4hr Expt

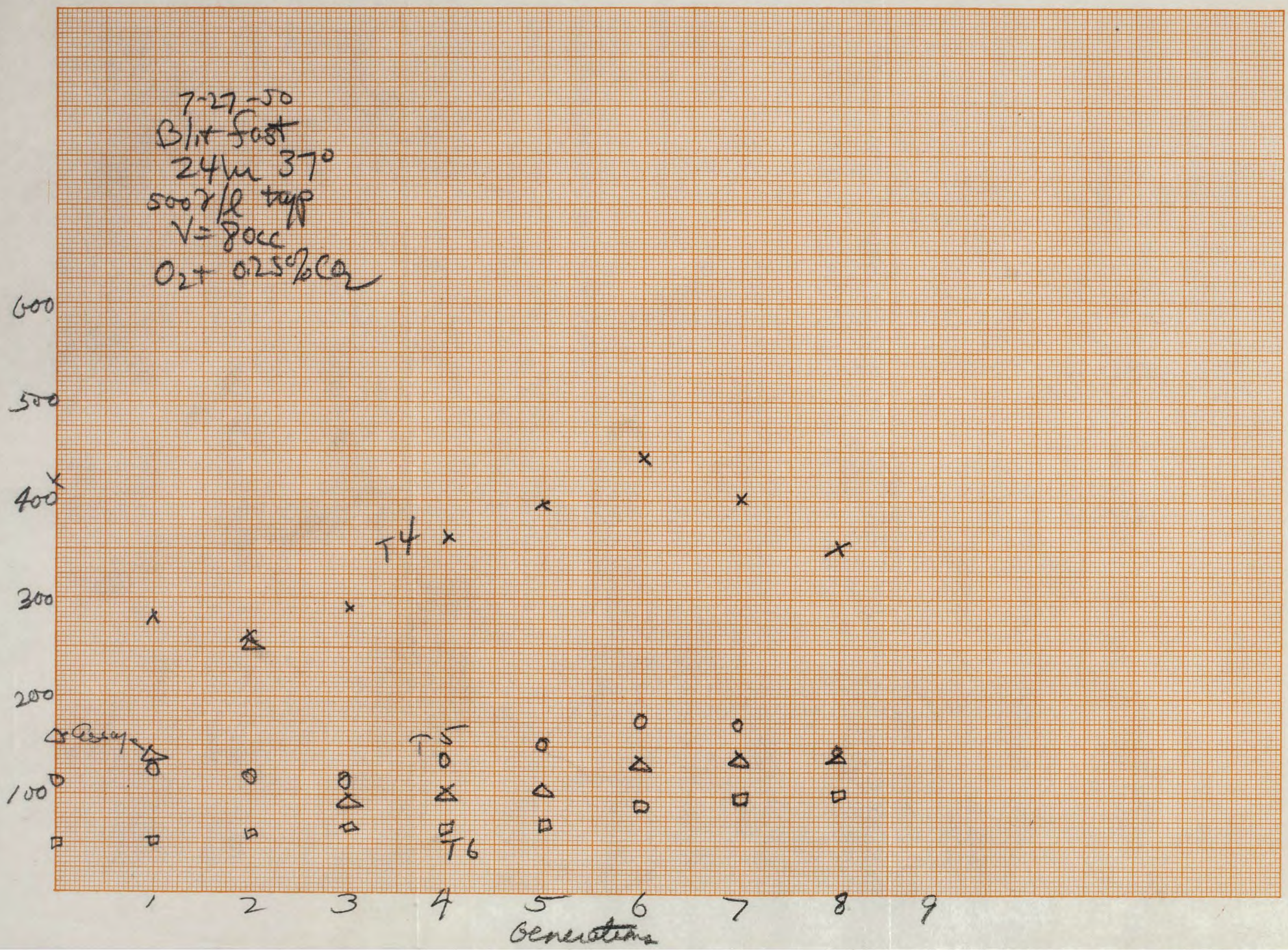
Generations	T4	T5	T6
83	1092	673	213
89	2236	603	196
95	7686	594	266
101	9160	478	224
107	13,000	338	199

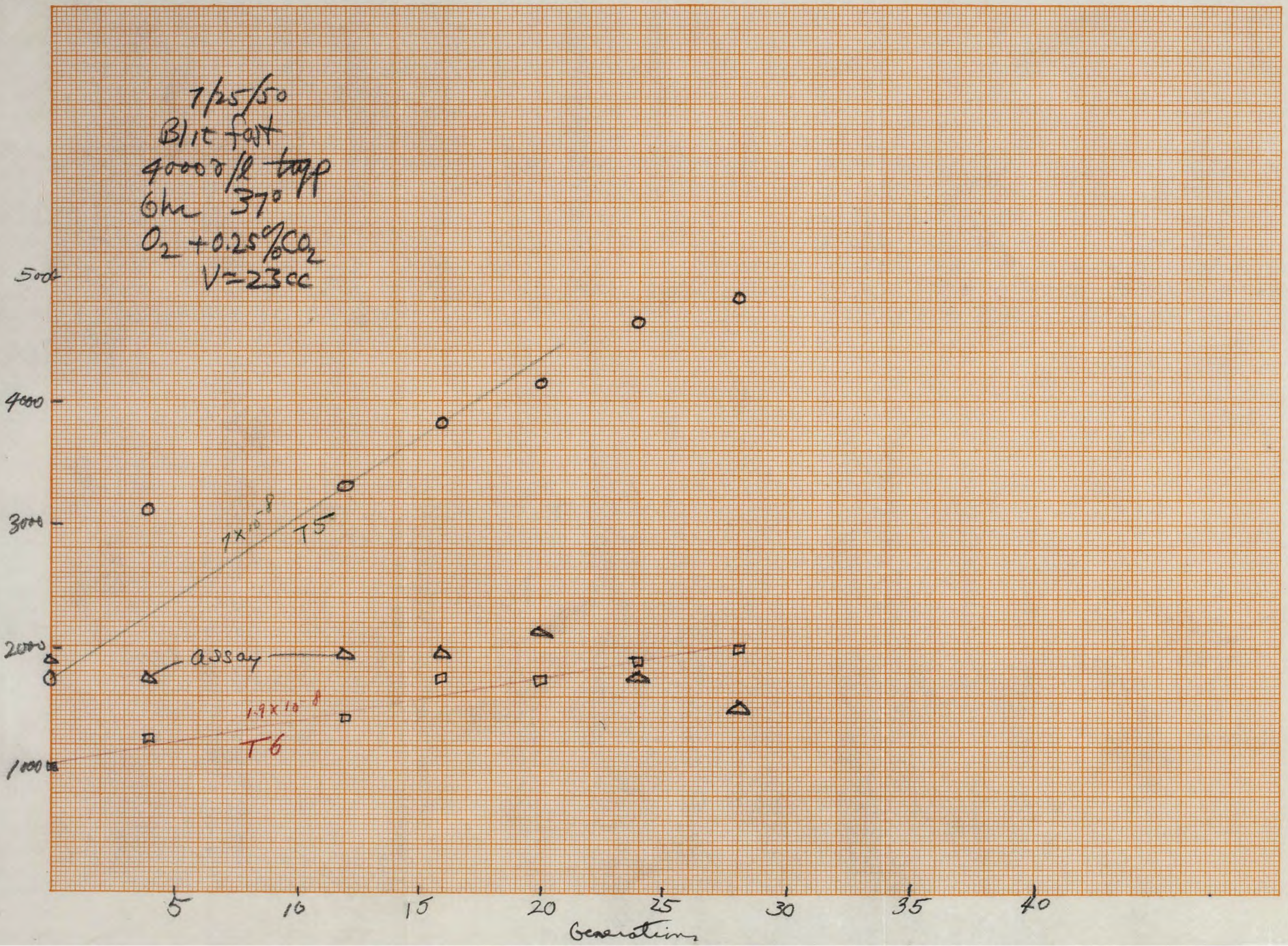
Below are a few examples of characteristics of earlier "falls"

