1136~~ ~~W1137~~ ~~W1138~~ ~~W1139~~ ~~W1140~~ ~~W1141~~ ~~W1142~~ ~~W1143~~ ~~W1144~~ ~~W1145~~ ~~W1146~~ ~~W1147~~ ~~W1148~~ ~~W1149~~ ~~W1150~~ ~~W1151~~ ~~W1152~~ ~~W1153~~ ~~W1154~~ ~~W1155~~ ~~W1156~~ ~~W1157~~ ~~W1158~~ ~~W1159~~ ~~W1160~~ ~~W1161~~ ~~W1162~~ ~~W1163~~ ~~W1164~~ ~~W1165~~ ~~W1166~~ ~~W1167~~ ~~W1168~~ ~~W1169~~ ~~W1170~~ ~~W1171~~ ~~W1172~~ ~~W1173~~ ~~W1174~~ ~~W1175~~ ~~W1176~~ ~~W1177~~ ~~W1178~~ ~~W1179~~ ~~W1180~~ ~~W1181~~ ~~W1182~~ ~~W1183~~ ~~W1184~~ ~~W1185~~ ~~W1186~~ ~~W1187~~ ~~W1188~~ ~~W1189~~ ~~W1190~~ ~~W1191~~ ~~W1192~~ ~~W1193~~ ~~W1194~~ ~~W1195~~ ~~W1196~~ ~~W1197~~ ~~W1198~~ ~~W1199~~ ~~W1200~~ ~~W1201~~ ~~W1202~~ ~~W1203~~ ~~W1204~~ ~~W1205~~ ~~W1206~~ ~~W1207~~ ~~W1208~~ ~~W1209~~ ~~W1210~~ ~~W1211~~ ~~W1212~~ ~~W1213~~ ~~W1214~~ ~~W1215~~ ~~W1216~~ ~~W1217~~ ~~W1218~~ ~~W1219~~



Make radiation constant strain of K12!

To Demand

If we give (continuous addition) just so much glucose that in an ~~optimal~~ "adapted" situation  $1/2$  of glucose and  $1/2$  of galactose are consumed. Does that mean per se that  $1/2$  of the bacteria use full amount of glucose and the other half full amount of galactose?

Can we allow bacteria to metabolize preexisting mutator and evolutionary death? - for mutational prevalence in such a situation? what about B/r in this situation?

Select mutations deficient for a growth factor by growing in presence of excess of that growth factor under starvation conditions. - (old idea)

To Cohen: How does phosphate grow  
of very little ~~the~~ P present in nutrient?

To Howard second remark

This experiment becomes  
easy if constant amounts  
of glucose and say ~~or~~ lactose  
can be added per unit time.  
An apparatus (Krogh) which  
maintains a culture under constant  
conditions in the laboratory  
growth phase is therefore proposed  
by ~~the~~ ~~apparatus~~ ~~to~~ ~~be~~ ~~used~~  
This can be done in either of  
two ways. Either nutrient is added  
at constant time intervals / intervals  
slightly ~~higher~~ longer than would  
correspond to the steepest portion

