Separate mention of the cultures that were classified as double (-) by transduction test must be made partially because the results are more incomplete and partially because they may offer some additional information upon the transduction phenomenon. Four such (--) have been obtained, three of the gal_1-gal_2- type and one of the gal_2-gal_4- type. The evidence that such cultures are (--) is that they are not transduced either by homotypic nor heterotypic lysates but are transduced by wild type or some other gal (-).

Lysates of these (--) cultures have been found to have little transducing activity regardless of the gal (-) tester used with but one exception. Whether this implies a failure of the phage particles to pick up a fragment of cell chromosome or whether the resultant thansduction is not phenotypically (+) through some interaction among the genes concerned is not known. The exceptional case resulted in the recovery of each of the (-) making up the (--) individually and not conjunctively. The homotypic locus transduced with this lysate was not recovered among the segregants.

As might be expected the (--) are more stable on galactose medium and have seldom been seen to revert.

Some experiments of interest have been performed with one of the (--) obtained. It was unfortunately a prototroph and the results obtained with it must also be repeated and extended with auxotrophic strains.

Although this (--) was not transduced by either, lysates of either (-) singly it was transduced to a lesser extent (where a solid layer of papillae with a (-) would have been obtained, less than 100 papillae were found by a mixture of the two HFT lysates). In this case it was taken that the cells transduced to (+) had received two phage particles with the addition of two (+) alleles in separate segments.

The cell that was transduced to (+) may be represented as follows:

$$---2^{-}--1^{-}---*$$

and the resultant transduction as follows:

$$\begin{array}{l} ---2^{-}--1^{-}---* \\ \quad -2^{-}--1^{+}- \\ \quad -2^{+}--1^{-}- \end{array}$$

In this case the extra (-) added in the segments are inferred from the results with transductions of single (-) in which the heterotypic locus is recovered among the segregants. Segregation from this transduction in the absence of crossing over or exchange between chromosome and segments can result in three types of (-) segregants.

(1) $---2^{-}--1^{-}---*$ (2) $\begin{array}{l} ---2^{-}--1^{-}---* \\ \quad 2^{-}--1^{+}- \end{array}$ (3) $\begin{array}{l} ---2^{-}--1^{-}---* \\ \quad -2^{+}--1^{-}- \end{array}$

which would be classified as (—), (2^{-}) and (1^{-}) presumably. With exchange between segments and the chromsome segregants with the (+) alleles would be found in the chromsome and subsequent segregation would yield(in addition to the types 2 and 3 above with the (+) transposed) the following types:

(4) $---2^{-}--1^{+}---*$ (5) $---2^{+}--1^{-}---*$

An additional type can be obtained if there be exchanges between segments. The order of frequency of exchange and segregation of the above types is unknown but on anaxlogy with the simple transductions the first three mentioned would be expected most frequently, that is, loss of a segment is more frequent than exchange and loss of a segment.(This in turn is dependent upon the independence of exchange and loss) Examination of 24 separate segregants from one such transduction gave the following distribution of segregants by transduction test: 13 (—), 6 (1^{-}) and 5 (2^{-}). Since over 50 percent of the segregants were (—) it appears that when loss of a segment occurrs it is more likely to involve loss of both segments. The (1^{-}) and (2^{-}) found could be of two types, 2,4 and 3,5 above respectively. These types can be distinguished by means

of analysis of (+) reversions. In cases 2 and 3 the reversions will be unstable and segregate, and in cases 4 and 5 they will be stable for galactose. Reversions were examined for their stability from each of the (-) obtained. All the (1^-) gave stable reversions and therefore were presumably of the $---2^+--1^---*$ type. Of the (2^-) examined all but one gave stable reversions and therfore the two types $---2^--1^+--*$ and $\begin{matrix}---2^--1^+\\ -2^--1^+-\end{matrix}$ were indicated with the most frequent being the former.

Examination of the (2^-) culture giving the unstable reversions showed that it did segregate (—) cells but as yet it has not been established that it segregates (2^-) of the following type $---2^--1^+--*$.

The reversions of the type 2 (2^-) can be of two types and they should (perhaps) be distinguishable in turn by the segregants that they yield. Reversion of the form $\begin{matrix}---2^--1^---*\\ -2^+--1^+---\end{matrix}$ should be expected to segregate (—) predominately and reversions of the form $\begin{matrix}---2^+--1^---*\\ -2^--1^+--\end{matrix}$ should be expected to segregate (1^-) predominately.