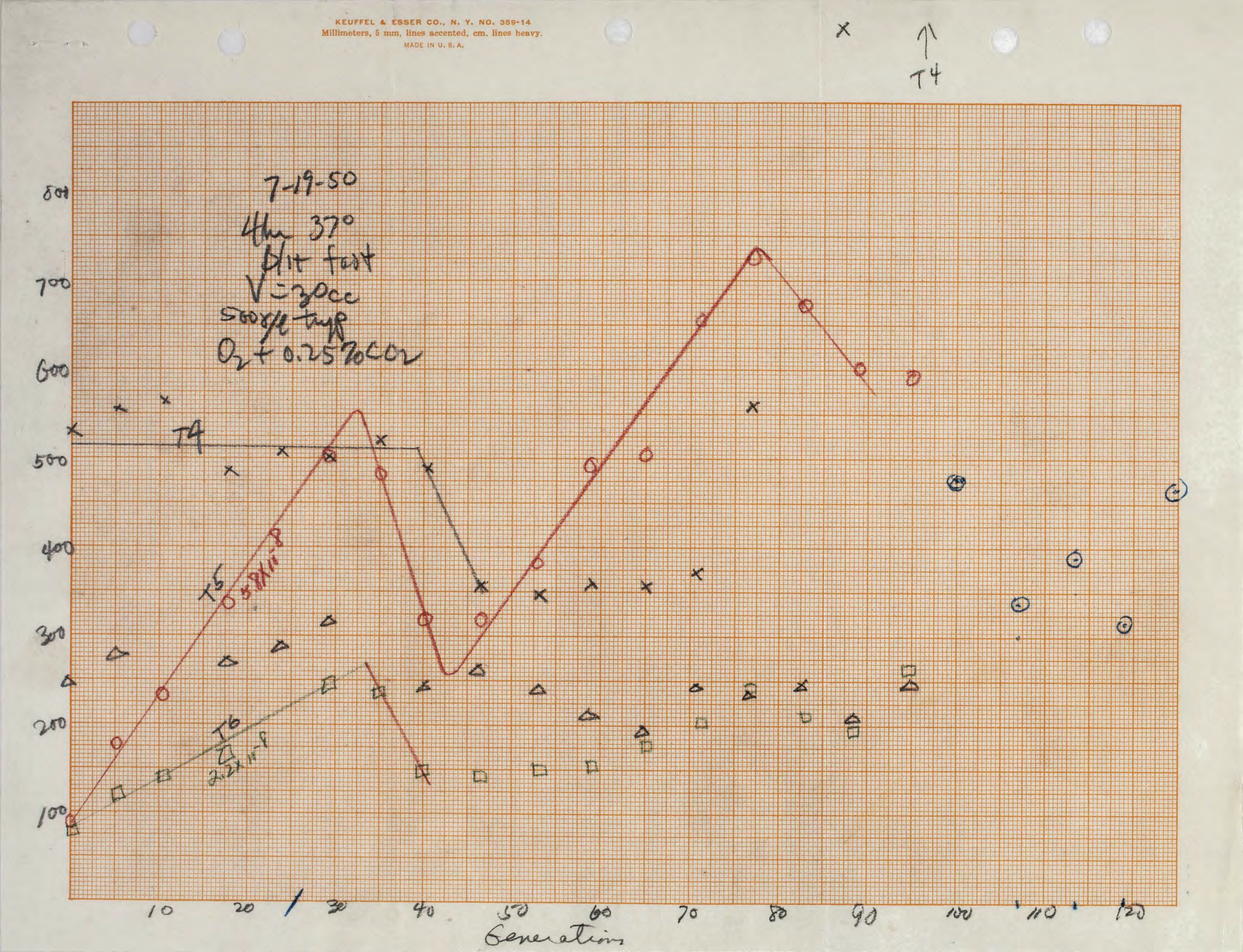
Rate	Conc typ	Strain	Generation fall began	Generation fall ended	Fraction left after fall
6 hr	1000 δ	fast	31	45	0.5
2 hr	2000 δ	fast	38	45	0.4
6 hr	1000 δ	hyper	50	80	0.1

P.S. About you're coming east. I don't think the phage meetings will be worth the trip. Perhaps it would be better to spend the time together in Chicago — unless you have other business in NYC.

My sister is getting married the 27th of August. I'll probably be busy on the 26th and 27th entertaining relatives.







λ	2hr reaction on an iced sample 8/5/50	6hr ditto above	Expt of 8/2/50 Collected in ice Samples divided in ½ "Cold" centrifuged immediately "Warm" incubated at 37° for 14hr — 4hr cold	24hr cold	24hr samples are diluted in FG ½ — 4hr warm	24hr warm
350	.020	.036	017	025	034	026
300	.039	.137	032	064	060	068
290	.103	.575	076	162	125	208
280	.167	.945	122	260	212	350
270	.180	.970	140	279	273	390
260	.169	.850	142	267	305	376
250	.148	.695	147	274	342	365
240	.153	.680	200	409	482	505
230	.290	1.21	402	900	960	1.07

167
103
(64)

945
575
3.70

180
103
77

970
578
395

140
76
64

$\frac{945}{2} = 472$

680
472
(208) not hypophosphate

at 4 hrs transframe rate should be [140] 760 — 190 observed 200

Absorption of hypophosphate

	Extinction
2900 Å	0.220
2800	.276
2700	.295
⋮	
2400	.137 (about ½ of value for 2800 Å)

4 hr, 500 f/l on O_2

Generation	T4	T5	T6	Assay
101	9160	478	224	2.2×10^8
107	13700	338	202	2.2×10^8
113	23,300	350	294	1.5×10^8
119	36,000	314	265	0.87×10^8
125	46,300	414		1.88×10^8

2.4 hr O_2 500 f/l trypt

8	355	146	104	1.45×10^8
9	259	156	113	1.62×10^8

Switched to 12 hours after this point = calling the 4 hr 0 gen

2	537	238	174	2.5×10^8
4	505	310	202	1.66×10^8
6	577	327	231	1.38×10^8

these are 12 hr generation

6 hr high typ (4000 f) 6 hr

32	—	5080	1760	2.0×10^9
36	—	3670	1510	1.66×10^9
40	—	3440	1530	1.9×10^9
44	—	3180	1460	1.7×10^9
48	—	3530	1570	1.9×10^9

If we keep a strain of bacteria growing in the growth tube of the chemostat and another bacterial strain is generated from it through spontaneous mutations which has the same growth rate as the original strain ($\alpha^* = \alpha$) [i.e. in the absence of selection for or against the mutant] the bacterial density n^* of the mutant strain should increase linearly with time i.e.

$$\frac{dn^*}{dt} = \frac{\lambda}{\tau} n \quad ;$$

where n^* is the density of the mutant population, and n the density of the original population of parent strain and λ the number of the mutant produced per generation per bacterium. This should hold as long as $n^* \ll n$ (under the assumption that the mutation rate is very low)

If the growth rate of the mutant strain is less than the growth rate of the parent strain ($\alpha^* < \alpha$) i.e. if the mutant is selected against then after an initial rise

the doubling of the mutant population in the growth tube of the Chemostat should ~~stop~~ – after an initial rise – remain constant at a level given by

$$n^* = \frac{\alpha}{\alpha^* - \alpha} \ln$$

~~If these two cases it does by the former one is more suitable for determinations~~

If we are interested in determining the mutation rate α the case without selection is the more favourable one since

If the nonsense mutations occurring in a growing bacterial population mutants resistant to a bacterial virus are particularly easy to score with great accuracy and we ~~simply~~ used ~~it out~~ in our experiments mutants ~~of the type of the cold strain~~ of our cold strain which were resistant to the Bacterial viruses T4 or T5. or T6. –

When we grew ~~our~~ the strain B/1 f in the Chemostat ~~under~~ with a high ~~nature~~ conc of the tryptophane conc in the nutrient in the storage tank but a ~~low~~ conc of bacteria

so that lactate rather than ~~try~~ tryptophane was the controlling growth factor we found that after a short initial period ~~the mutants~~ the ~~density~~ ~~densities of the~~ bacterial density lies ~~for all three mutants~~ ~~of all three and~~ of the mutant ~~which mutates~~ T_1 to T_4 or T_5 or T_6 respectively resistant ~~to~~

remained constant from day to day, the level corresponding to a ~~the~~ selection factor $\left(\frac{\alpha - \alpha^*}{\alpha}\right)$ of a few per cent. —

~~It one is tempted to say here~~
~~It is perhaps not too surpri~~
~~One can perhaps understand that, under conditions of starvation for the main carbon source~~
~~so that most mutants starve)~~
~~It might very well be that mutants~~
~~It might be then important~~
~~Perhaps it might be so that most mutants are selected against from slower than the wild~~ It is conceivable that practically all mutational steps ~~at least~~ which lead away from the "wild type" ~~grow~~ lead to mutants which grow slower under conditions of "starvation" for the main carbon source

~~We should not however expect the mutant~~ There is however no reason to expect that mutants in general must grow slower than the „wild type"

If ~~that~~ we grow our strain however ~~in the pre~~ in the chemostat with a high conc of lactate in the nutrient in the storage tank, ~~and~~ use tryptophane as a growth factor and ~~set~~ have the generation time τ well above the minimal generation time of 20 min (which holds for high tryptophane concentrations) then there is no reason to expect ~~[illegible]~~ in general mutants to grow slower than the parent strain ~~, if the growth factor~~ which is slowed down by keeping the ~~tryptophane~~ tryptophane conc. low ~~mutation should have some direct effect happen to affect the [illegible] uptake or utilization of tryptophane than only and would of course expect~~ in the chemostat

In this case one would expect ~~a direct of~~ the mutation to affect the growth rate only if the mutation affect the uptake or utilization of tryptophane

Fig 8 shows the ~~number of~~ bacterial density for mutants resistant to T_5 ~~as~~ ~~[illegible]~~ present in the growth tube of the chemostat as a function of the number of generations through which the present stream has passed (~~[illegible]~~ Number of generations $= \frac{t}{\tau_W}$) for two experiments in which the generation times were 2 hr, 6 hrs and 12 hrs respectively. ~~[illegible]~~ The slopes of the straight lines give the mutation rates per generation as 2.5, 7.5 and 12.5 ~~[illegible]~~ $\times 10^{-8}$ per ~~[illegible]~~ generation per bacterium. —

We see that the mutation rate per gen is 3 times as high for $\tau = 6$ hrs as it is for $\tau = 2$ hrs and 6 times " " for $\tau = 12$ hrs as it is for $\tau = 2$ h

What appears to remain constant is the number of mutations produced per unit time and bacterium. ~~[illegible]~~

$$\frac{\lambda}{\tau} = \frac{2.5}{2} 10^{-8} = 1.25 \, 10^{-8} \text{ per hour and bacterium}$$

This is contrary to what had been generally expected ~~[illegible]~~

epithelia

1.) ~~fibroblast~~ [Carell] a) w. Kembryonic

b) w. embryonic fluid

Iris and liver epithelium.

