Table –

Segregational Behavior of Reversions of lp^s and lp^R Segregants.

Expt.	Segregant Phenotype	Segregant Number	No. Reversions Per Segregant	Total Number Formal Segregants
287	Gal_2^- lp^R	2	8	8
	Gal_2^- lp^s	1	6	0
292	Gal_2^- lp^R	12	1	11
	Gal_2^- lp^s	3	1	0
	Gal_4^- lp^s	1	1	0
292A	Gal_2^- lp^R	1	2	2
	Gal_2^- lp^R	3	1	3
	Gal_2^- lp^s	5	1	0
298	Gal_2^- lp^R	5	2	10
323	Gal_6^- lp^R	1	6	1
	Gal_6^- lp^s	1	2	0

Heterogenotes, 287, Gal_2^- lp^s // Gal_2^+ lp^R

292, 292A, 298 Gal_2^+ Gal_4^- lp^s // Gal_2^- Gal_4^+ lp^R

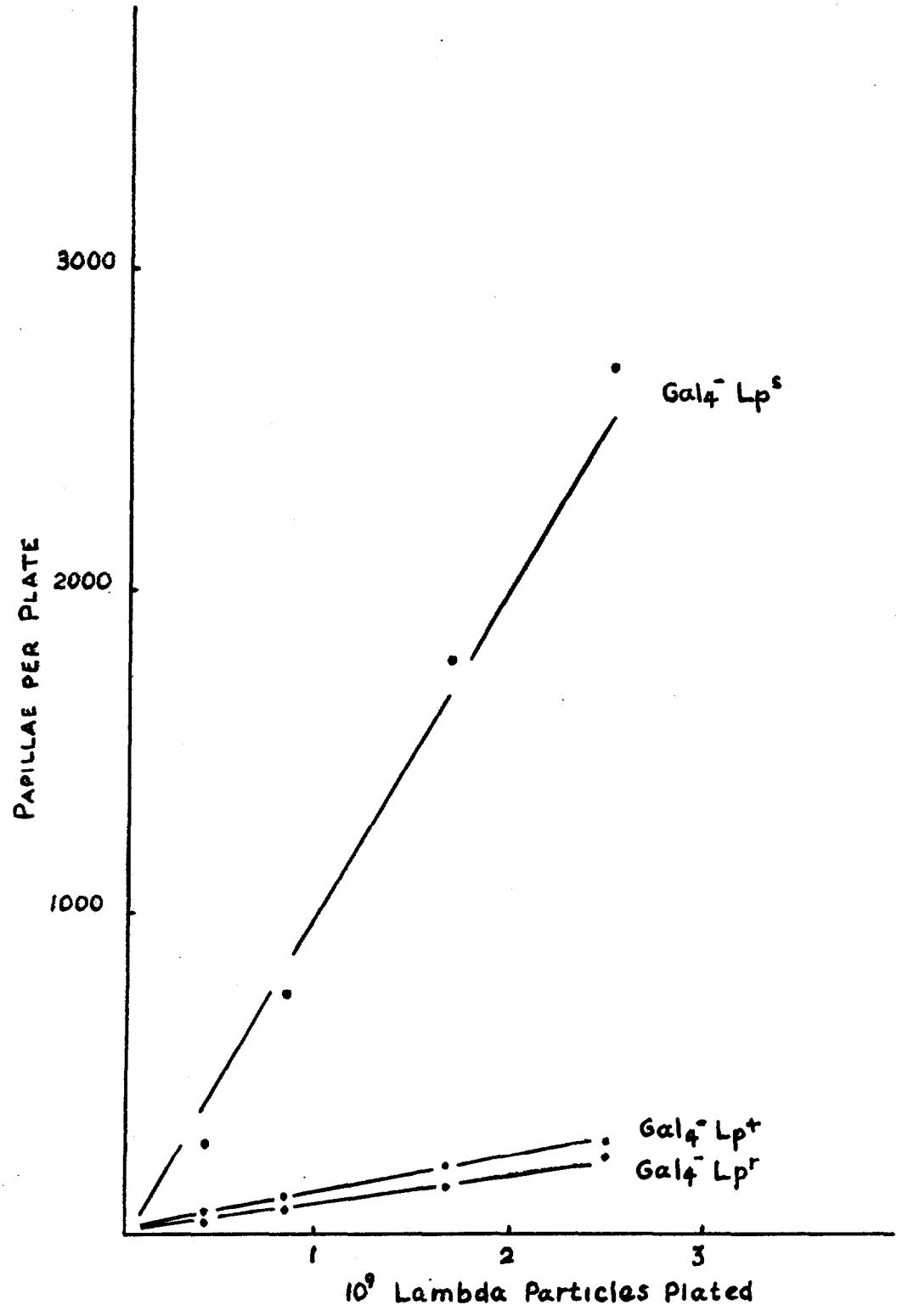
323, Gal_6^+ Gal_1^- lp^s // Gal_6^- Gal_1^+ lp^R

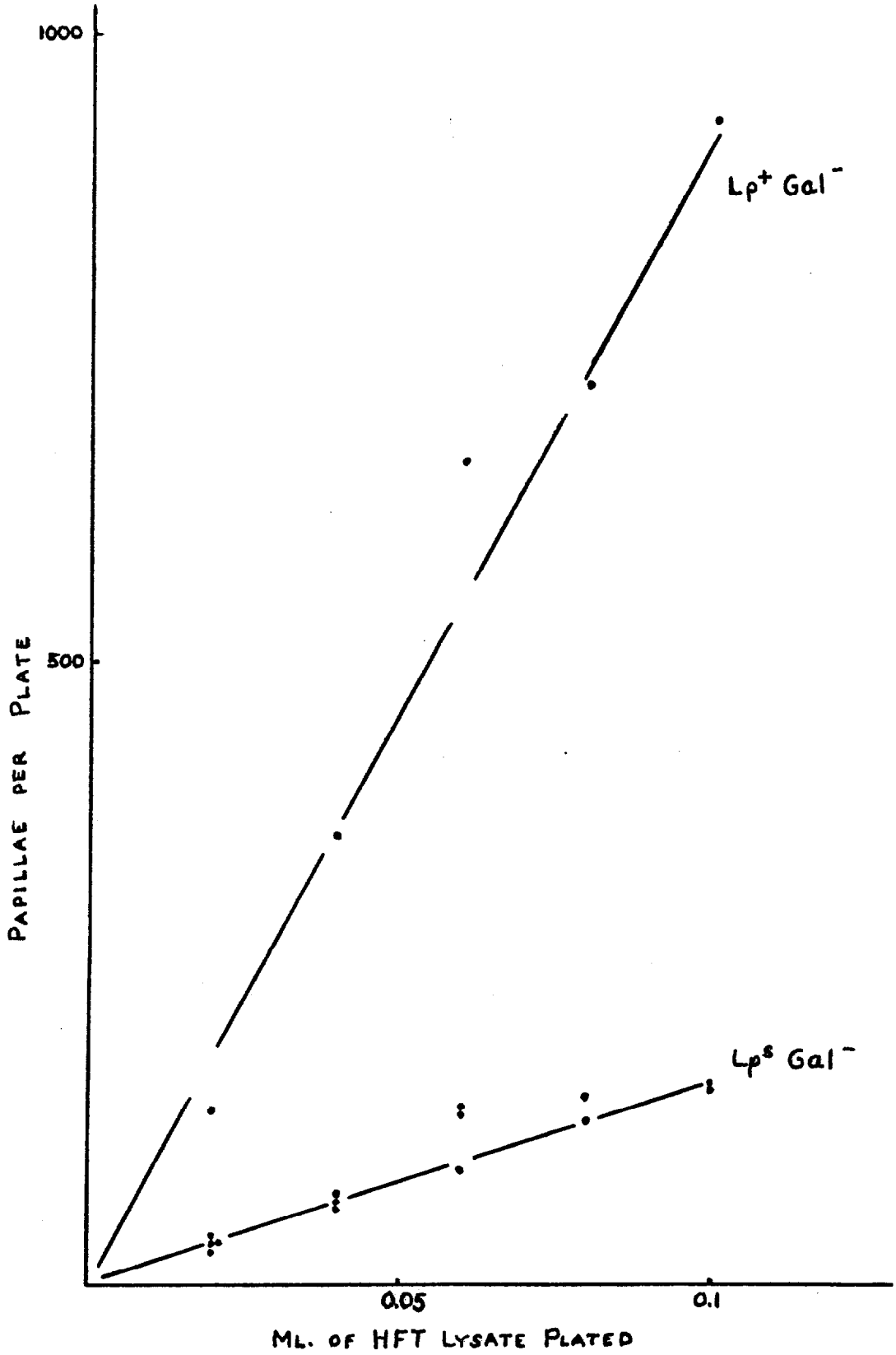
MLP Genetics Soc. Mich State Coll. Sept. 1955