Reversions of the type 2 (2^-) appear to be of two types. From one type 33 segregants were obtained, of which 32 were (—), the remaining one a (2^-). The other type gave almost equivalent amounts of (2^-) and (—) and no (1^-) thus far. The failure to recover (1^-) types from the reverted cultures is disturbing but this may be related to elimination of the gal_1 locus in crosses. Presumably crosses between $\begin{matrix}---2^--1^---*\\ -2^--1^+==\end{matrix}$ and $---2^+--1^---*$ should yield a larger number of (+) than crosses between (1^-) and (2^-) of normal constitution when there is sucessful transfer of the segment through the zygote. these (+) in addition would be unstable for galactose. The culture used unfortunately is a prototroph and unless sucessful crosses between it and a Hfr strain can be accomplished the problem can not be attack from this aspect. (Sucessful transmission of the segment through the zygote was observed in some early experiments not related to the above.)

Examination of another (—) has begun. In this case Gal_2^- and Gal_4^- are involved and a crossable stock has been selected. There has been another complication in this case. That is when the culture was first isolated, and also in the case of a repeat test, it was not found to be transduced by either (2^-) or (4^-) lyssates. In several additional tests it has also reactive in this manner. In the instances where it was attempted to obtain transductions by mixtures of the two lysates it was found that the culture was transduced, to a lesser extant, by lysates of (2^-). It was thought to explain this incongruent result by postulating that reversions had occurred during the growth of the culture and that in effect the culture consisted of (—) with (4^-) contaminants. On this assumption the aberrant transductions of the culture would in effect be of the form (2^-) —x (4^-) and the resultant transductions would be expected to segregate (4^-) predominately. This was not the case, of the six segregants examined (from six separate transductions) 3 were (2^-), 2 were (—) and only one was (4^-). This does not rule out the explanation but requires a great frequency of exchange between segment and chromosome for compatibility.

Examination of this culture had progressed to the stage of isolating a (4^-) segregant that gave unstable reversions as well as a type which did not, at the time of writing.

Not all of the Gal- cultures studied have been found transducible although the most frequently occuring (-) after ultraviolet radiation appear to be of this type. Three distinctly different occurrences of non-transducible gal- have been found. Two of these were induced by ultraviolet, and the third by copper exposure (H. Byers). One of the ultraviolet mutants has been examined to some extent. The results are given in table 18. It appears that this (-) is not transduced by any of the lysates and futher that lysates of it in turn transduce all known transducible loci, but Gal_2 with lowered frequency.

Table 13
Analysis of a Non-transducible Galactose Locus in W2312
by Transduction Assay

Experiment		Plate Additions				
		None	HFT Lysates Gal_1-	Gal_2-	Gal_4-	NFT Wild Type
206	(1)	0*	0*	0*	0	-
	(2)	0	0	-	-	0
220	(1)	0	0	0	0	-
	(2)	0	0**	0**	0**	0

* number of papillae per plate
** NFT (normal frequency of transduction) lysates used in these cases

Table 14
Activity of Lysates of W2312 on Selected Galactose Loci

Galactose Locus		Plate Addition None	W2312 Lysate
Gal_1- Lp^+		4*	37*
Gal_2- Lp^+	(220)	8	7
	(221)	19	28**
Gal_4- Lp^+		17	74
Gal_6- Lp^s		3	121

* numbers of papillae per plate
** 12/12 examined were found to be stable Gal+

Table 15
Results of Crosses of W2312 with Selected Galactose Loci

Selected Galactose Locus	Numbers Gal+	Total Prototrophic Recombinants	Percent Gal+
Gal_2- F^-	1	2112	0.05
Gal_4- F^+	1	198	0.5

For the purpose of collecting new gal- and for observing the occurrence of transducible loci two separate experiments were performed. Gal- mutations were induced in W1673 (glyc or ser)$^-$ pro$^-$ and W1765 hist$^-$ leuc$^-$ by means of ultraviolet. Table 19 gives a summary of these experiments. Reccurrences of both Gal_1- and Gal_2- were found as well as a number of new loci and possibly several (—). No recurrences of Gal_4- were observed.