Dobzhansky

see Laser Lippmann | Edmund Mayer
Stamford Conn.
Cytanamide

Bruesj Paul Weissj

Nelson T. ~~Spratt~~ jr, Minnesota

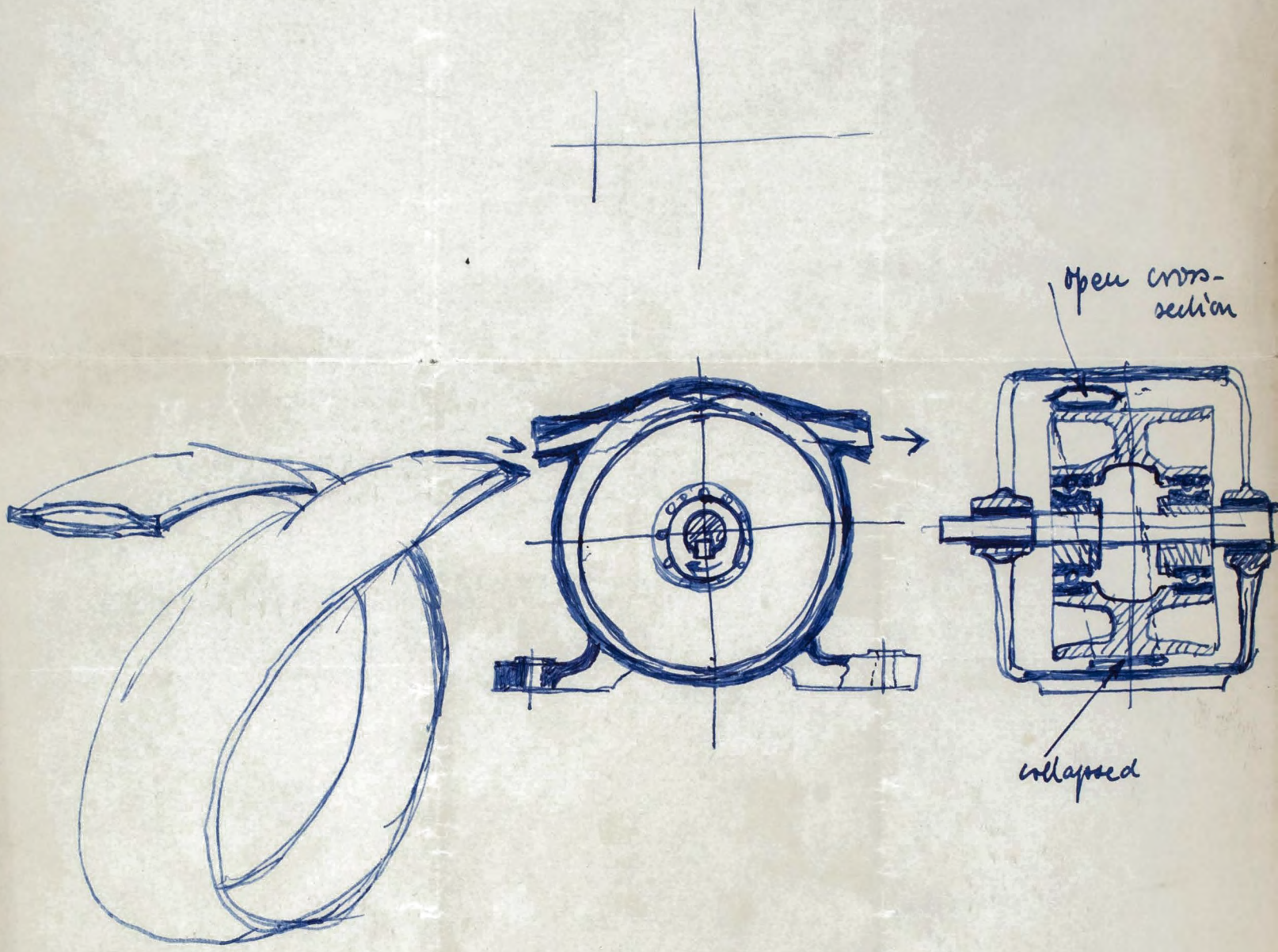
Journ. of exp. Zoology
Vol. 107 No 1 Feb 48 p. 33.

(Ulrich embryo on agar)

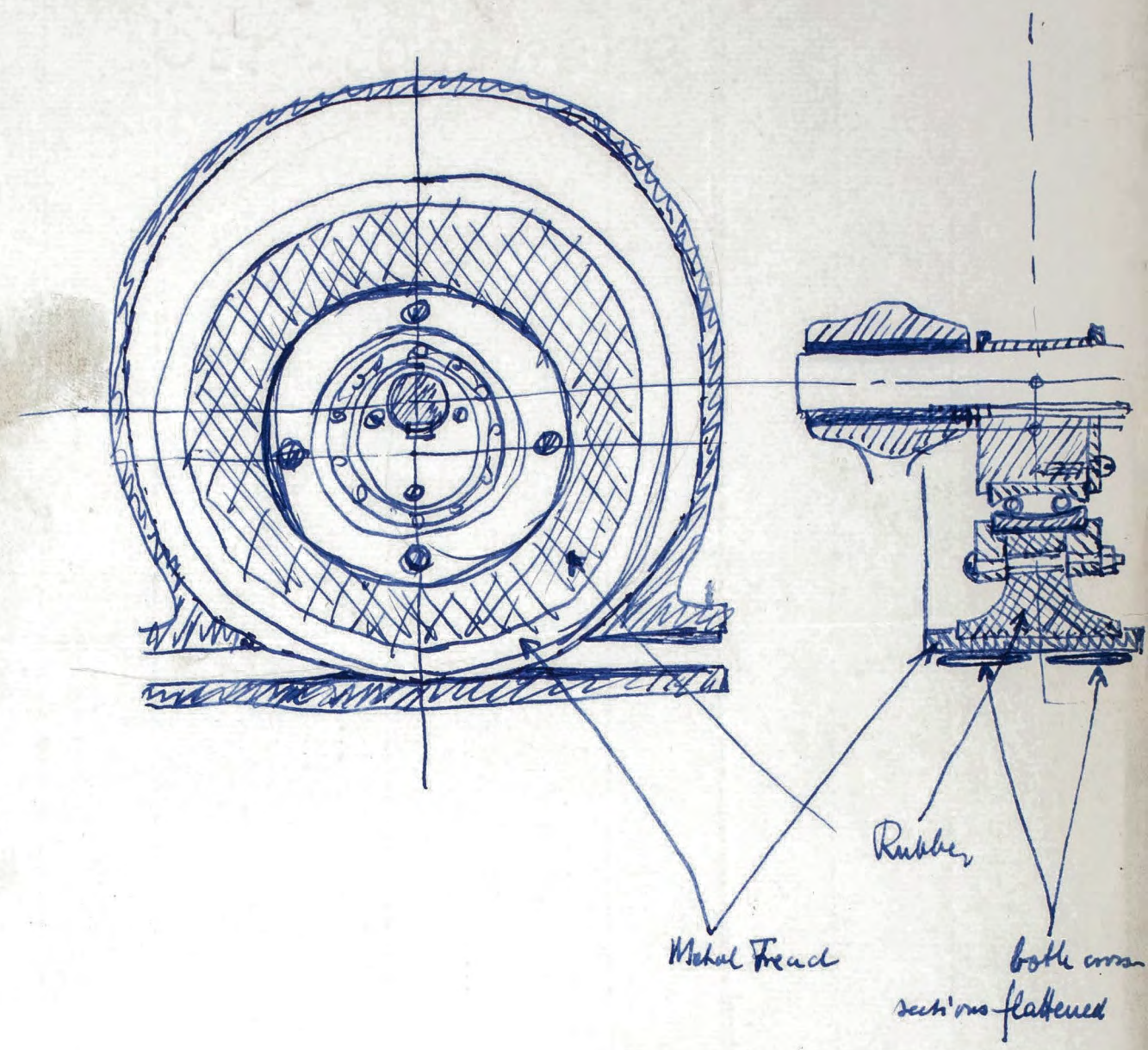
Tabulae Biologicae
Vol XIX Pars I (Cellula) Uitgeverij Dr. W. Junk Den Haag.
1933