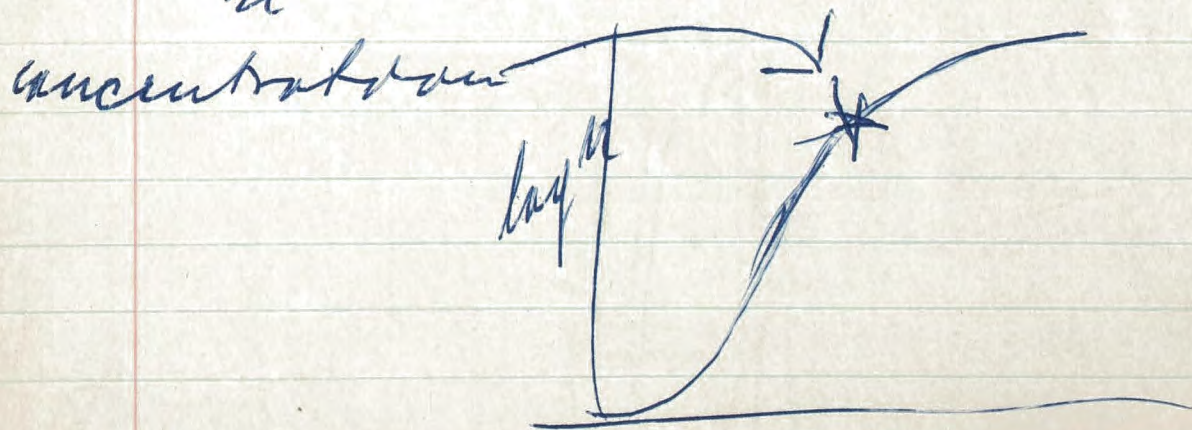
of ~~lag~~ lag ~~growth~~ growth curve. Or nutrient is added whenever turbidity exceed a certain value.

In former case:  $\bar{t}$  is minimal  
 time in which concentration rises from 1 to  $e$  ( $n = e^{\frac{t}{\bar{t}}}$ )

for large values of  $n$  we throw away then  $\frac{t}{n}$  because if we add to  $1$   $e$   $\frac{t}{n}$  of  $e$  this is just compensated by growth in time of  $\bar{t}$ .

In order to have  $n$  intervals we add  $\frac{t}{n}$   $e$  at time intervals

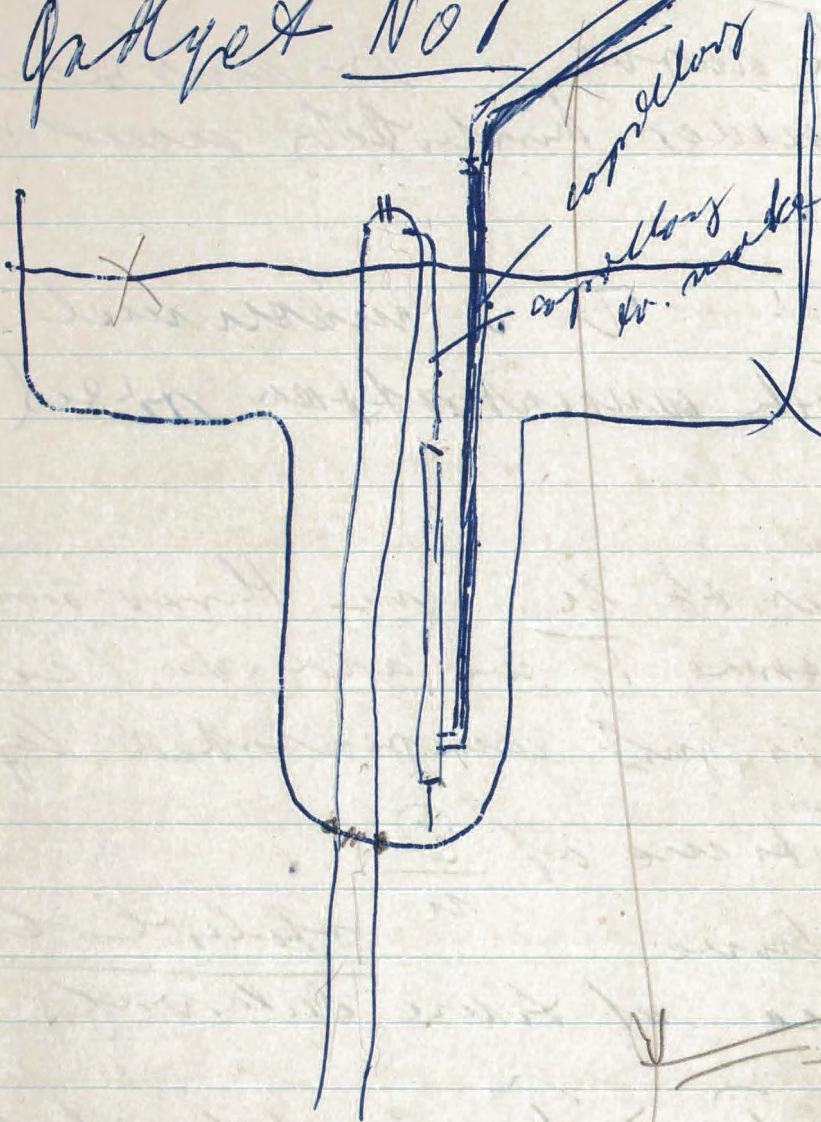
$\Delta t = \frac{\bar{t}}{n}$   $\bar{t}_1 > \bar{t}$  add substrate