The effect of ultraviolet radiation on the transducing activity of lysates has been investigated in three experiments. The first two experiments were concerned with NFT lysates, the last with an HFT lysate. The effect of ultraviolet upon NFT lysates is shown in figure 2. With increasing dose of ultraviolet there is a linear increase in the activity of the lysates on Lp^+ or Lp^r assay cells until a survivial of the plaque-forming titter has become reduced about 10^{-3}. Thereafter there is a gradual decease in transduction activity with increasing dose. On Lp^s there is a slight increase in transducing activity and then a gradual decrease. The maximum reached by the lysates on Lp^+ or Lp^r cells is about four times the maximum reached on Lp^s cells. In performing this experiment about 10^8 Lp^s assay cells were used, since figure 1 indicates that this number of cells may indicate only about one-third to one-fourth the number of transductions actually present the Lp^s assay is probably that much low. This then would suggest that the absolute number of transductions is approximated upon Lp^s cells when a sufficient number of cells are used and that the action of ultraviolet is to increase the assay on Lp^+ or Lp^r cells to the level of the absolute number present. In connection with this it should be noted that survival of the transductions of Lp^s is still about 0.5 even at the extreme doses used. From the above it is suggested that the action of ultraviolet is several fold. First and most rapid is the destruction of plaque forming activity of Lp^s cells. Secondly, to destroy that property of the phage which causes them to be "excluded" by lysogenic cells, as regards transduction, and thirdly to destroy