V. ~~Potter~~ [Advances in Enzymology Vol 4
Intercidence. 1944]

Plant tissue cultures
Howard dept. of Biology



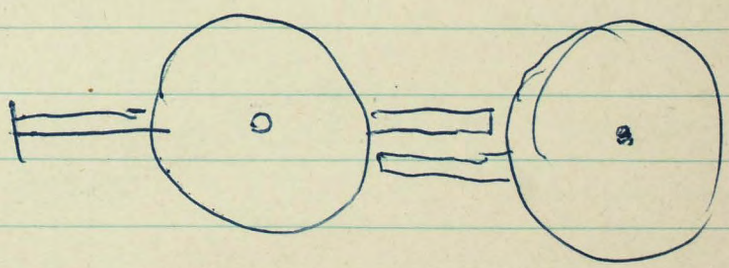
Cross section


Rubber
Metal Tread
both cross sections flattened

Tryptophane absorption

2900 Å 0.220
2800 Å 0.276
2700 Å 0.295

2400 Å 0.137 (about $\frac{1}{2}$ of value at 2800 Å



14/2.7 = 5.1

32 325
42 550
225 / 16 = 14

12/1

7-13-50
6h 37°
Bit fast
V=4.4ml
5000/c typ

Second Beckmann measurements

Last Beckmann measurements

First Beckmann measurements

T4 △
T5 ○
T6 ×
Assay ▽

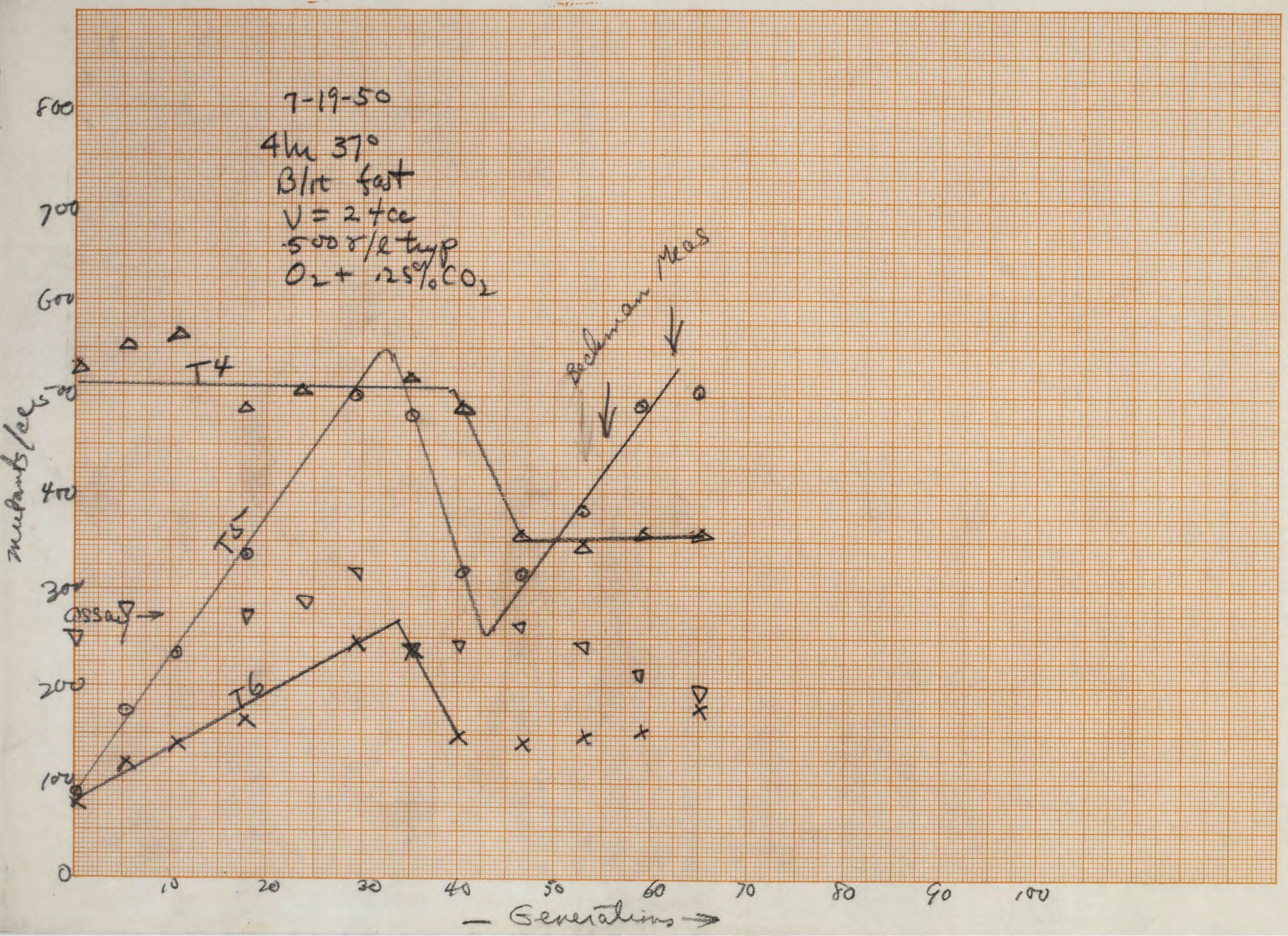
Mutants/10

800
700
600
500
400
300
200
100
0

← air → | → O_2 + 0.25% CO_2 →

10 (12) 20 30 40 50 60 70 80

Gen →



July 13, 1950

First Beckmann Meas
Undiluted samples vs dist water

	2 hr	6 hr
360	.103	0.116
340	.108	
330	.113	
320	.120	
300	.157	0.210
290	.288	0.626
280	.420	0.980
270	.460	1.00
260	.451	0.85
250	.410	0.645
240	.385	0600
230	.710	1.20
226	1.10	1.58

calculated 1:1 with H_2O

2 hr	6 hr	~~6 hr~~
.059	.055	~~055~~
.062	.058	~~058~~
.065	.060	~~060~~
.068	.064	~~064~~
082	.091	~~088~~
.156	.296	~~091~~
.231	.479	~~296~~
253	.485	~~479~~
.242	.403	~~485~~
.208	.291	~~47~~
.185	.236	
.158	.355	
.135	.730	

Absorption of bacteria alone at this density and absorption of F given below

λ	Bacteria	F
290	0.25	0.05
280	0.31	0.06
270	0.36	0.06
260	0.39	0.06

Recent results on reverse side

110 670

231
150
71

July 30 1950

Bacteria in water vs water

λ	2hr	24hr	4hr	6hr (4000 r/l dil $\frac{1}{8}$ in H_2O)
350	.148	.181	.148	.179
300	.200	.240	.199	.243
290	.254	.303	.255	.300
280	.320	.371	.320	.360
270	.370	.424	.367	.400
260	.392	.454	.396	.424
250	.390	.450	.390	.430
240	.398	.470	.400	.470
230	.560	.655	.552	.662
225	.664	.783	.663	.840

Filtrates vs Fmed

λ	2hr	24hr	4hr	6hr dil $\frac{1}{8}$ in F	6hr (old) of 7/22	6hr old of 7/28
350	.0175	.022	.010	015	018	.010
300	.052	.092	.045	050	.062	.043
290	.215	.440	.215	.400	.132	.117
280	.370	.760	.376	.673	.238	.217
270	.405	.775	.407	.685	.288	.259
260	.350	.660	.353	.560	.290	.256
250	.263	.475	.275	.385	.290	.242
240	.226	.475	.277	.312	.332	.251
230	.433	1.08	.585	.700	.591	.420
225	1.03	1.43	1.17	1.3	—	—

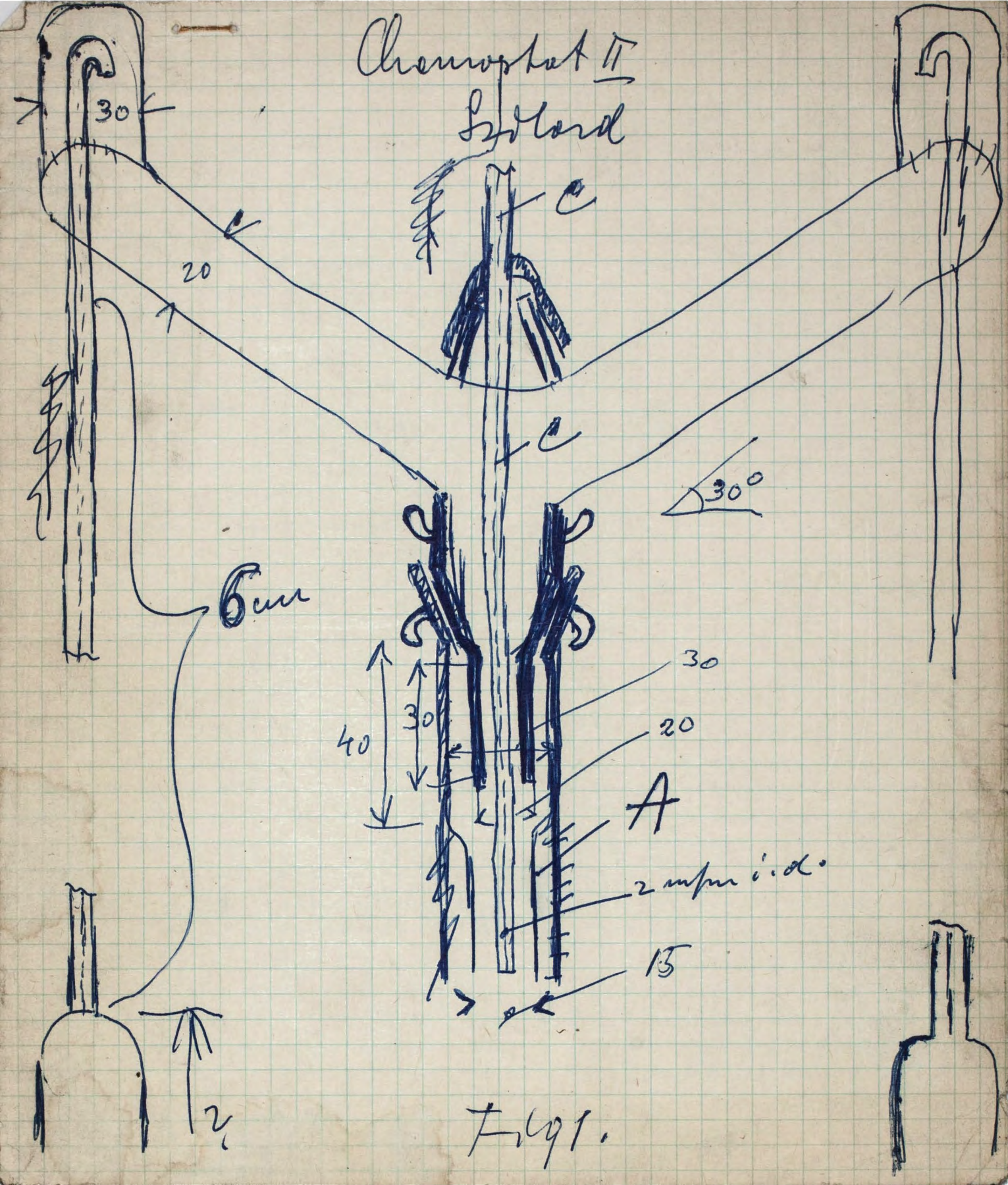
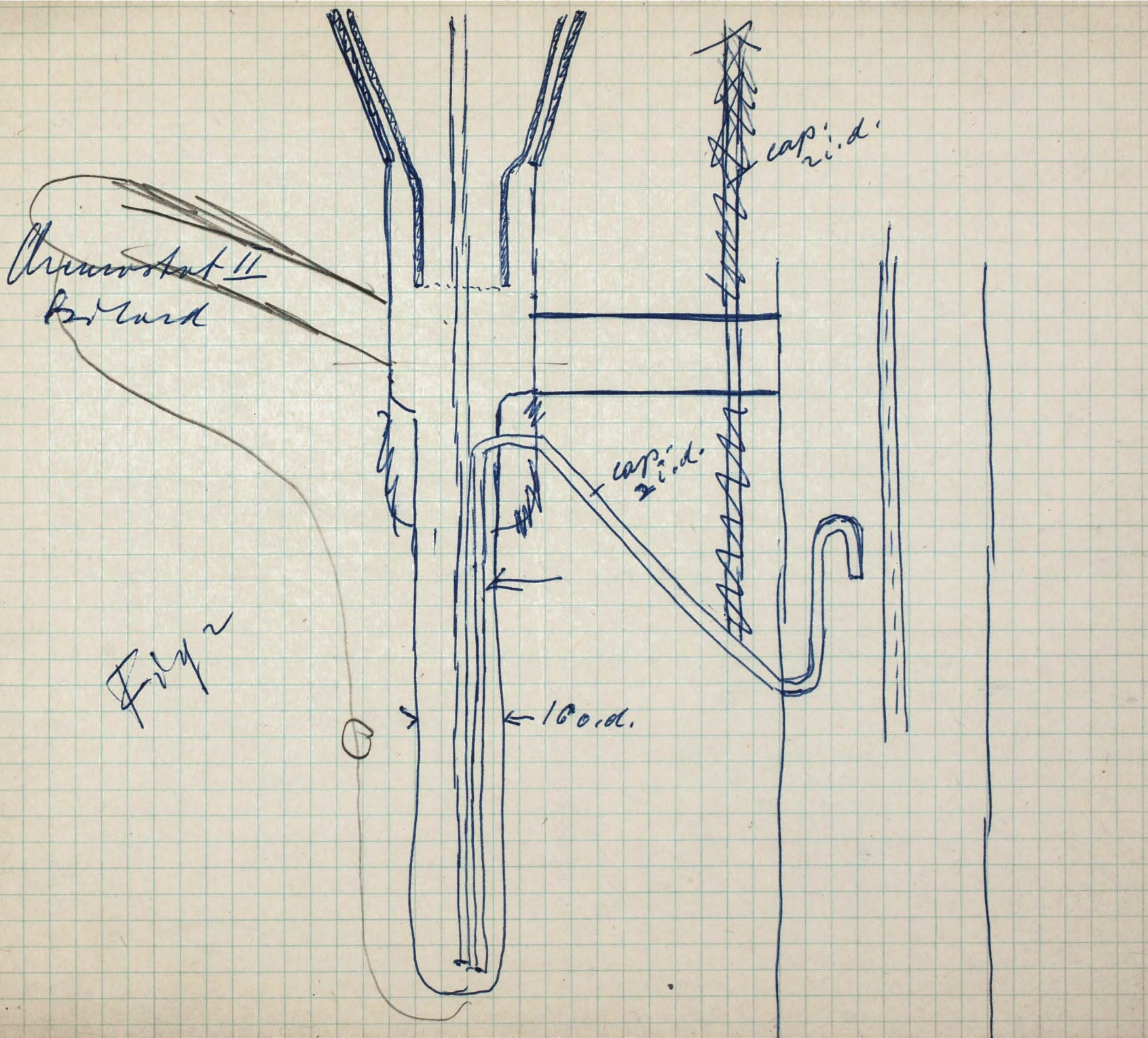