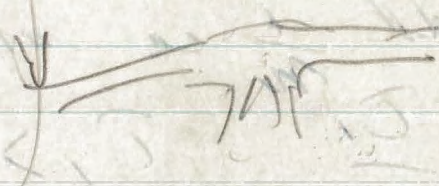
Project No 1

Car

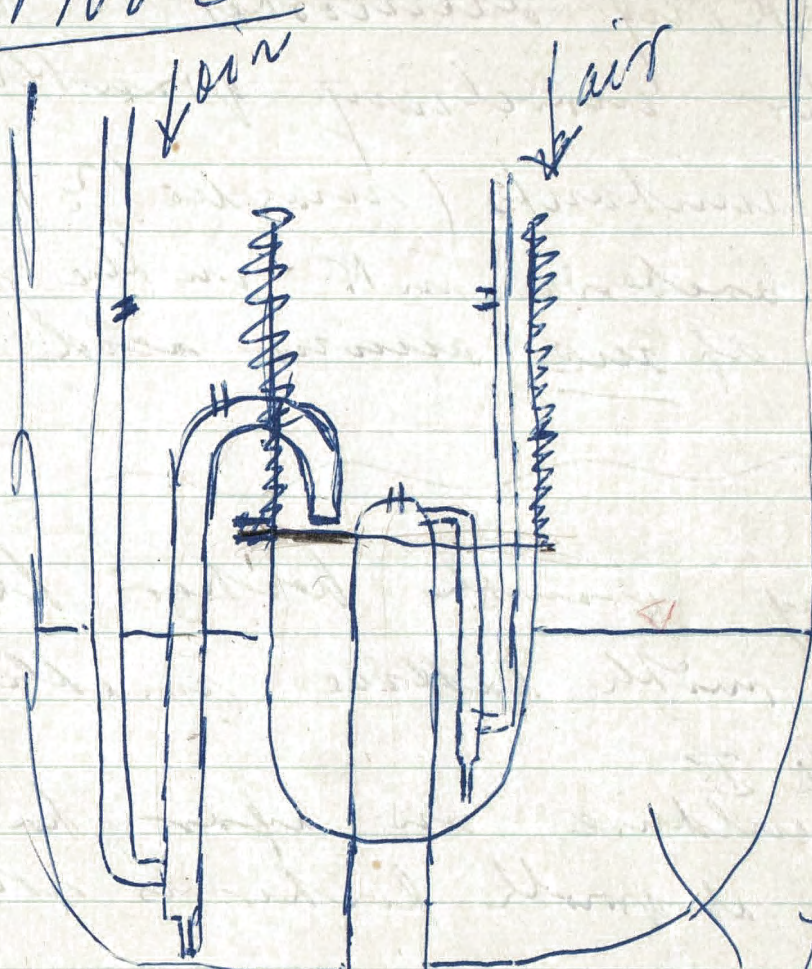


account for the  
independent  
of level

Tank

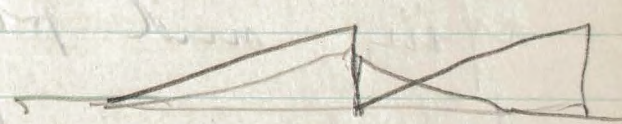
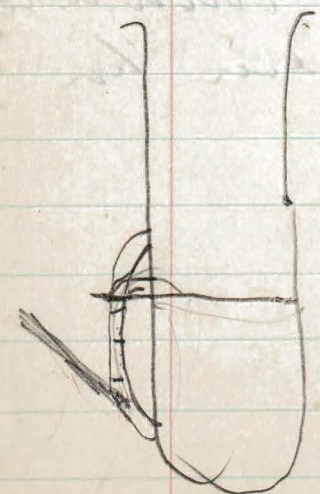


# Gadget No 2



Automatic  
Pipettes  
and  
Burettes  
F. Maclett  
p 815  
p 697  
p 116

Tanks  
air need down



Preceding "thermostat" is very suitable for modeling growth factor dependent mutants (maybe?) by showing bacteria in it in the presence of excess of one amino acid.

---

detecting growth factor dependent mutants with lattice method

Method I

spread culture on agar to which very little of growth factor is added and incubate, photograph to catch micro colonies of dependent mutant, then spray uniformly with growth factor and incubate again and photograph again to detect new big colonies.

Method II

Spores bacteria through lattice on  
 $\frac{1}{2}$  mm thin agar:  $\frac{1}{2}$  mm