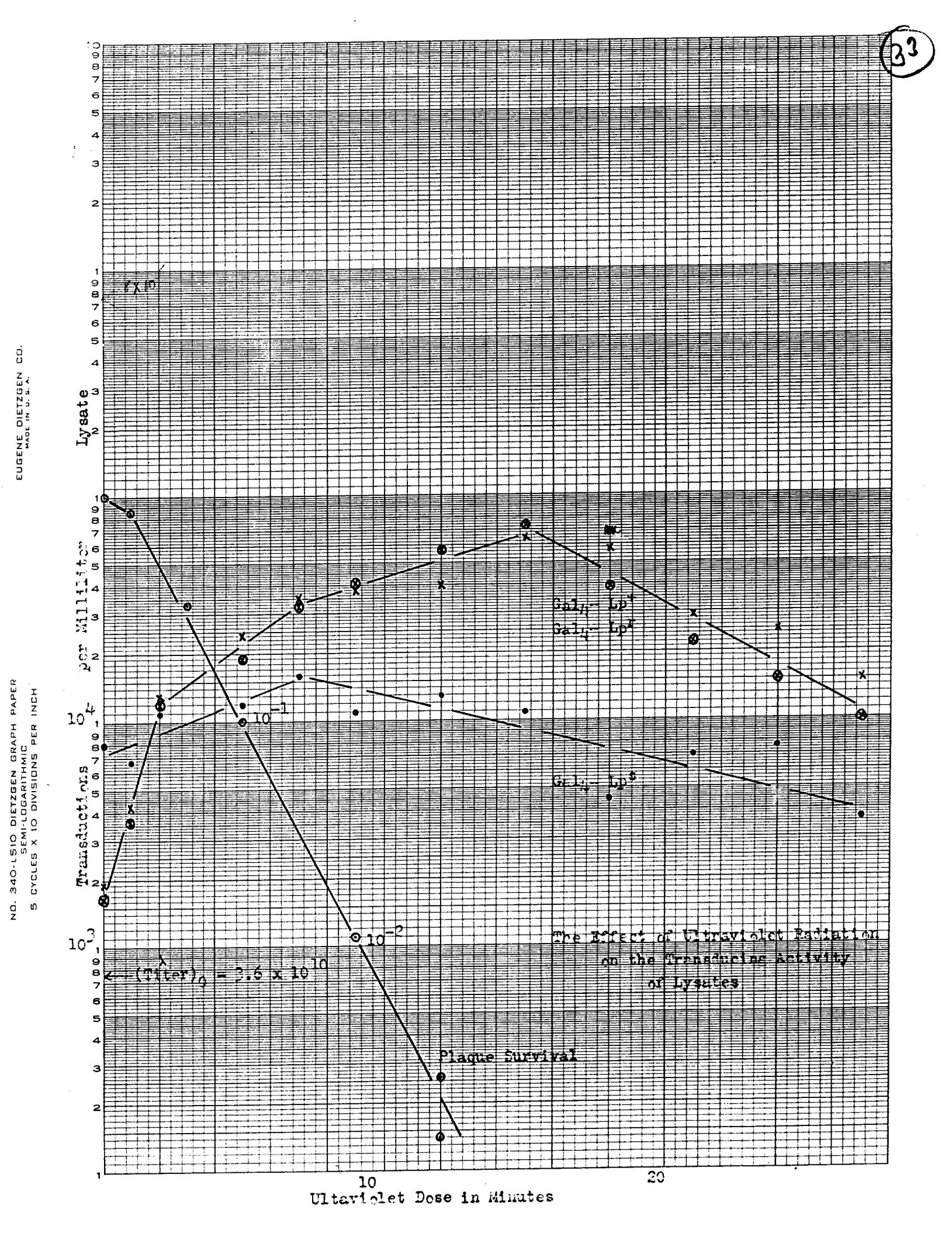
Table

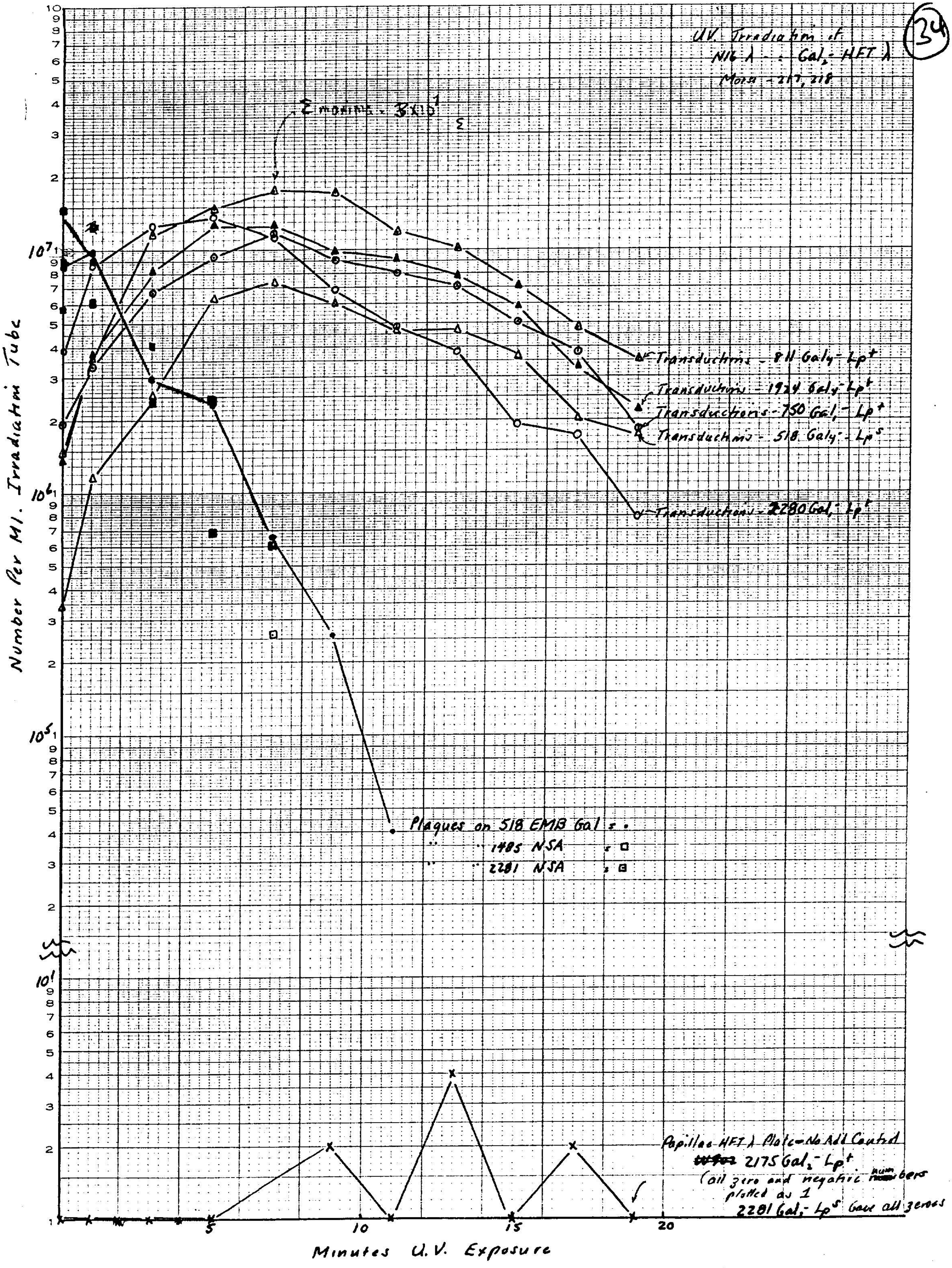
Transduction Assay of Some Galactose Negative Mutants Induced by Means of Ultraviolet