Fig. 91.


Thermostat II
Bad
Fig 2
cap i.d.
cap i.d.
160 o.d.

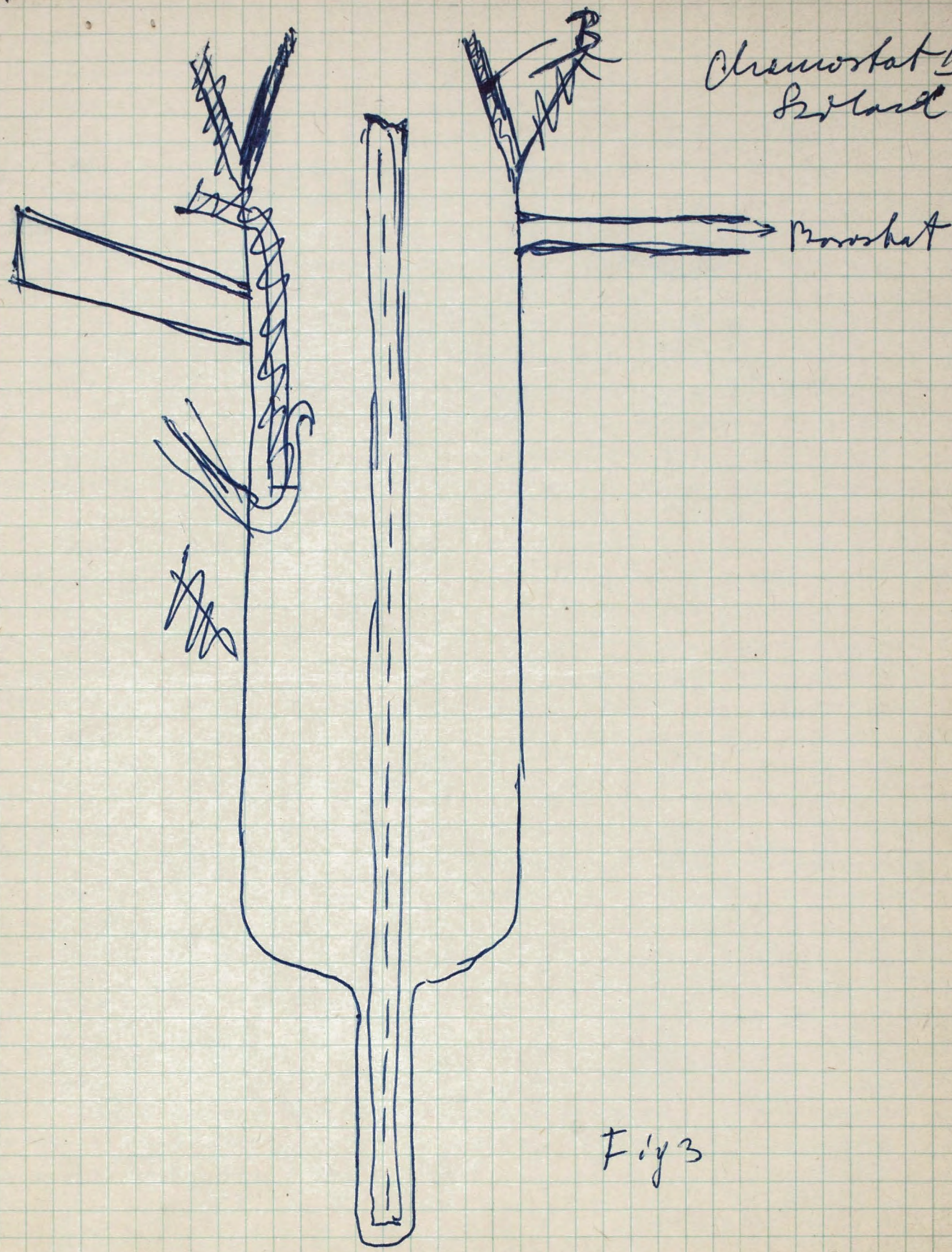


Fig 3

Chemostat II
Bolard

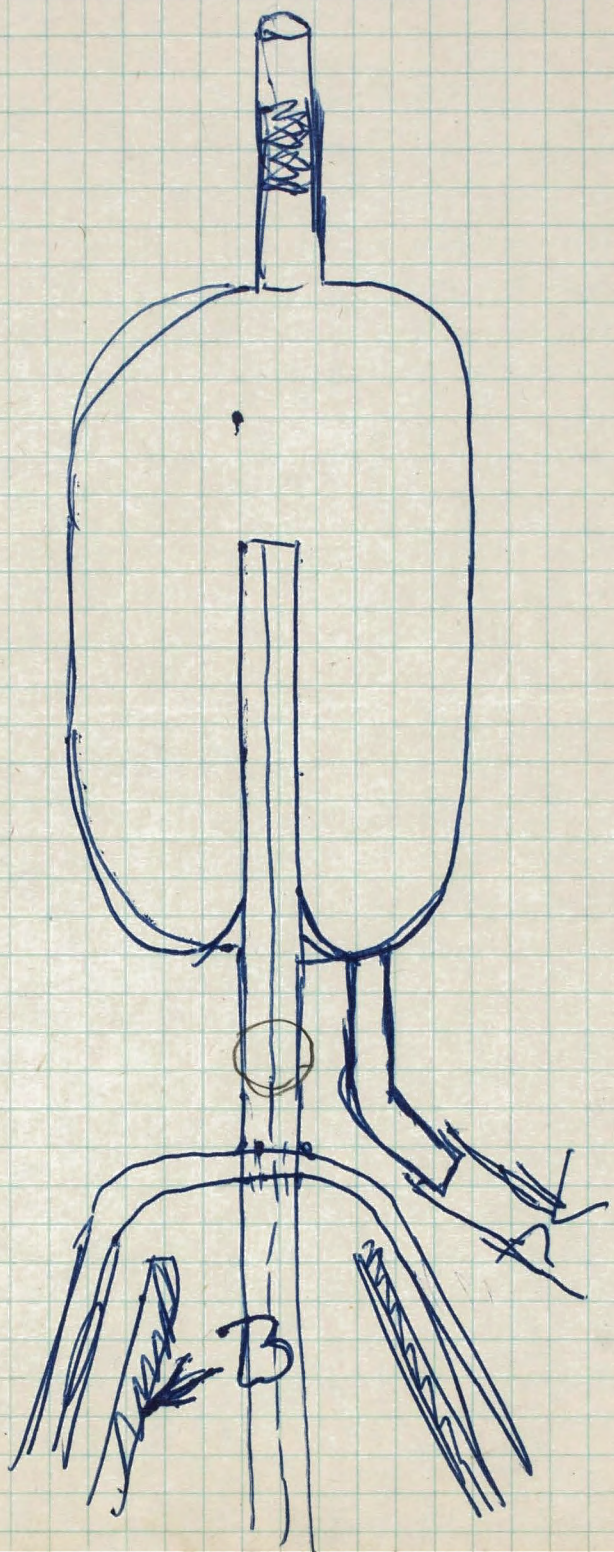


Fig 4

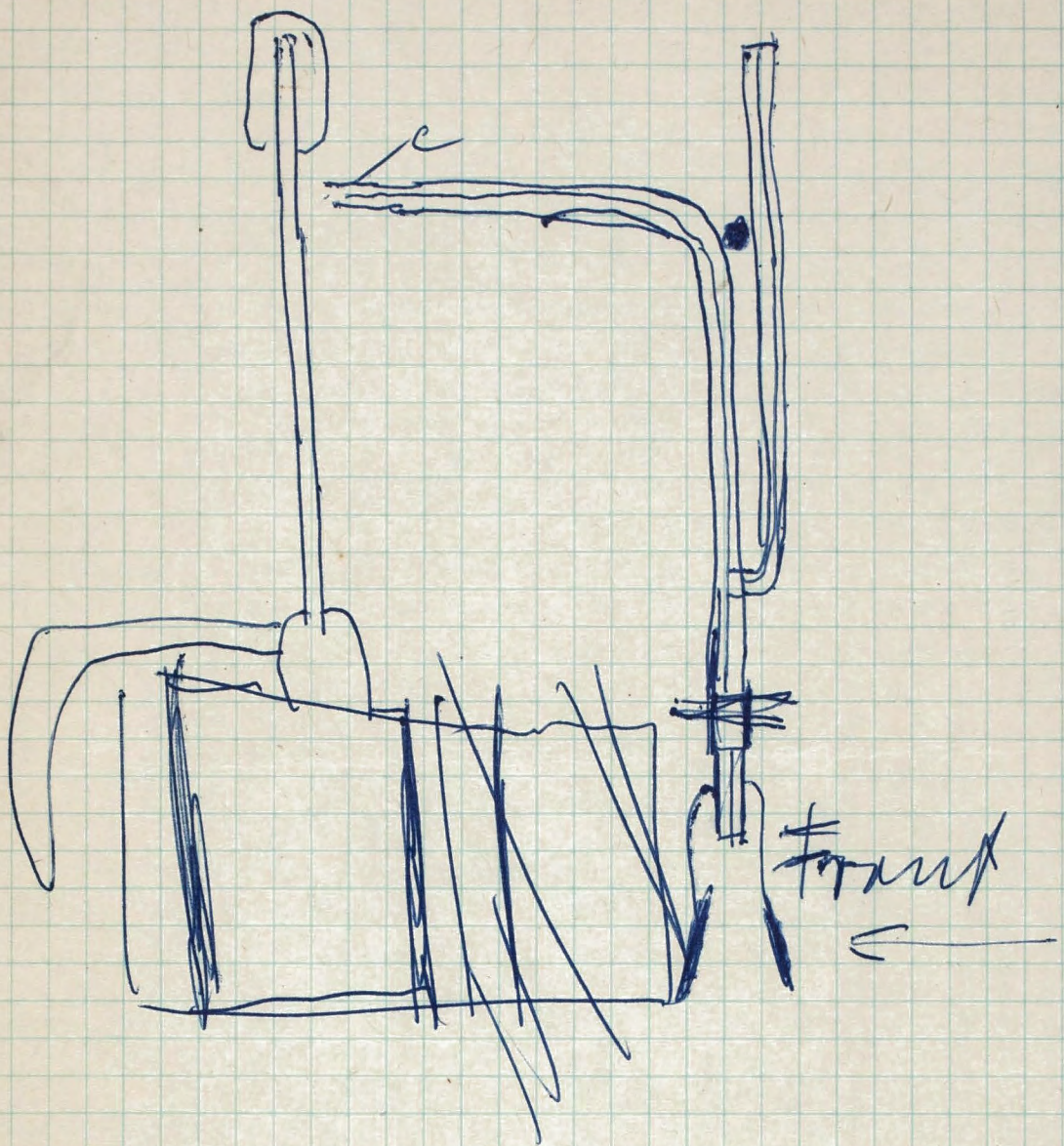