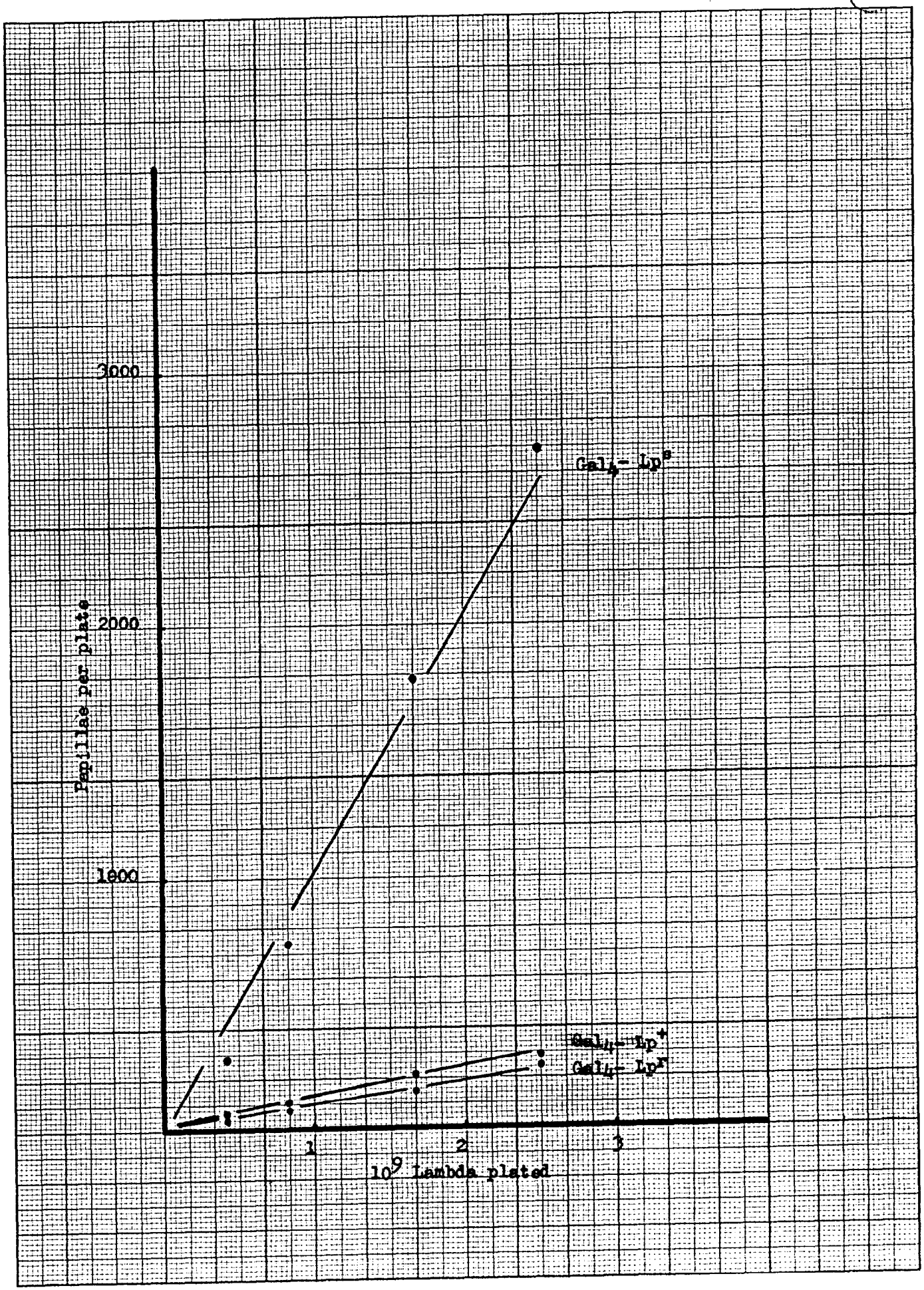
(227)

Cis-trans position effects in transduction heterogenotes of *Escherichia coli*

—— The phage lambda can transduce a fragment which includes a cluster of genes for galactose fermentation. Most of the transformed clones are "diploid" or heterogenotic for the transduced genes. Many combinations of non-allelic Gal- mutants give galactose positive heterogenotes as readily as Gal+/Gal-. However, some combinations of Gal- gave smaller and delayed yields of positive clones. Further analysis disclosed a cis-trans position effect between certain loci. For example, while the cis ++/-- heterogenotes formed by transduction from Gal_1+ Gal_4+ to Gal_1-Gal_4- are positive, the trans +-/-+ heterogenotes from the transduction from Gal_1-Gal_4+ to Gal_1+Gal_4- are phenotypically galactose negative. In the negative clones, positive heterogenotes are later formed by crossing over in occasional cells. Further segregation results in all possible haploid combinations, +-, -+, ++, and --. The delayed yields that were observed initially are based on these secondary events. Reciprocal transductions have given identical phenotypes, so that in heterogenotes the genes in the fragment are functionally equivalent to the homologous genes in the chromosome. The galactose positive phenotype thus requires that + alleles be in adjacent positions either in the fragment or the chromosome.


3000
2000
1000
Papillae per Plate
Gal4⁻ Lp^s
Gal4⁻ Lp^+
Gal4⁻ Lp^r
1
2
3
10^9 Lambda Particles Plated


1000
500
Papillae per Plate
Lp+ Gal−
Lps Gal−
0.05
0.1
Ml. of HFT Lysate Plated



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4. Transduction to Lp^s recipients

It has been stated previously that transductions to Lp^s recipients cells with LFT lambda result in lysogeny of the clone. Nearly all of these lysogenizations are Lp^+, but rarely a clone with Lp^r phenotype results. With HFT lambda there is a higher frequency of the Lp^r type, a result which may only be owing to the lower chances of secondary infection lambda in with HFT lysates. Of 58 syngenotes isolated as single colonies, 13 (22 percent) were of Lp^r phenotype. These syngenotes were made with different lysate preparations, ~~and were~~ derived from different homogenotes, and there is no indication, as yet, of an association of Lp^r clone formation with either a locus or a lysate preparation.