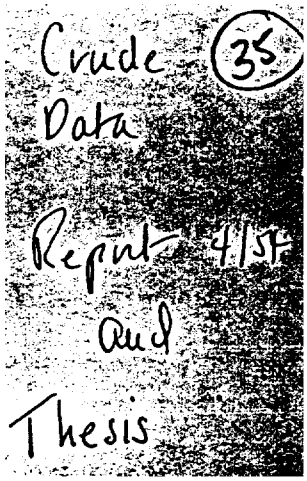
Culture Treated	Mutant Designation	Transduced by HFT Gal_1-	Gal_2-	Gal_4-	Possible Genotype
W1673 Lp^s	W2310	0	+	0	Gal_1-Gal_4-
	W2311	0	+	0	" "
	W2312	0	0	0	nontransducible
	W2313	+	0	+	Gal_2-
	W2314	+	+	+	Gal_x-
	W2315	+	+	+	Gal_x-
	W2316	0	+	+	Gal_1-
	W2317	0	+	0	Gal_1-Gal_4-
	W2318	0	0	0	nontransducible
W1765 Lp^s	238-2	0	0	0	nontransducible
	238-5	+	+	+	Gal_x-
	238-6	0	+	+	Gal_1-
	238-8	+	+	+	Gal_x-
	238-10	+	+	+	Gal_x-
	238-11	0	+	0	Gal_1-Gal_4-
	238-12	+	0	+	Gal_2-
	238-13	+	0	+	Gal_2-

the transducing activity itself, perhaps by destroying the adsorption of the phage particles.

The effect of ultraviolet on HFT lysates is similar to that of UV on NFT lysates. The increase in transducing activity with dose in this case is not as great as with NFT lysates. A maximum is reached that is approximately equivalent to the plaque titer of the lysate which suggests that plaque and transducing particles may be the same but that appearance of a particle as a plaque excludes its appearance as a transduction. Platings for plaque formation on EMB galactose have not indicated that one particle can function in both capacities but the appearance of a plaque might be obscured by papillae formation. The sum of the activities (maximal) of the lysate on the two assay loci is 2-3 times the plaque titer, which may be an indication that the activities are confined to a single particle. The occurrence of transductions with Lp^r genotype has been noted with this lysate, and the equivalence of plaque and transduction titer might not be expected on the assumption that in these cases the effect was accomplished by a defective phage particle which would not give rise to plaques as well as to lysogenization. (This would require that Lp^r genotypes were the result of such defective particles rather than of a defective act of lysogenization.)






Crude
35
Data
Report
and
Thesis

Interaction of the Gal- lysate

Numbers of papillae/plate - 0.1 ml lysate plated

Cells	No. Addition →	Gal$_1^-$ 2.9×10^{10}	Gal$_2^-$ 4.9×10^{10}	Gal$_4^-$ 1.7×10^{10}	Wild 1.4×10^{10}
Gal$_1^-$ Hp$^+$	(1) 2	—	176	43	[illegible]
	(2) 2	2	—	—	405
Gal$_2^-$ Hp$^+$	(1) 14	52	11	43	—
	(2) 20	—	10	—	356
Gal$_4^-$ Hp$^+$	(1) 89	—	202	—	396
	(2) 50	85	—	—	417
	(3) 47	—	—	50	394