Fig 5.

Chemostat II
Szilard

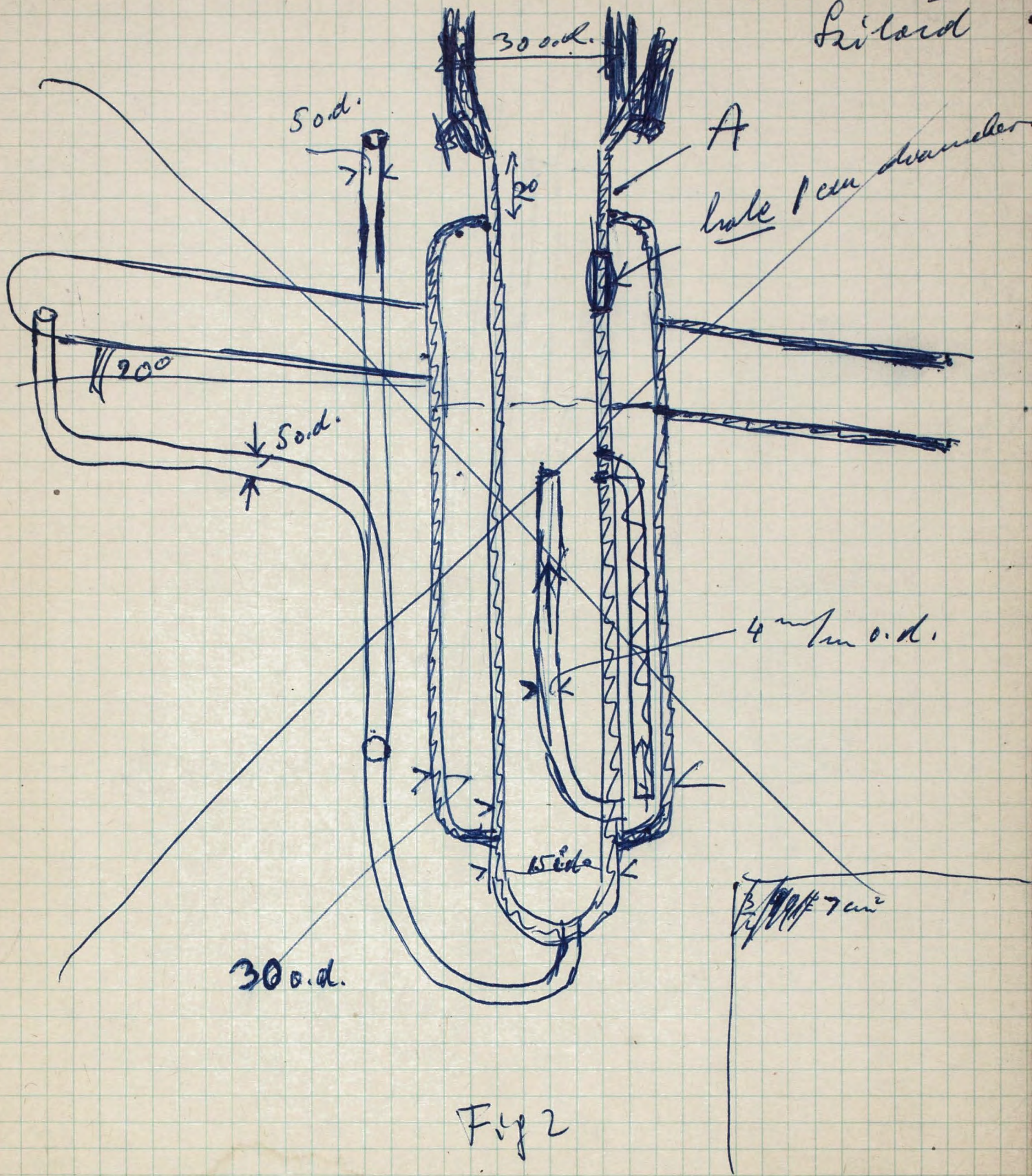
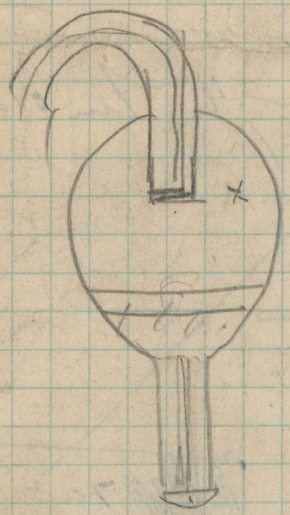
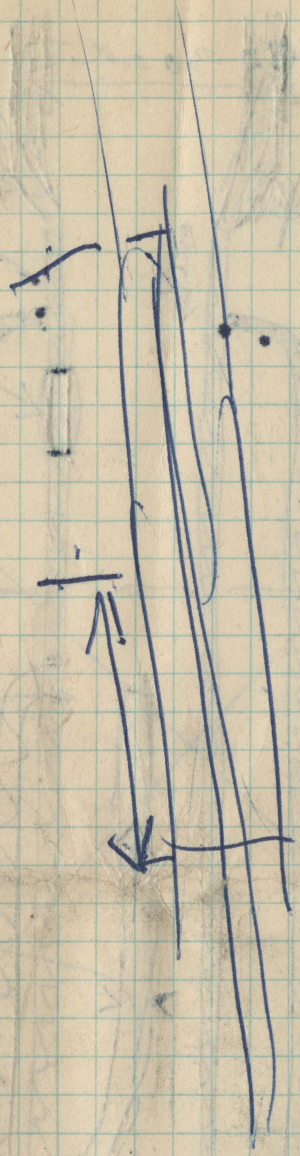
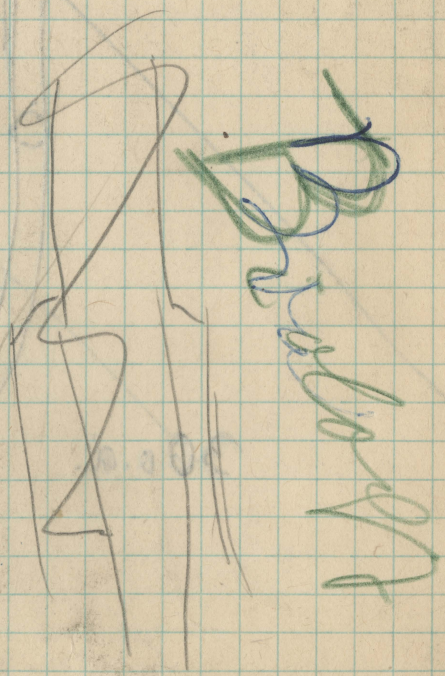