The Lp^r clones described previously in this report are carriers of a "defective" prophage (Appleyard, 1954), but plaque-forming lambda, in small quantities, may be obtained from them after irradiation with ultraviolet. The Lp^r clones obtained with HFT lambda have not given lambda after UV treatment, and differ from previously described Lp^r cultures in segregating for Lp, yielding Lp^s. Thus they appear to be syngenotes of the form Gal^- Lp^s//Gal^+ Lp^r. Segregation yields Gal-Lp^s, or Gal^+Lp^s haploid segregants. No non-segregating Lp^r clones have been observed. This last observation suggests that the lambda "defect" in these cases is with lysogenization as well as with production of plaque-forming particles.

Obvious segregation at Lp was not observed when Gal+ segregated from Lp^s recipients, and it was not possible with these syngenotes to relate the function of the prophage to the genetic material. Lp^r _//Lp^s heterogenotes permit study of this relationship. If the chromosomal fragment is independent of the Lp genotype, Lp^s segregant cultures may be homogenotic. Gal+ reversions of segre ants from Lp^r_//Lp^s syngenotes were examined for their segregational behavior. Under conditions where the reversion test indicated 23/23 Lp^r Gal− segregants to have been homogenotes, 10/11 Lp^s Gal− segregants were found haploid(table 10). Although it is not possible to determine the adequacy of the data, the indication is that the Lp^r allele has a centromeric function, that Lp^+ probably does not, and that the Lp^s allele cannot so function. Failure to obtain segregation of the Lp^+ allele in transductions to Lp^s recipients may only be an indication that the heterogenotes studied are not the primary product of lambda-sensitive cell interaction.

Table 10

Segregational behavior of Gal+ reversions of Lp^s and Lp^r segregants

Experiment	Segregant Phenotype	Segregant Number	Number of Reversions per segregant	Number reversions found segregating
287	Gal_2^- Lp^r	1	8	8
	Gal_2^- Lp^s	1	6	0
292	Gal_2^- Lp^r	12	1	11
	Gal_2^- Lp^s	3	1	0
	Gal_4^- Lp^s	1	1	0
292A	Gal_2^- Lp^r	1	2	2
	Gal_2^- Lp^r	3	1	3
	Gal_2^- Lp^s	5	1	0
298	Gal_2^- Lp^r	5	2	10
323	Gal_6^- Lp^r	1	6	1
	Gal_6^- Lp^s	1	2	0