$\frac{2.9\times10^{9}}{3.2\times10^{2}} = 8\times10^{7}$ $\quad \frac{4.9\times10^{10}}{1.7\times10^{3}} = 3\times10^{7}$ $\quad \frac{1.7\times10^{9}}{4.1\times10^{2}}$ 4×10^{7} $\quad \frac{1.4\times10^{9}}{4\times10^{3}} = 3\times10^{6}$

data from Arnold & Gr

Lysate

Cultures	Gal1 W750	Gal1 W2319	Gal1 W2343	Gal2 W902	Gal2 W2251	Gal2 W2175	V1210	Gal3	Gal4 W811	Gal4 W1821
Gal1 W750	2/2, 3/0	1/0	0/0	176/21, 116/2, 83/0	49/0	148/0	92/1		8/4, 43/2, 9/1, 10/3, 8/0, 19/2, 14/2, 33/2, 25/2	31/2
(7305?) → W2319	25/21			428/21					128/29	
W2343	0/1			84/1					14/1, 8/5, 12/3	
W2373				11/1			56/0		30/1	
Gal2 W2175	52/14, 71/5, 10/4, 50/15, 88/14		16/4	18/20, 11/14, 34/51, 0/0, 0/1			10/18		43/14, 51/5, 34/13, 50/13, 32/15	
W1210	119/2, 61/4								78/14, 56/3	
W2251	364/5, 214/0								98/0	
W1924	25/31, 43/33			235/31						
Gal4 W811	201/16, 85/50, 93/51, 55/45			147/44, 202/84, 100/2	40/2				50/47	51/47
W1736									27/12	13/12
W1402	28/17			61/17					22/17	
W518	40/45, 79/28, 3/2, 73/29, 73/0		3/2	117/4, 1153/29, 128/28, 473/11		109/2	128/4		11/11, 56/163, 17/41	
W1578									18/10	
W1436	145/24									
811 [illegible]									18/23	

Not used in controls

Heated λ

— see pg 121 also

no cond 37
heated λ 19
λ 219
} 56c - 30'

Culture	no cond	boiled (K12) λ	K12 λ
W1736	17	22	335
	—	13	410
W1662	—	19	311
W811	—	66	535
W1821	—	30	581
W750	0	0	469
	—	2	542
W518	—	4	2112
W1924	—	29	129

λ titer = 2.3×10^{10}

heated λ titer = 2.2×10^{9}

Other transduction attempts

good comparison on pg 94
W112 lp, R – lp2 ... [illegible]

pg in 85	marker	culture
71 (82)	lac	W112 (W1736 gal+R)
74	serine or glyc	W1678
75, 78	leuc	W1736
82 (83)(85)	methionine (BM)(BM)	58-161 (W811)(W821)
		W1821 (rpt.) (rpt.)
83 (85)(130)	xylose	W518
95	SR	W1692, W1920
96	proline	262 (W1092 x W1402) a galy pr
100	proline	"
104, 105, 106	proline	W1436
113	Leucine	W2071
119	mal x-	W518
180	BM - (with HFT)	W2062
200	pr (with HFT's)	W2062
227	pr with lytic d)	

VV

Σ

Locus	Attempts	Culture
lac1	4	W112
(ser or glyc)	1	W1678
leuc	3	W1736, W143
Methionine	4	58-161, W811, W1821, W518
Xylose	3	W1821
S	1	W518
proline	7	W1692, W192, W2062
mal x-	1	W2071

for multiple transductions (other factors)

Partial attempts – (indirectly through checks to see if gal only transd.)

pg	markers	culture
84	T L B, L	W1736, W1662
86 (87)	BM lac	W811
	TLB, lac	W1736
87	BM xyl lac	W1821
93	BM lac	W750

(P 133, 135)

DNA ase effect

Lysate	No. plaques on 0.1 ml Gal$^-$ hp^s	Gal$^-$ hp^r	Titer
wild untreated	960	—	—
DNA ase treated	998	—	—
gal$^-$ reversion untreated	—	201, 204	6.1×10^9
DNA ase treated	—	296	6.0×10^9

Effect of hp$_2$ allele on transd.

Allele	Spont.	Popular hp$_1$+hp$_2^s$	hp$_1$+hp$_2^r$	Pg
Gal$_1^-$	1	426/1	2/1	91, 99
Gal$_2^-$	$\frac{4+20}{2} = 17$	356/20	14/14	100
Gal$_3^-$				
Gal$_4^-$	50	296/59	57/50	92, 99

Action of Lysates of (+)^{Rev}

PS	Culture	No ood	$+^R$ culture	# rep
89	W1736	12	W811	191
93	W750	2	W811	144
~~128a~~	~~W578~~	~~41~~	~~W811 #1~~	~~27~~ (don't transduce 811 culture)
		~~41~~	~~" 2~~	~~15~~
133	W578	30	W811 #5	883
134	W811	39	W811 #5	204
135	W811	25	W811 #5	201, 296
		25	#8	291
151	811 prototroph	~~23~~	~~W811 #1~~	~~15~~
		~~11~~	~~#2~~	~~22~~
		"	#5	214 (461 another lysate)
		"	#8	319
240	W 750	0	W750	648
240	W 2175	10	W 2175 #1	96
		6	" #2	552
240	W 750	0	W811 #5	146
		1	W811 #8	153