Fig 2







R.F. Kimball Oak Ridge

variety (1) [Immobilization variety 4]

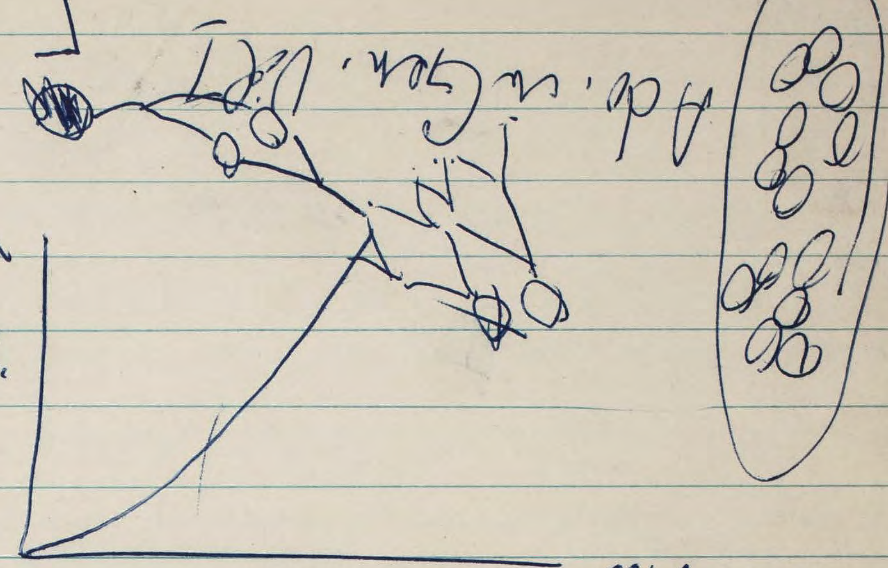
Pearson [ ]

Gilman (bukakse)

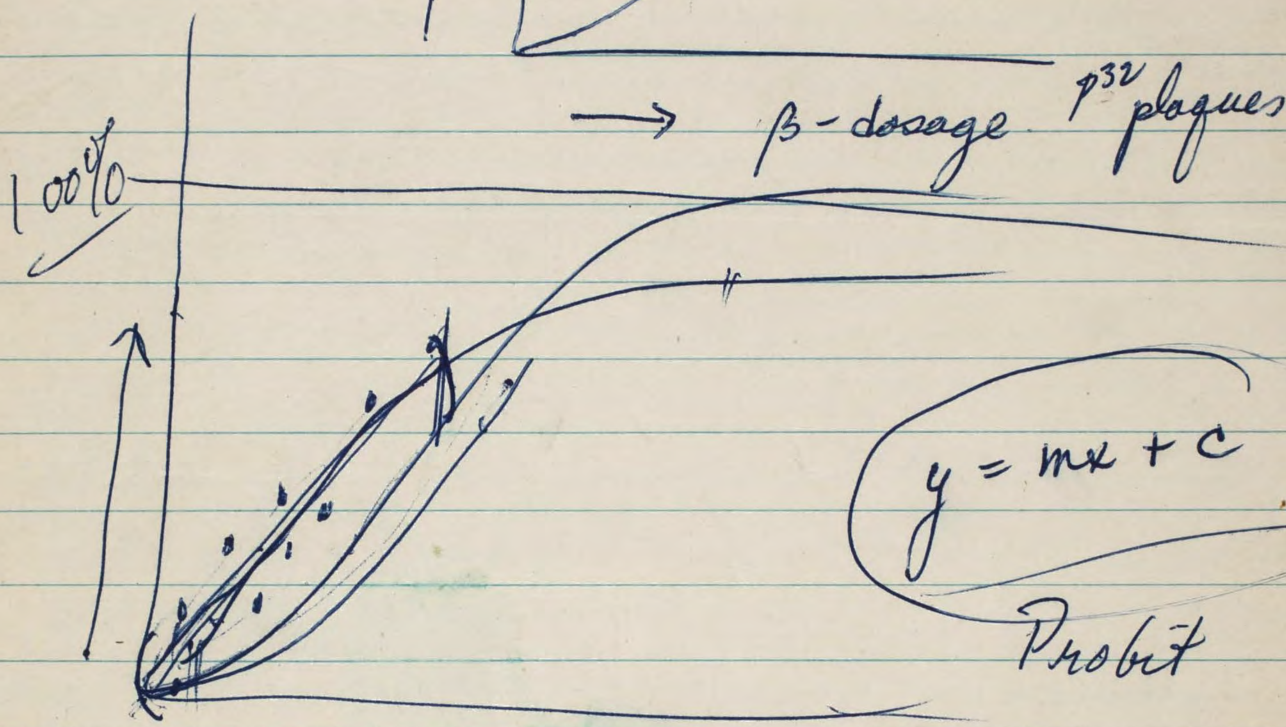
Paramecium caudatum

Giese
Stanford

D. after aut.



→ β-dosage P^{32} plaques



$y = mx + c$

Probit

219
202

4

No of macronuclei

125 x 40 x 40

10^{-7} cc

Paramecium (Caudatum)

: after [crossed out] mixed infection in B/1 (T2 × T4 cross) growth in B/2/1 and then growth in B/4/1, and last step is growth in B/4, then lysis by T1 and phage so obtained is "T2" used in new cross with T4

4.) Plating of [crossed out] of [crossed out] lysate Nol bad B/2 grown in B (plaque a) on various B/24 + B

[crossed out] 4×6.) Plating of T2r × T4r cross on one B/24+B (which registers plaque a!)

5.) Enriching T2r × T4r cross by growing alternately in B/2 and B/4

death rate [and mut. rate] for [crossed out] [crossed out] B and B/r natural rate and X-rays.

Antiserum search for mutants which "escape" immunity

Plenhardt | Turbidity Standard

APHA Turbidity Standard

1000 mgm parts per million mgm water

Constant voltage devices

15, 30, 60, 120, 250, [110 and 6 Volts output]

direct reading [Barrier layer cell]

~~Balanced~~ circuit no ~~need~~ advantage

use galvanometer ~~below~~ 500 ~~Ω~~ Ω

Lamp [6 Volt] Microscope illumination

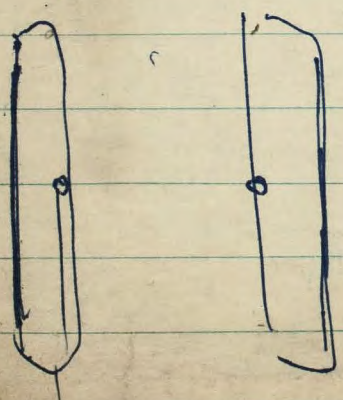
P.E. Rotation for filament lamps

Holder lamps

Blue filter useful, to emphasize scattered light

Galvanometer 3×10^{-7} Amp full scale

P.E. multiple reflection [243 g. 9] X 100



Balanced circuit if doubt about constancy of lamp

II

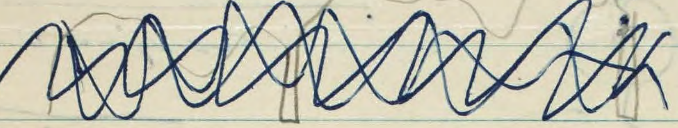
Recording and controlling.

~~Bolo~~ border cells, balanced circuit, Brown recorder

if sensitive enough

otherwise:

A.C. amplifier (chopped light) ~~[illegible]~~



Vacuum photocell or multiplier

If D.C. amplifier zero would shift this is no trouble for recording but bothers relays. — If no amplifier is used but multiplier tubes, zero does not shift. —