x x x x



x x x x

New tube second lattice } for growth factor

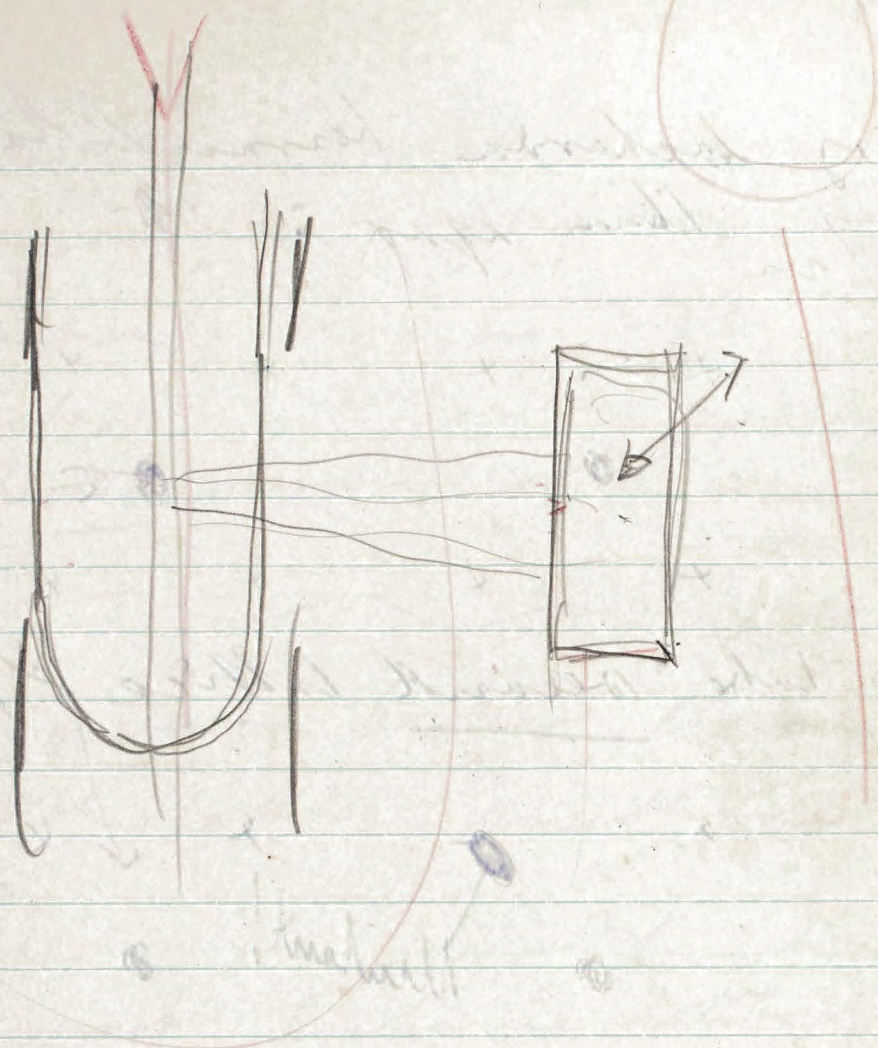
x x x x



Mutant!

x x x x

Original lattice could see  $\frac{1}{2}$  mm / mm  
 holes 1, 3 mm apart covering about  
 1000 colonies per 100 cm<sup>2</sup>



4

- 6 cf. Inuit
- 6 cf. sea wax
- 1 center page
- 6 times and tubes signals
- Detrital studies
- Test tubes
- spores
- box per spores

Total dust vol  $10^{-12}$  cc of  $10^8$  / cc  $10^{-4}$  cc  
 $10^{-5}$  gm  $10^{-6}$  guff / cc

~~just~~

*[Faint, illegible handwriting, possibly bleed-through from the reverse side of the page]*

Ward Chemostat experiment  
analyse for glucose by using strain  
which cannot adapt to the other sugar  
and measure turbidity of fully grown  
(glucose limited) culture. — Question  
is of time (as I expect) that if we have  