Used in paper

Table 4

Restoration by Reverse Mutation of the Ability to Transduce ~~Previously Nontransducible Loci~~

Locus	Revertant	No. of large colonies	Revertant lysate
Gal_1^- (Lp^+)	Gal_1^+ #1	0	648
Gal_2^- (Lp^+)	Gal_2^+ #1	10	96
	Gal_2^+ #2	6	552
Gal_4^- (Lp^+)	Gal_4^+ #5	39	204
	Gal_4^+ #8	25	291

Transduction of Lp^s + Lp^+ Lp^+

Expt	Culture	λ	trans. assay
92	W518	+	2112/4
		2-	1112/4
	W811	+	296/89
		2-	202/89
140	W518	2-	1152/29
	W811	2-	147/44

not needed?

Lytic λ

227 used λ on 518 lwr
228 also no positive deletion 2062 with
gal- on W1485 no trand. c 750, 518, 2175
239 (1) rpt of gal/1485 lyo — " "
(2) growth of AFT λ lytic · 518 — no growth
(3) used on 518 (above) trand. 1, 2, 4

Expt	Assay cult	no trand	lytic λ
228	W750	3	2
	W518	9	8
	W2175	7	8
239	W750	2	0
	W518	13	8
	W2175	6	2

254		
W750	—	3
W518	—	6
W2281	—	9
W2373	—	6
W811	—	39

Absorption of λ

eb	ig	λ absorbed
~~W58~~	~~12~~	~~61~~
W57	12	52
		~~37~~
W54	285	?
W50	236	?
W2175	11	?

2

transduction absorbed
~~5~~
67.5
7

Relationship of the gal⁻ (199) (210)

page

Cross	minimum no. prototrophs	no. (+)	% (+)	Recombinants
$Gal_1^- \times gal_2^-$	>1500	2	<0.13	199
$Gal_1^- \times gal_3^-$	>1600	2	<0.13	~200
$Gal_1 \times gal_4^-$	4554		0.13	210
$Gal_2^- \times gal_4^-$	2654		0.22	174, 175
$Gal_1^- \times gal_2^-$	>6517	4	<0.06	214
$Gal_1 \times gal_2$ (2251)	3606	1	0.027	240
$\Sigma gal_1 + gal_2$	623 >11620	7	<0.06	

.06 .13
2 ⟷ 1 ⟷ 4
⟷
.24

16/19
0.81
19 | 160
152
8

Correlation of transduction with lysogenicity

Allele source lysate	Host	no.	% lysogenic	Ref
gal_4^- tp^s W518	Hybrid	18	100	120a
gal_4^- tp^s W518	gal_2^-	19	100	146
gal_4^- tp^s W518 11	gal^- (88)	22	100	147
	11 (88)	23	100	153
gal_4^- tp^r	wild	29	3.1	216
gal_4^- tp^r LW1924		18	5.5	213
gal_2^- tp^s W2291	wild	9 (16)	44 (44)	229A
	gal_1^-	23 (21)	95 (88)	229B
	gal_4^-	19 (21)	81 (81)	229C
	wild	18	57	250
W2373	gal_4^-	22	77	249A
	gal^- (1210)	24	88	249B
	gal_2^-	12	58	249C
	wild	23	87	249D

0.67
0.0
23 | 20 · 4
18
160
144

0.11
13 | 2.0
1.7
3

2 The Occurrence of Stable Transductants

λ Source

Recipient Cells	K-12		Gal$_1$- W750		Gal$_2$- WQ02		Gal$_3$- W2238	Gal$_4$- WF11	
	Stable Expected	Observed	Stable Expected	Observed	Stable Expected	Observed	Stable Expected / Observed	Stable Expected	Observed
Gal$_1$- 254^{ts}	1/143	42			1/84	3.5 $\chi^2 = 6.25$	~~not done~~ 4/24 10	12/27	27 * all stable
Gal$_2$-	17/248	20.7 $\chi^2 = 0.87$	14/83	61.1			~~not done~~ 7/48 = 32	14/79	52.1
Gal$_3$-	not done		2/88	88 all stable	5/34	34 all stable		12/56	48.7 (possibly 56)
Gal$_4$- Lp^s	19/835	383	29/72	72 * all stable?	11/472	19.7	not done ? doesn't go?		
Gal$_4$- Lp$^+$	41/573	133	51/96	96 * all stable?	47/147	30.6 **	not done doesn't go?		
Gal$_4$- Lp^r	3/320	127	25/31	not * done all stable?	31/238	49.6 $\chi^2 = 12.7$	not done		

* These may be instances of stable transductions or just estimates of the variation in spontaneous reversions on the plates.