Heterogenotes. 287; Gal_2^- Lp^s // Gal_2^+ Lp^r

292,292A,298; $Gal_2^+ Gal_4^-$ Lp^s // Gal_2^- Gal_4^+ Lp^r

323; $Gal_6^+ Gal_1^-$ Lp^s // $Gal_6^- Gal_1^+$ Lp^r

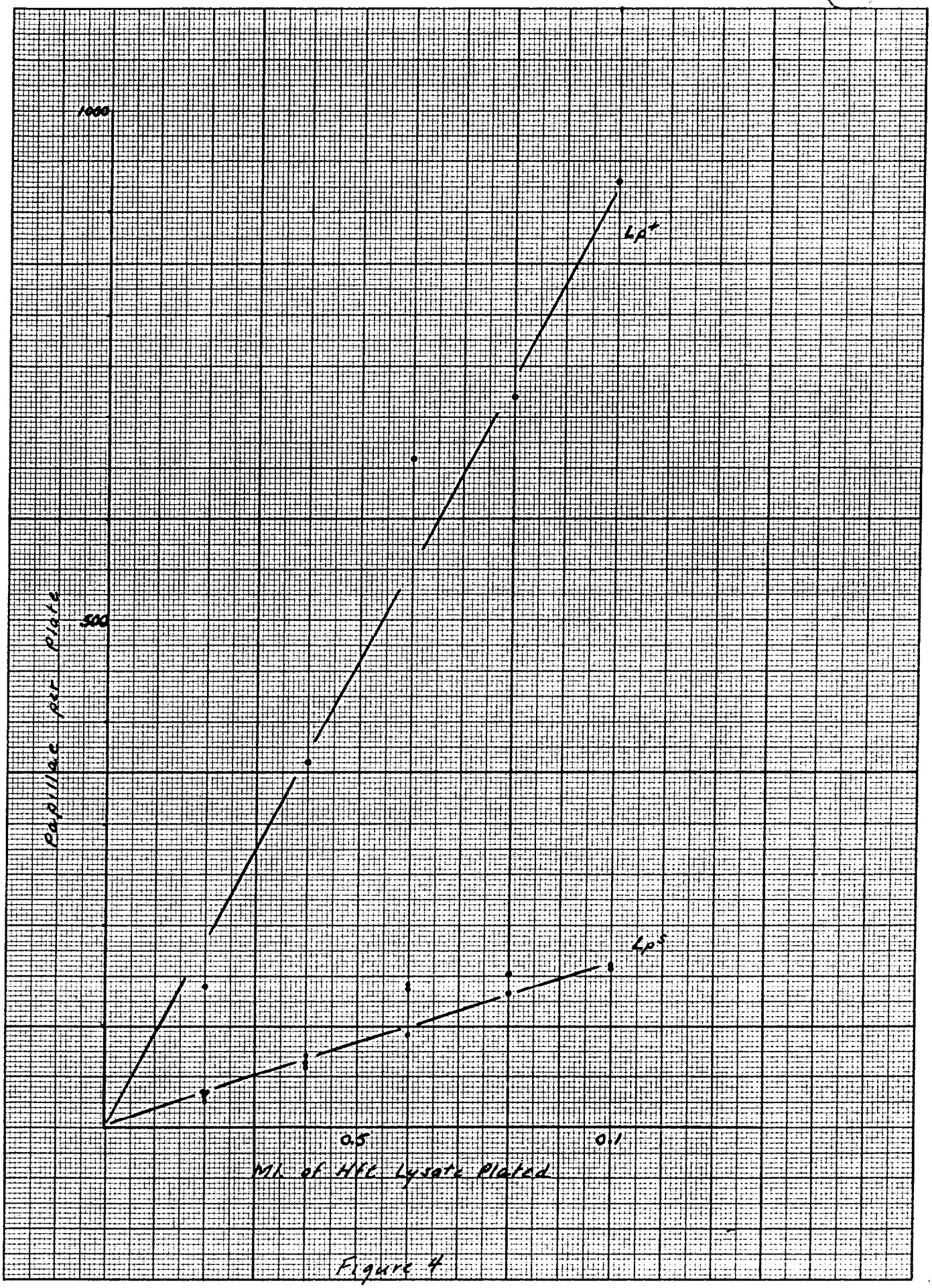

Figure 4

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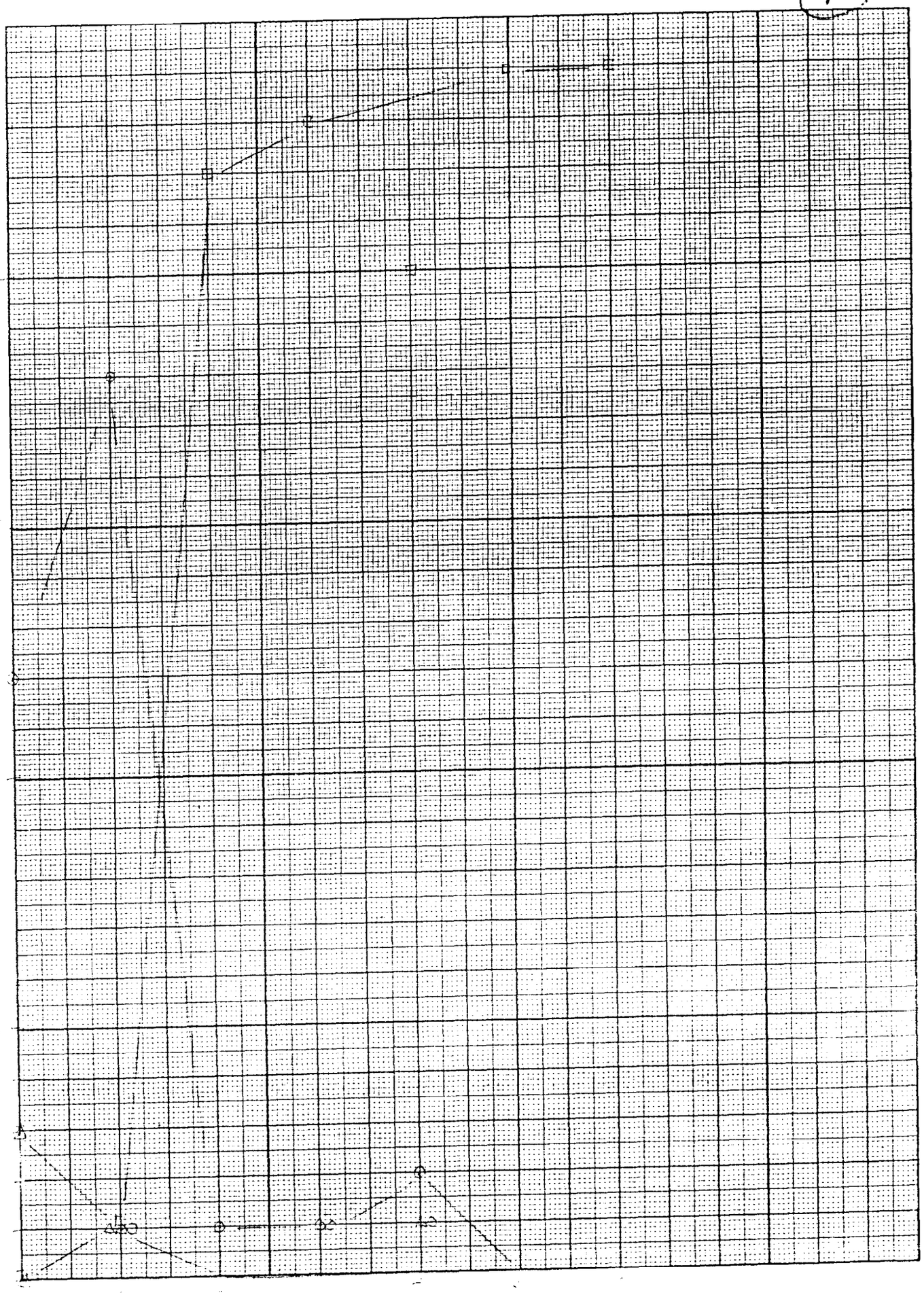

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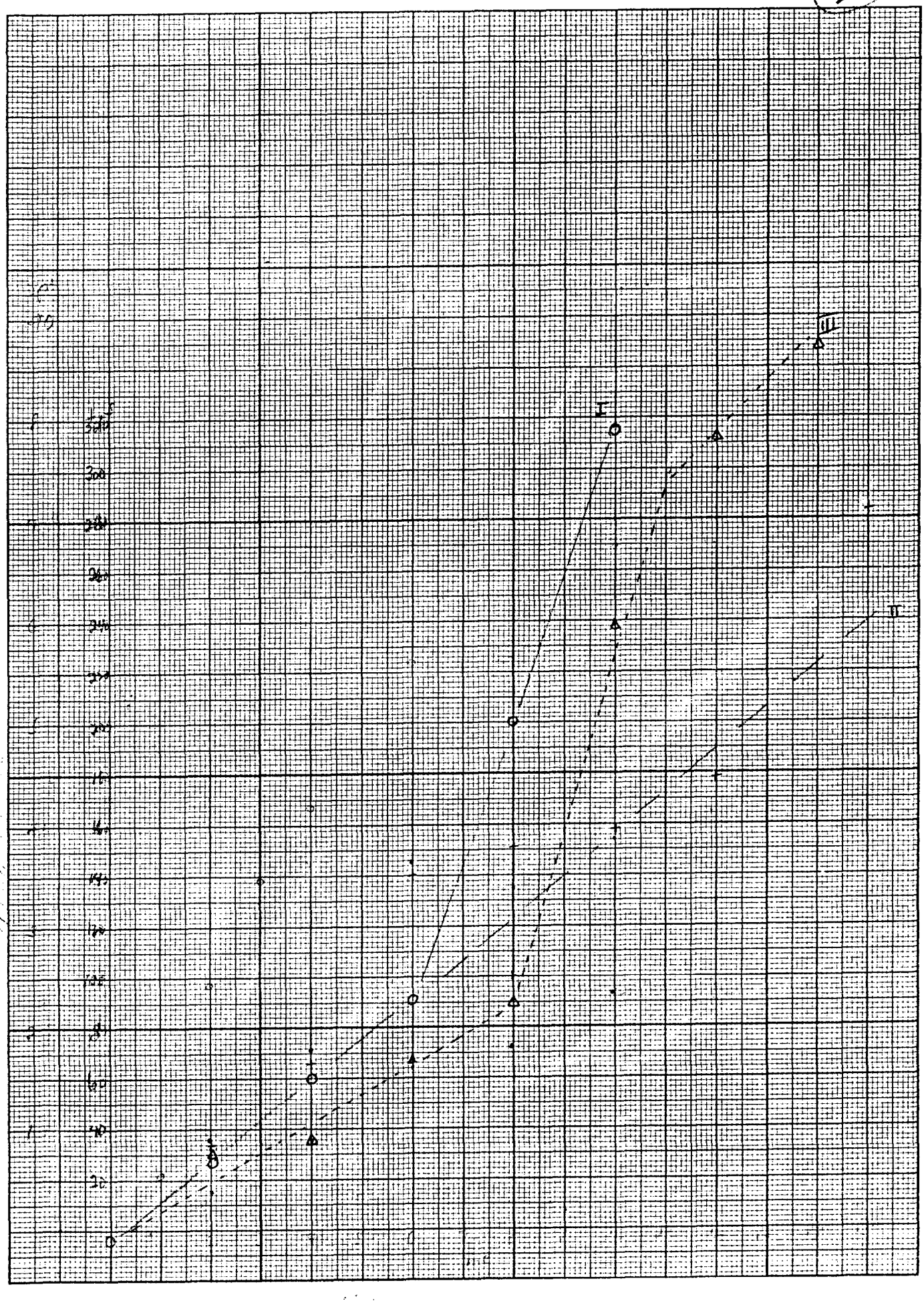

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392

285
288
433
327
471
829
649

$\frac{1804}{5} = 361$

$361 \overline{)739}$ 2.0
722
170

$\frac{180}{2} = 90 = 739$

412

103
117
85
113
108
74
94
70
77
$9 \overline{)8431}$
93

$93 \overline{)177}$ 1.9
93
840
837

170
183
177

399

27
47
135
100 OD = .58
115 % survival = 5.5
176
191
123
96

$\frac{1010}{9} = 112$

400

45
34
37
39
40 OD = 0.58
42 % survival = 39
46
$\frac{283}{7} = 40$

27
24
25
20
$\frac{96}{4} = 24$

$40 \overline{)24}$ 0.6

135
140
$112 \overline{)138}$ 1.2
112
260

410

16
14
20
26
5
$5 \overline{)81}$
16

10
4
18
28
28
$\frac{108}{5} = 21$

$16 \overline{)21}$ 1.3
16
50

397

84
101
92
104
121
87
$\frac{589}{6} = 98$

66
78
106
76
117
$\frac{443}{5} = 89$

OD = 0.58
% survival = 15%

$98 \overline{)89.0}$ 0.9
882

detw. from B gal. [illegible] only

	Expt	Begin Rise	B. S	Trawl. particles / Trawl. center	Expt Length	% Cut [illegible]
	412	100'	ca. 25	1.9	180'	<1.0
	410	90'	ca. 17	1.3	180'	<1.0
	399	90'	ca. 20	1.2	120'	5%
	397	85'	ca. 30	0.9	125'	15%
	392	ca. 85'	—	2.0	180'	—
HFT	400	90'	ca 13	0.6	150'	40.