culture in chemostat which ~~addresses~~  
uses glucose in amount of  $\frac{1}{n}$  of Total  
sugar consumption that  $1 - \frac{1}{n}$  is adopted  
and ~~all sugar~~ to glucose ~~then~~  
~~would be~~ played ~~with~~ on plating on  
glucose free agar would form plaques  
while  $\frac{1}{n}$  would form no plaques. —

Experiments of this sort should be  
extended to various nitrogenous bases. —

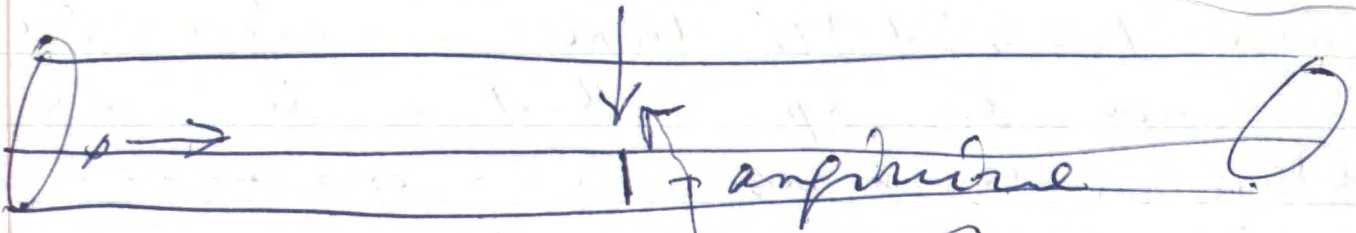
Ward suggest using specific absorption  
in 3600 wave to assay phage culture  
containing defects of bacteria. —

Do mutants in general  
lack corresponding enzyme?  
For instance Proteins from which  
enzyme can be extracted if it mutates  
or that it no longer can be an



lower but cannot be fed amino-  
acids self does it show less  
extractable release?