UV measurement

Gen. El. 4 Watt germicidal Lamp + Ballast for it 58 G. 825 with starter

Gen El. —

use with multiplier

a.) ~~[illegible]~~ photomultiplier + galvanometer or

b.) also amplifier (A.C.) from Lamp

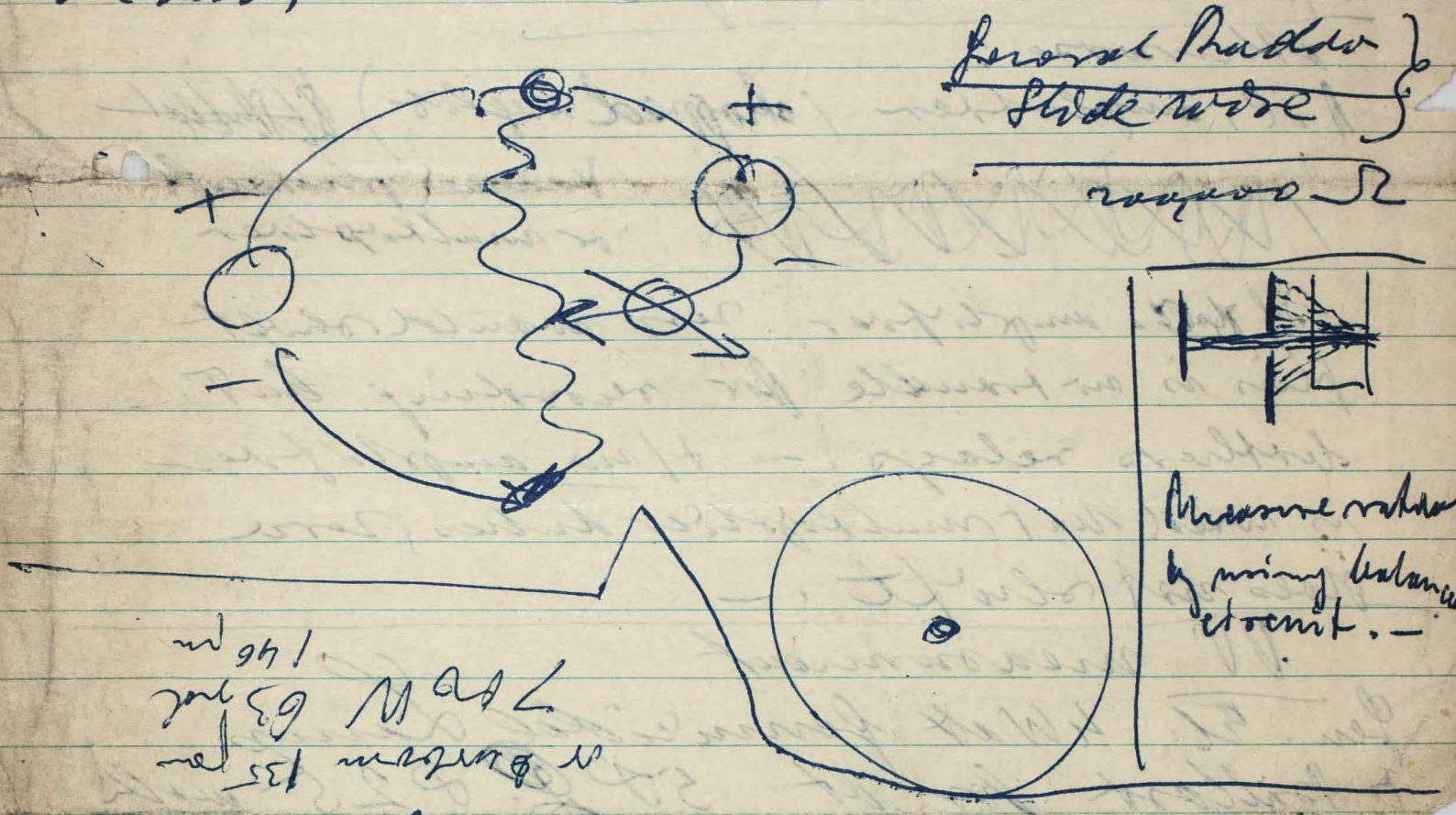
~~[illegible]~~

check lamp and amplifier with

~~[illegible]~~

by passing, Cl-Ng use Wood filter

If no amplifier is used to multipliers are balanced around to make sure that lamp fluctuations are out;

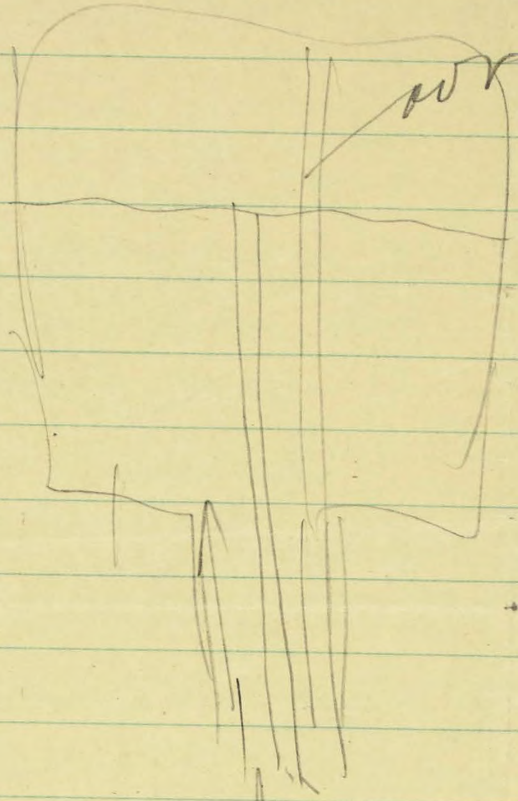


If U.V. lamp constant enough d.c amplifier (battery) (ready at Photo-volt) could be used constant enough to make check with luminous desk unnecessary (X) very well short through but price does not change

Pyrogen

1 lbs 5 Gallons

Call 10–11
on Monday



15 Hours

15 min
each

Add Na nitrate to get rid Ca
~~Add above acid~~ Hydrogen for wash water

filter | wet cake dry also alk
for 2 hours

filter again again alkohol
and ~~heat~~ heat to boil in alk.
filter dry ~~in~~ on wax paper

Klett Manufacturing
Hudson & Columbia.
Klett Mfg Co
N.Y.

Standard Electric Glass and
Apparatus Co N.Y
automobile [illegible]

[

Conn.

Beales [Essex

*Humphreys

Wilson Wiatt ~~Wash~~

Louisville Ky

Friday pm [Moreland]

No 3 · Vol 67
March 1948

Woolley
Proc. Soc. Exp. Biol. & Med

Burnet Austr. J. Exp. Biol. Med Sci.
1937, 15, 227

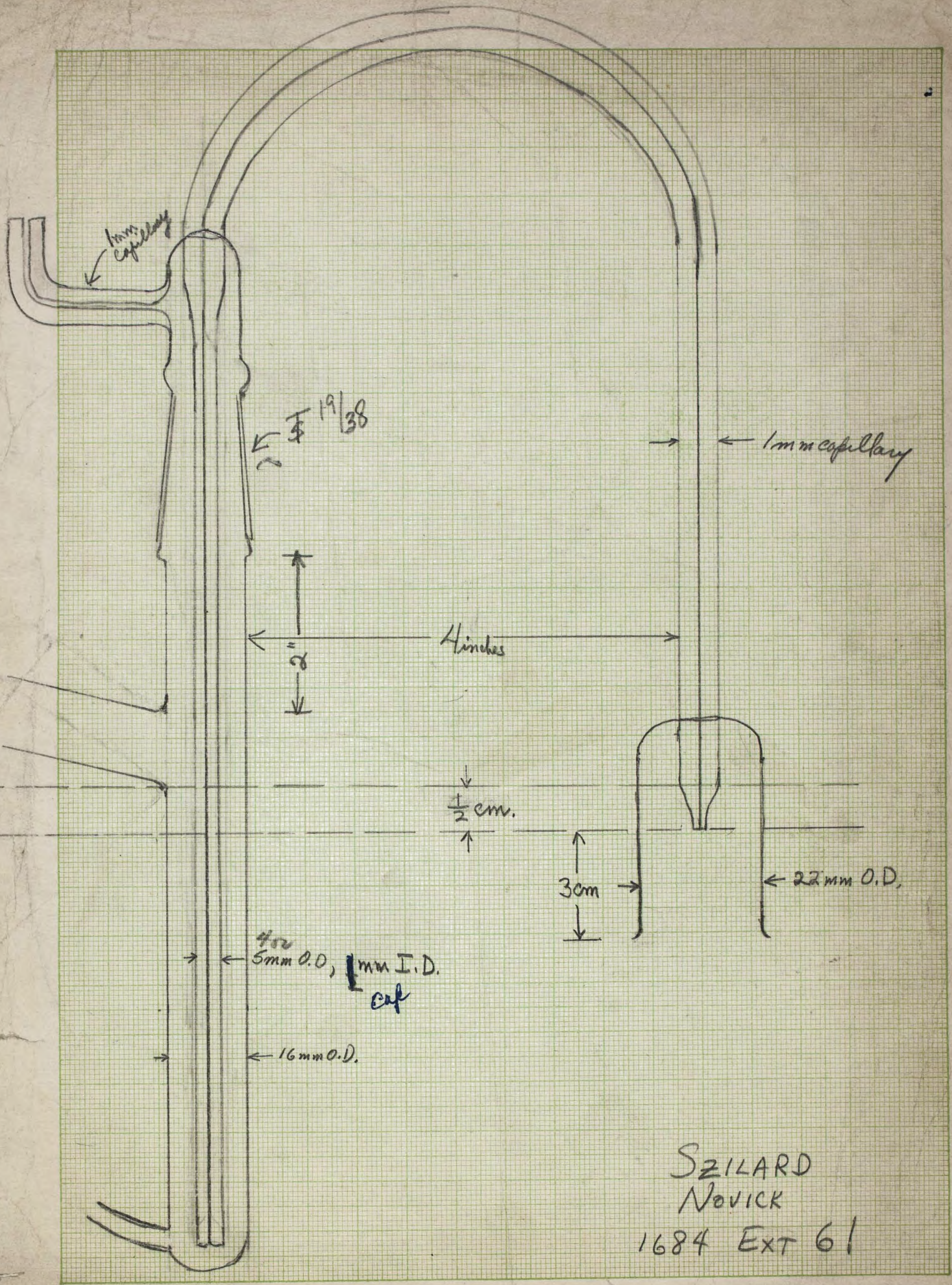
Hoyt et al J. Biol Chem 1946, 165, 241

Woolley & Green J. Biol. 1947 54 63

Green, Woolley
Journ of Exp. Med 1947, 86, 63

[Dr. Winslow Fox]

(430)



SZILARD
NOVICK
1684 EXT 61

Experiments Oct 2, '48

MUS 4-2520
MID 3-3056

See in N.Y.

1.) Mark Adams autosera, polio
2.) Davis – mutants that revert to wild type –
3.) Heidelberger about selection methods
4.) Witkin ~ Doermann [get B/r]
5.) Seymour Cohen in Philad.
6.) Stewart in Rochester ~ Bethe in Ithaca

1.) cross ~~T~~ T_2 and T_2h
grow in B/2 plate on B + B/2 see if there is an increase in opaque plaques „before" and after
2.) ditto with T_1 cross T_1h

~~[illegible]~~

3. (Incipient T_2–s) cross $T_2 \times T_4$ grow in B/2 plate in B/4. Pick 20 plaques and mix virus of these. Use this as "T_2" and cross with T_4; determine ratio of "T_2 & T_4 and growth" in B/2
3b.) refinement of the above (avoids multiple infections in a B/2 plate.)!