(Time = 5 hours) from Page 354 (239)

Reciprocal on next page

Crossing over in P.E. heterogenotes.

Het.	Donor	Recip
342E2	6-	4-

Multiplicity / 0.1 ml = 0.71

Culture with:	No growth	No Gal+	Gal+
	3	10	6

Clone size: 7000, -34

Non-diff. Clones total	Differentiative clones (+)	total	Est. reg. prob.
1406	ca. 1000	ca 3000	—
ca 3000	4	5144	1.3×10^{-4}
1544	2	6728	5.3×10^{-5}
3088	5	2266	4.0×10^{-4}
ca 150	1	5925	3.0×10^{-5}
5144	ca 1000	ca 3000	—
ca 4000			
8728			
2266			
ca 7000			
~~5925~~			
2245			
748			
34			

Using null method clone size 5900 $\frac{2.3}{5900} \log \frac{1}{12/18} = 7.0 \times 10^{-5}$

see 354 for re-computation using mean clone size

origins see page 354

Crossing over (Time 3.25 hours.)

Het Donor Recip

4- 6-

Melt. 5.8/0.1 ml

Cultures with: No growth No Gal+ Gal+

0 17 3

Non def. clones	Def. Clones (+)	total	Estimate Freq. Prob.
2000			
660	2	1004	4×10^{-4}
688	1	185	
640	1	1249	1.4×10^{-4}
392			
640			
728			
644			
1192			
496			
664			
1096			
592			
720			
1216			
616			
496			

Using null method, clone size 1200

$$\cancel{a = \frac{2.3}{1200} \log \frac{1}{\frac{17}{20}} = 2.6 \times 10^{-4}}$$

$$\text{Total cells} = \frac{16778}{20} = 838/\text{clone}$$

$$a = \frac{2.3}{838} \log \frac{1}{\frac{17}{20}} = \frac{(2.3) \log 1.2}{8.38 \times 10^2} = \frac{(2.3)(0.08)}{8.38 \times 10^2}$$

$$= \frac{0.18}{8.38 \times 10^2} = \frac{1.8 \times 10^{-1}}{8.38 \times 10^2}$$

(2.2×10^{-4})

$a = 0.602r/N \log N$

These experiments indicate washing technique not adequate

(241)

368-1 4⁻ -x 1⁻

multiplicity = 0.45/sample of 0.05 Elapsed time = 4.66 hours.

Samples well: No growth | No Gal + | Gal +

6 | 3 | 1

Diffinite cultures. Ratio +/- / total = 1/7/265

	Gal +	Gal −	Total
(washed)	1	345	858
	0	ca 300	ca 600
	0	ca 300	ca 600
	0	549	549

$a = 0.602(1)/858 \log 858$
$= 0.602/2.94(858)$
$= 0.602/2520$
$\frac{6.02\times10^{-1}}{2.52\times10^{-3}}$
$= 2.4\times10^{-4}$

$a = \frac{2.3}{600} \log \frac{1}{3/4}$

$a = 0.38 \log 1.33$ 4.7×10^{-2}

$a = 0.38\,(0.124) = 0.047$

These expts on 376

368-2 mult. = 0.34 Ratio $10^{+}/3/201$

No growth	No Gal +	Gal +	Gal +	Gal −	Total
4	5	1	346	0	ca 500
			0	8	794
			0	1	379
			0	ca 300	ca 600
			0	0	208

$a = \frac{2.3}{600} \log \frac{1}{5/6}$

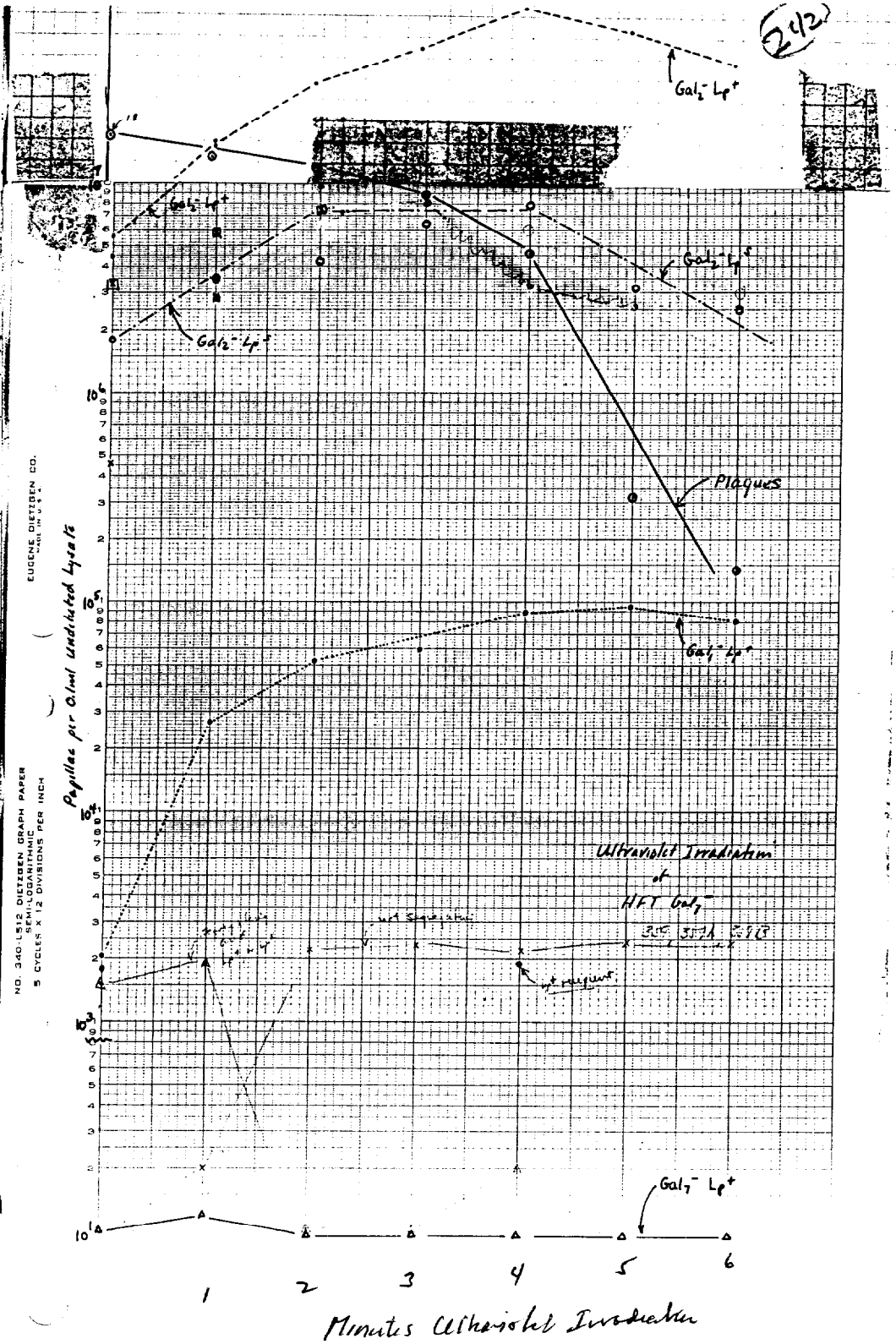
$a = 0.38 \log 1.2$
$= 0.38\,(0.079) = 0.030$
$= 3.0\times10^{-2}$

see 376

Because of the failure of the washing in the pipette method, incubation on B gal attempted, with respreading. Inc. 5.5 hours.