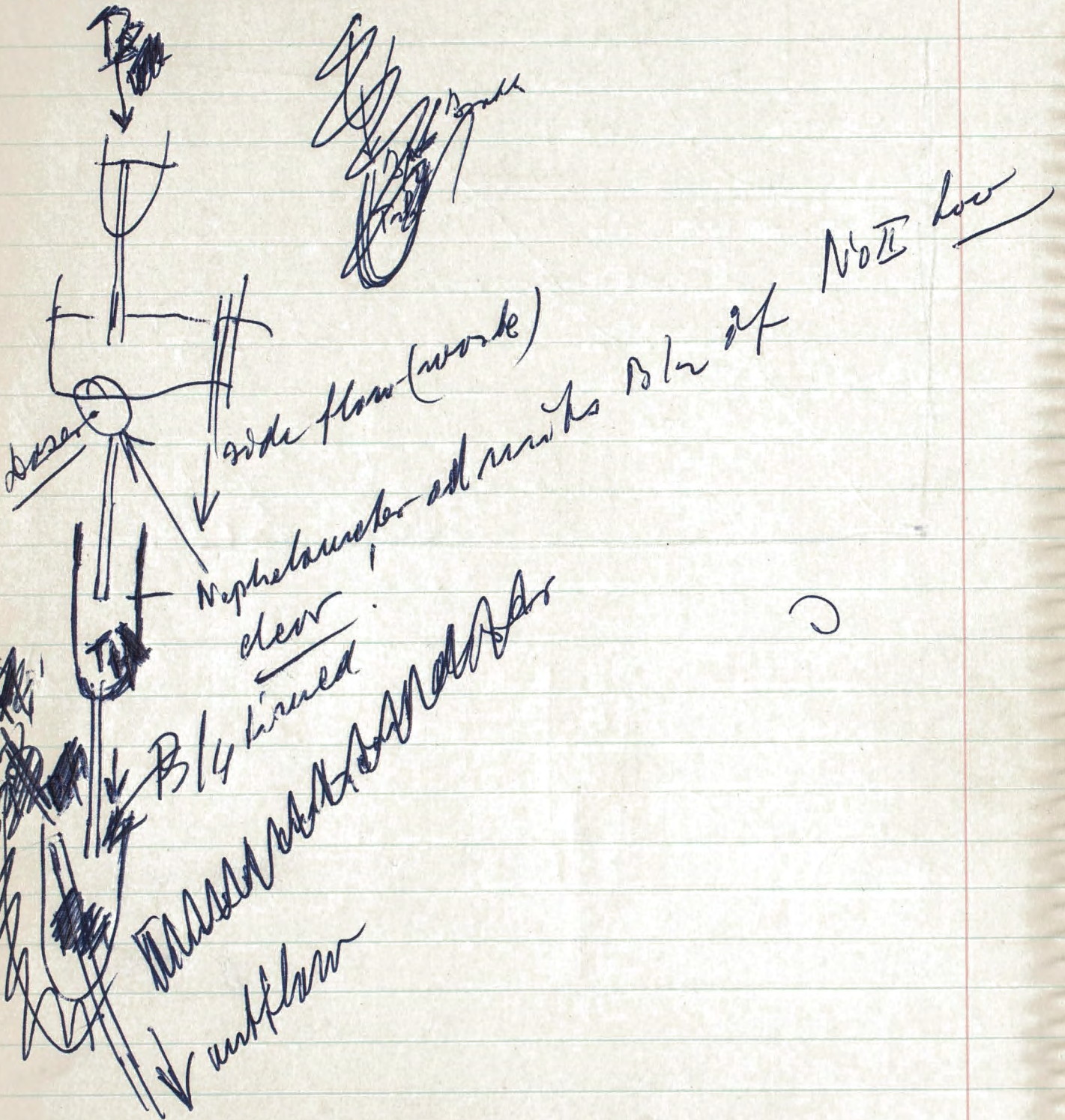
---



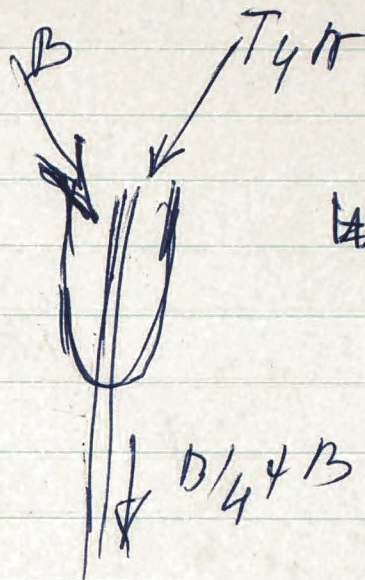
To experiment whether I suggested  
to Beadle. Does heterozygous carrying  
from left stop here