368-1 mult.: Ratio +/- / total = 0/27/173

No growth	No Gal +	Gal +	Gal +	Gal −	Total
1	6	0	0	6	42
			0	5	314
			0	2	71
			0	226	229
			0	0	2
			0	0	9
			0	0	51



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5 CYCLES X 12 DIVISIONS PER INCH
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Defective Heterogenote Number	Gal⁻ Segregants	
	Lambda Sensitive	Lambda Defective
292	24	36
323	4	2
331	6	0
336	12	0
343	5	1
346	5	1
365	20	1
368	3	0
374	9	0
382	14	1
415A	16	1
420	16	2
420A	9	4
Totals	143	49

Table 1

Expt. 316 2/1/54

Procedure: Ultraviolet irradiation of HFT 2⁻, lysate diluted 1-100 in D(M), 0.1 ml. sample removed and added to 10 ml. Penassay. HFT 2⁻ stock = 241-14, mol- derivative. Distance from lamp, 50 cm.

UV Dose in Seconds

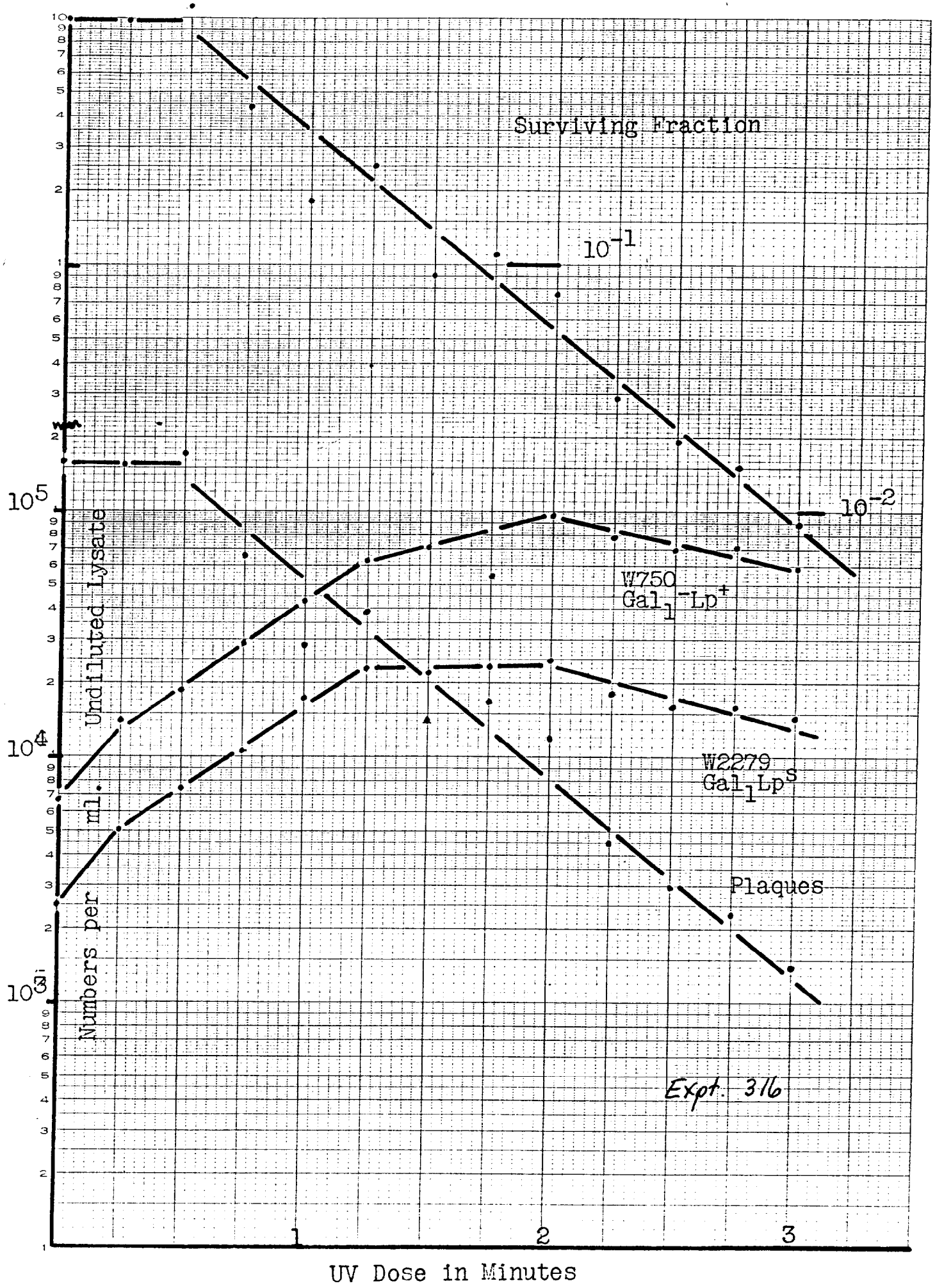
Trnsd. x 10^3 on:	0	15	30	45	60	75	90	105	120	135	150	165	180
$Gal_1^-Lp^S$ W2279	2.5	5.1	7.5	10.5	17.3	22.7	21.8	23.4	24.9	18.1	16.0	16.0	14.5
$Gal_1^-Lp^+$ W750	6.7	14.0	18.4	29.3	43.4	63.8	71.1	53.6	95.8	79.1	69.9	71.7	58.9
Plaques x 10^3	155	151	172	66	28	39	14	17	12	4.5	3.0	2.3	1.4
Fraction Surviving	1.0	0.97	1.1	0.43	0.18	0.25	0.09	0.11	0.077	0.029	0.019	0.015	0.009

Table 2

Analysis of Transduction on $Gal_1^-Lp^S$ Recipient

UV Dose in Seconds

	0	15	30	45	60	75	90	120 to 180
No. of Trnsd. Tested	1	18	18	18	18	18	18	18
No. Seg.	0	6	1	0	1	1	1	0
% Seg.	0	33	6.0	0	6	6	6	0
Lp Gene Types of Segregating Gal+								
Lp^S	-	-	-	-	-	-	-	-
Lp^+	-	-	-	-	-	-	-	-
Lp^R	-	6	1	-	R	R	R	-
Lp Gene Types of Non-Segregating Gal+								
Lp^S	-	7	14	17	16	16	17	-
Lp^+	-	2	0	0	0	1	0	-
Lp^R	-	3	2	1	1	0	0	-
% Lp^S	-	58	88	94	94	94	100	-



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5 CYCLES X 12 DIVISIONS PER INCH

?

Lysate diluted D(M) 1-100 —→ 0.1 ml samples to broth
10 ml ~~samples~~

(2279) (750)

Page 316 - Diluted HFT lysate (241-14 mal-) —x Gal⁻ Lp⁵, Gal⁻ Lp⁺

Spot test	Dose	0	15	30	45	60	75	90	105	120	135	150	165	180
0.1 ml of 1-10 dilution →	Lp⁵	25	51	75	105	173	227	218	234	249	181	160	160	145
	x10³ titer/ml UVS	25	5.1	7.5	10.5	17.3	22.7	22.8	23.4	24.9	18.1	16.0	16.0	14.5
	Recovery		2.6	5.0	9.0	14.8	20.2	19.2	20.9	22.4	15.6	13.8	13.8	12.0
0.1 ml of 1-100 dil →	x10³ (Lp⁺-0)	1	15	22	25	22	19	24	37	31	2.0	—	—	—
			14	21	24	21	18	23	36	30	1.0			
	Plaques x10³	155	151	172	66	28	39	14	17	12	4.5	3.0	2.3	1.4
		1.5x10⁵ · 100 · 100 = 1.5x10¹³ plaques/ml												
		6.7x10³ · 10⁵ = 6.7x10⁸ transd. lys												
	No. pipettes to pick off spot	1	18	18	18	18	18	18	18	18	18	18	18	18
	Seg =	—	33%	6.0%	0	6.0	6.0	6.0	0	6.0	0	0	0	0
	No. stable	1	12	17	18	17	17	17	18	17	18	18	18	18
	Gal stable prototrophs	R	2+ 7S 3R	14S 2R	17S 1R	16S 1R	16S	17S						
	% Lp⁵ =	0	0.58	0.875	0.94	0.94	.94	1.0						
	x10³ Lp⁺	6.7	14.0	18.4	29.3	43.4	63.8	71.1	53.6	95.8	79.1	69.9	71.7	58.9
		0	7.3	11.7	22.6	36.7	57.1	64.4	46.9	89.1	72.4	63.2	65.0	52.2
		~~0~~	~~15~~	~~30~~	~~45~~	~~60~~	~~75~~	~~90~~	~~105~~	~~120~~				

Ignore?

359 - 359A - 359B

(247)

Raw data

HFT 7 undiluted lysate.

Technic. ~~dilute 1-10 with D(M), UV and 0.1ml added to 10ml~~

	Dilution	min UV 0	1	2	3	4	5	6
Transd Assay /2580	$\times 10^7$ 2×10^5	4.7 / 235	14.0 / 707	—	—	—	—	—
/2790	$\times 10^7$ 2×10^5	0.46 / 23	3.5 / 176	4.2 / 213	4.5 / 227	—	3.2 / 161	2.7 / 134
purified cult. → /2790	$\times 10^7$ 1×10^5	1.8 / 189	2.8 / 280	9.8 / 977	—	—	—	—
prewarmed plates. /2915	$\times 10^7$ 1×10^5	3.3 / 330	5.7 / 588	6.5 / 653	—	—	—	—
/750	$\times 10^5$ 1×10^3	0.2 / 21	2.7 / 273 ~~252~~	5.2 / 517 ~~496~~	5.4 / 593 ~~572~~	8.7 / 885 ~~864~~	9.5 / 950 ~~9~~	8.1 / 809
/2307	1-20	5	6	-2	-2	2	3	3
~~[illegible]~~ /2580	$\times 10^7$ 1×10^6	4.4 / 44	18.3 / 183	34.7 / 347	54.5 / 545	68.9 / 689	53.2 / 532	38.1 / 381
/2341	$\times 10^7$ 1×10^6	3.5 / 35	—	—	—	25.3 / 253	—	—
	Ave lp	$\frac{5.6}{3}=1.8$	$\frac{12.2}{3}=4.1$	$\frac{20.5}{3}=6.8$				
Plaques /2790	$\times 10^7$ 2×10^5	500+	500+	11.7 / 584	8.7 / 436	5.7 / 234	0.32 / 16	0.14 / 7
prewarmed plates, purif. cult. /2790		—	—	ca 1000				
/2915	$\times 10^7$ 10^5	16.5 / 1650	11.8 / 1176	6.5 / 653				

Testing Transduction

	0	1	2	3	4	5	6
No. sampled	24	24	23	24	24	24	24
/2790	9 Sent-ns	3s ns	22 all ns	22s 22ns	21s-21ns	24s-ns	24s-ns
	3+ s	2+ 1ns 1s	0	0	1-ns	0	0
	12r s	19r 1ns 18s	1r-seg	2 1ns 1s	2 1ns 1seg	0	0
Spont. present	9.6 s	1.7	1.4	—	—	—	—

The streaks of the last two doses /λ were restriction B gal. no evidence of seg suggesting that addition of λ does not restore seg. behavior

/2915 No.	36	34	47	Recheck of this last by add. streak showed
	0 s	0	38s 38ns	38 ns
	8+ 2ns 6s	2 2seg	0	—
	28r 0ns 28s	32r 31s 1ns	9r 9s	9 seg 8 ns 1

Total over

359 - 359A - 359B

248

Testing Transd	0'	4'
Picture	24	24
/2580 Lpt	24	24
Seg	18	19
NS	6	5
Sp. reversions	9.8	1

on retest not weak 10 single colonies of wt tested found non lysogenic

4' dose 2580

Nature of Segregants		Endo Lpt	Endo Lpr	Exo Lpt	Exo Lpr	Amphi Lpt	Amphi Lpr
→ x	Transd. 1	3	0	4 1wk	0	0	0
	c 2	6	0	0	0	1	0
→ 5a = 7 endo x	3.	5 1wk	0	0	0	0	0
5b = 6 endo a	4.	7	0	0	0	0	0
2c = 1 endo 1 amphi a	5.	7	0	0	0	0	0
b	6.	6	0	0	0	0	0
b	7.	6	0	0	0	0	0
a	8.	7	0	0	0	0	0
b	9.	6	0	0	0	0	0
x	10.	6	$\boxed{1}$	0	0	0	0
→ x	11	5 1wk	0	1	0	0	0
→ b	12	6 1wk	0	0	0	0	0
c	13.	6	0	1	0	0	0
a	14.	7	0	0	0	0	0
d	15.	5	0	0	0	0	0
b	16.	6	0	0	0	0	0
c	17.	6	0	0	0	1	0
a	18.	7	0	0	0	0	0

Exo 10f

Summary - Analysis of Transductants

Dose	0	1	2	3	4	5	6
$CaCl_2$ - Lp^s Recip. %							
Lp^+	22 ~~21.6~~	7 ~~6.9~~	0	0	4	0	0
Lp^R	78 ~~78.4~~	91 ~~89~~	14	8	8	0	0
Lp^s	0	2 ~~4.1~~	86	92	88	100	100
$Lp^+ + Lp^R$	100	98	14	8	12	0	0
% seq.	94 ~~49~~	93 ~~52~~	14 ~~40~~	4	9	0	0
% not seq.	6 ~~51~~	7 ~~46~~	86 ~~60~~	96	91	100	100

Table 1

Expt. 316 2/1/54

Procedure: Ultraviolet irradiation of HFT 2⁻, lysate diluted 1-100 in D(M), 0.1 ml samples removed and added to 10 ml Penassay. HFT 2⁻ stock = 241-14, mol- derivative. Distance from lamp, 50 cm.