---

Selection of various nutrients in the  
diagram. —



# Selection of resistant B



Timing:  
 1st ~~subculture~~ of T411 =  
 normal, doubling rate  
 of B/4 = 30 min we  
 admit about 1/2 cc B  
 at 10<sup>8</sup> per 30 min  
 subculture will be approx  
 10<sup>10</sup> per 1 cc or  
 50% in a day a "normal"  
 chance for the begin  
 of B/4 growth of one  
 in 10<sup>9</sup> is B/4 case  
 all this at Vol = 1 cc

Chemical Kinetics of  
the bacterial cell

Hinschelwood

Oxford Under Press

Gray L. H. to Mrs. Green  
Brit Commonwealth Fe. Off.

Room 2002

43 East 14th

N.Y.C.

Forgent

Central Scientific Co  
1700 W Irving Pl

look up

W. H. Stone Proc. Nat. Acad.  
March 47

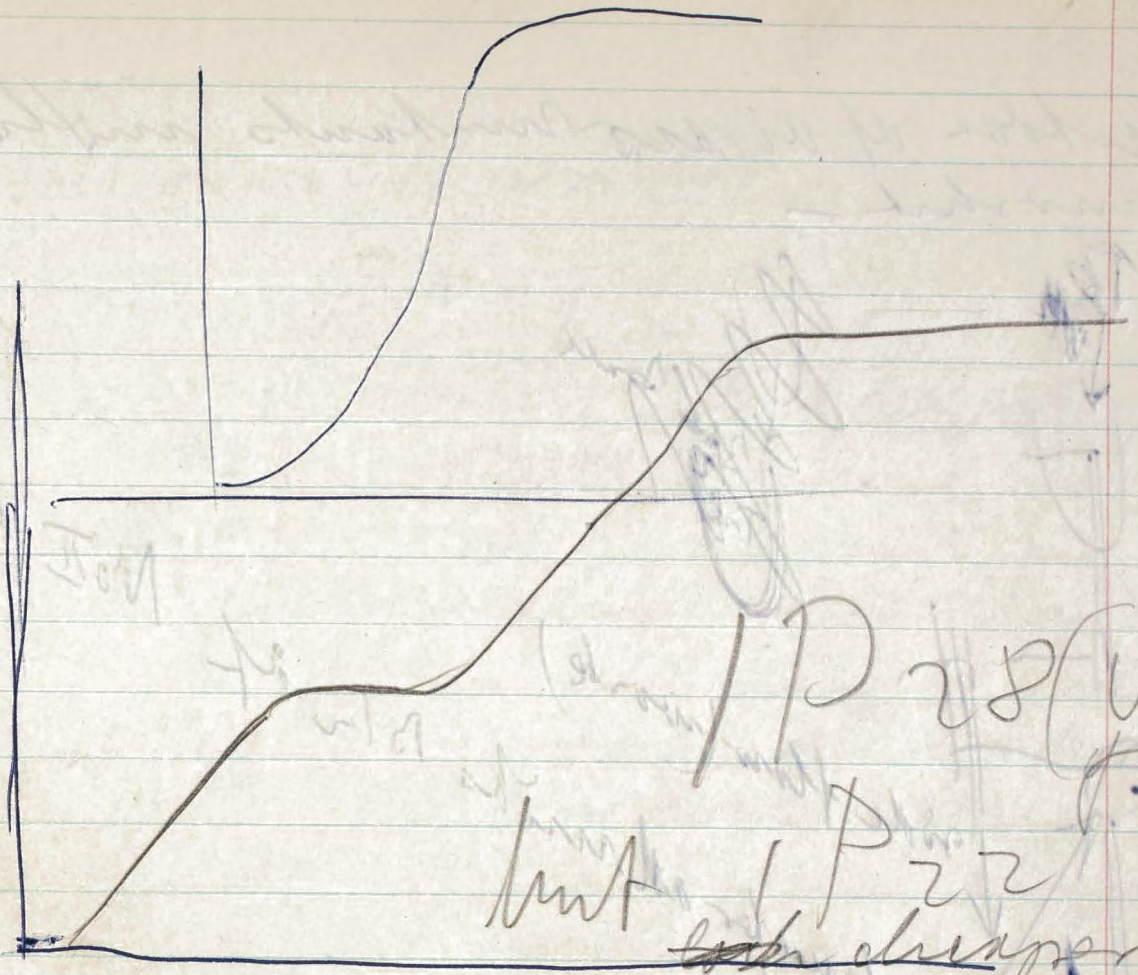
not complete

needed for  
present work

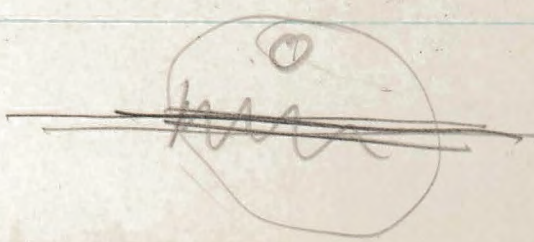
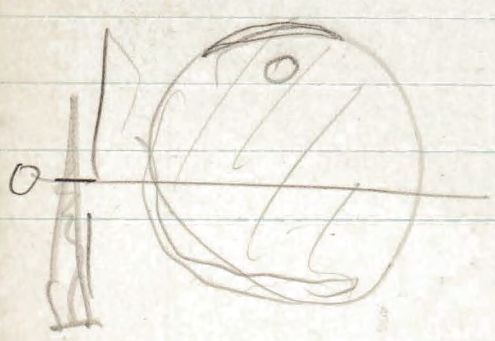
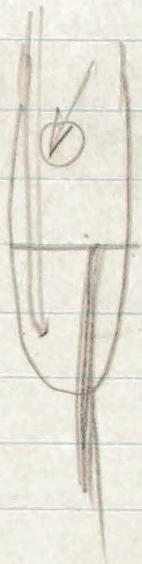
to order

Gift of Mineral

Dawson Scientific Co  
711-723 Park St. Boston  
633-635 Greenwich St. N.Y.



but 1P22  
~~both cheaper~~



Atomic energy is a two ~~subject~~ <sup>issue</sup> ~~subject~~  
to be seriously discussed all the time.  
May I therefore <sup>respectfully</sup> suggest that your  
opponent Senator Taft as Chairman of  
the Atomic Energy Commission of the  
Senate should refuse to confirm Mrs  
Wideman. - While Taft may not be  
temporarily fit to be President we  
are doubtful that his <sup>former</sup> ~~present~~ <sup>in</sup> ~~beliefs~~ and  
competence ~~will~~ - If subsequent to  
his appointment he <sup>were to</sup> ~~direct~~ his undivided  
attention to the problems <sup>now</sup> facing the Atomic En.  
Commission we could hope that by the spring  
of 1948 this commission could begin to operate  
in a satisfactory manner. - In the meantime  
the scientists now ~~employed~~ working for the  
commission could be ~~retained~~ kept  
at their work by a suitable law  
readily enacted by congress. ~~That a~~  
~~law might be even though such a~~  
law might be slightly unnecessary and  
and even though it might not be  
certain that ~~it~~ <sup>it</sup> would  
inspire the scientists to solve the  
difficult technical and technical  
problems ~~which~~ <sup>involved</sup> ~~are~~ <sup>in their</sup> ~~are~~ <sup>work</sup>  
at least it would keep the scientists  
prevent the scientists now working for the  
commission from obtaining employment elsewhere.