UV Dose in Seconds

Trnsd. ~~Dose~~ x 10³ on:	0	15	30	45	60	75	90	105	120	135	150	165	180
Gal_1^- Lp^S W2279	2.5	5.1	7.5	10.5	17.3	22.7	21.8	23.4	24.9	18.1	16.0	16.0	14.5
Gal_1^- Lp^+ W750	6.7	14.0	18.4	29.3	43.4	63.8	71.1	53.6	95.8	79.1	69.9	71.7	58.9
Plaques x10³	155	151	172	66	28	39	14	17	12	4.5	3.0	2.3	1.4
Fraction → ~~Fraction~~ surviving	1.0	0.97	1.1	0.43	0.18	0.25	0.09	0.11	0.077	0.029	0.019	0.015	0.009

Table 2

Analysis of Transductions on Gal_1^- Lp^S Recipient.

UV Dose in Seconds

No. of Trnsd. tested.	0	15	30	45	60	75	90	180 to 180
	1	18	18	18	18	18	18	18
No. Seg.*	0	6	1	0	1	1	1	0
% Seg	0	33	6.0	0	6	6	6	0
Lp ~~Lambda~~ ~~Genotypes~~ Genotypes of Segregating Gal+								
Lp^S	—	—	—	—	—	—	—	—
Lp^+	—	—	—	—	—	—	—	—
Lp^R	—	6	1	—	R	R	R	—
Lp Genotypes of Non Segregating Gal+								
Lp^S	—	7	14	17	16	16	17	—
Lp^+	—	2	0	0	0	1	0	—
Lp^R	—	3	2	1	1	0	0	—
% Lp^S	—	58	88	94	94	94	100	—

Table 1

Expt. 359 - 359A - 359B | 8/17/55

Procedure: Ultraviolet irradiation of HFT 7⁻, undiluted lysate in Penassay. Distance = 50 cm. Irradiation in petri dish, 15 ml volume, 1.0 ml samples removed at varying times. HFT 7 stock = W3067

Assays ① Plaques on B gal on W2915, W2790

Dose →	0	1	2	3	4	5	6
10^7 plaques / ml lysate	16.5	11.8	9.1	8.7	5.7	0.32	0.14
Fraction surviving	1.0	0.72	0.55	0.53	0.35	0.019	0.009

② Transductions on B gal vs. the following cultures

Recipient Culture		Dilution	0	1	2	3	4	5	6
$Gal_2^-Lp^+$ W2580	(1)	10^7	4.7	14.0	—	—	—	—	—
	(2)	10^7	4.4	18.3	34.7	54.5	68.9	53.2	38.1
$Gal_2^-Lp^s$ W2915		10^7	3.3	5.9	6.5	—	—	—	—
W2790	(1)	10^7	1.8	2.8	9.8	—	—	—	—
	(2)	10^7	0.46	3.5	4.2	4.5	—	3.2	2.7
$Gal_2^-Lp^{p/s}$ W2341		10^7	3.5	—	—	—	25.3	—	—
$Gal_1^-Lp^+$ W750		10^5	0.2	2.7	5.2	5.9	8.9	9.5	8.1
$Gal_7^-Lp^+$ W2307		1-20	5	6	-2 Ⓐ	-2	2	3	3

Ⓐ All values given have been corrected for spontaneous reversions of the indicator culture. In the assays on W2307 figures given are papillae on lysate addition plate — spontaneous reversions papillae. None of these papillae were checked for Galactose stability.

Table 3

(B) Transduction to Gal_2^- Lp^s Recipients - Total

Dose →	0	1	2	3	4	5	6
% Lp^+	22	7	0	0	4	0	0
% Lp^R	78	91	14	8	8	0	0
% Lp^S	0	2	86	92	88	100	100
% $Lp^+ + Lp^R$	100	98	14	8	12	0	0

Table 4

(A) Transduction to Gal_2^- Lp^+ Recipient. W2580

	UV. Dose (min) 0	4
Number tested	24	24
No. Lp^+	24	24
No. seg.	18	19
No. Not. Seg	6	5
No. Sp. Rec. in Sample	9.8	1

(B) Analysis of the transductions produced with lambda irradiated 4 minutes, survival = 2.0×10^{-2}. 18 different transductions analysed, about 7 segregants from each tested for lp genotype and Gal allele.

Number of transductions with the following seg. pattern	Endogenotic Lp^+	Endogenotic Lp^R	Exogenotic Lp^+	Exogenotic Lp^R	Amphitypic Lp^+	Amphitypic Lp^R
5	7	0	0	0	0	0
4	6	0	0	0	0	0
2	6	0	0	0	1	0
1	5	0	0	0	0	0
1	6	0	1	0	0	0
1	3	0	1 *	0	0	0
1	5 w	0	0	0	0	0
1	6	1 **	0	0	0	0
1	5 w	0	1	0	0	0
1	6 w	0	0	0	0	0
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w = one of these segregants gave slight lysis of Lp^s tester

* This seg. gave slight lysis of Lp^s tester. Streaked out and 10 colonies retested. All found Lp^R

were performed on a pure colony from the 1st streaking from the transduction plate, which was also streaked on B gal to observe segregation for galactose fermentation.

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Table 2

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Analysis of the transductions formed with UV'd lysate. At this time a number of spontaneous reversions of the indicators were examined and found stable for galactose fermentation and unchanged for lambda reaction. ~~[illegible]~~ Lp genotypes were determined from tests against both lambda + a lambda sensitive ~~[illegible]~~ culture. Those tests

(A) Transductions to Gal_2^- Lp^s W2790 (s = segregating, ns = not segregating)

UV Dose →	0	1	2	3	4	5	6
No. transd. examined →	24	24	23	24	24	24	24
No. Lp^s →	9 ns	3 ns	22 ns	22 ns	21 ns	24 ns	24 ns
" Lp^+ →	(1) 3 s	1 ns 1 s	0	0	1 s	0	0
" Lp^R →	12 s	18 s 1 ns	1 s	1 s 1 ns	1 s 1 ns	0	0
Spontaneous reversions present in sample	9.6	1.7	1.4	negligible →			

(B) Transductions to Gal_2^- Lp^s W2915

UV Dose	0	1	2	3	4	5	6
No. examined →	36	34	47				
No. Lp^s	0	38 ns	38 ns.				
" Lp^+	6 s 2 ns	2 s	0				
" Lp^R	28 s	31 s 1 ns	8 s 1 ns.				

Table 3

SEPARATE PAGE

(A) Totals for Gal_2^- Lp^s Recipients

UV Dose	0	1	2	3	4	5	6
Segregating	49	52	10	1	2	0	0
not segregating	2	4	60	23	22	24	24
% Seg	94	93	14	4	9	0	0
% not seg.	6	7	86	96	91	100	100

M.L. Morse

Progress Report
4/54

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Introduction

The transfer of genetic material between bacterial cells by temperate bacteriophages has been shown for certain Salmonella and for Corynebacterium diphtheriae . In each of these cases the transduction of genetic factors ~~singly~~ has been demonstrated. This mechanism of genetic recombination is in contrast with the complete sexual mechanism of recombination in which the whole genetic material of the cell participates at one time. The study of these two mechanisms and their interrelationship is difficult in biological systems in which only one has been found to operate. The present report summarizes a study of E. coli K-12 where the independent occurrence of sexual recombination (Tatum and Lederberg, 1947) and transductive recombination has been demonstrated.