** Estimated from two different experiments.

Explanation

$$\text{Stable Expected} = \frac{\text{no. papillae control plate}}{\text{no. papillae transd. plate}} = \frac{\text{spont. reversions}}{\text{transductions + sp. reversions}}$$

$$\text{Observed} = \frac{\text{no. stable observed}}{\text{no. in sample taken}} \times \frac{\text{no. papillae transd plate } (= \text{sp. revers.} + \text{transd.})}{\text{no. papillae in sample taken}}$$

Stability determined by streaking out single colonies on EMB gal. Consecutive

Segregant Σ

Expt	Allele Homo	Allele Hetero	Numbers Homo	Numbers Hetero	Homo Hetero	Total
			√ 16	—	—	16
248	1⁻ +	—	√ 9	—	—	9
249D	1⁻ s	—	√ 15	—	—	15
247 A	2⁻ +	—	√ 16	—	—	16
233	2⁻ s	—	√ 20	—	—	20
212	4⁻ +	—	√ 13	—	—	13
205	4⁻ s	—	—	—	—	—
—	4⁻ R	—	√ 20	—	—	20
196	2⁻ +	—	√ 17	—	—	17
192A	1⁻ +	—				
247 C	1210 2⁻ + √	1	19	2	0	21
236 B	2⁻ s √	1	20	0	0	20
209	2175 2⁻ + √	1	14	3	2	19
230	750 1⁻ + √	2 (902)	18 √	1	0	19
243	750 1⁻ + √	2 (1210)	18	3	0	21
249 B	1⁻ s √	2 (1210)	6	1	0	7
249 C	1⁻ s √	2 (902)	1	0	0	1
202	4⁻ + √	2	16	3	0	19
242	4⁻ s √	2 (1210)	17	2	0	19
198	4⁻ s √	2 (902)	18	3	0	21
213	~~4⁻ R √~~	~~2~~	15	3	0	18
192B	gal-pol 1⁻ + √	2 (902)	18.	5	0	23
249 A	1⁻ s √	4	√ 1	0	0	1
247 B	1210 2⁻ + √	4	22	1	0	23
236 C	2⁻ s √	4	21	1	1	23
207	2175 2 + √	4	9	7	0	16
			359 √	35 √	3 √	397
24			90.5	8.8	0.76	~~1006~~

(Margin: 169 / 133 / 136 / 147; "and gal-pol")

si → 146 (single transd.)	√4⁻ s	2 (902)	17.	2	1	20
single transd. → 145	√4⁻ s	+	15	0	0	15
170a	√4⁻ s	+	18	0	0	18
			409	37	4	450
			(90.9%)	(8.2%)	(0.88%)	

~~Segregant~~ Nat. Segregant from wild type transduct.

	Homo	Hetero	Total
169	168	0	168
2.	100	0	

409 + 169 = 240 (?); 281 + 169 = 450; 248 + 169 = 417; 409 − 136 = 273

~~1 Homo Hetero Total 190~~

Homo	Hetero	Di	Total
390	35	3	
+ 17	2	1	
240	37	4	281
240	37	4	281

	Homo	Hetero	Di	Total
Transd. Wild type	169	0	0	169
Between gal (?)	240 (.85)	37 (0.132)	4 (0.014)	281
Total	409 (0.91)	37 (0.82)	4 (0.008)	450

Occurrence of Stable transductions - Reversed

Lysates

Cells	Wild 1212 Expected	Wild 1212 Observed	Gal1⁻ W750 ~~Expected~~	Gal1⁻ W750 ~~Found~~	Gal2⁻ W902 ~~Expected~~	Gal2⁻ W902 Found	Gal2⁻ W1210 Expected	Gal2⁻ W1210 Found	Gal4⁻ W811 Expected	Gal4⁻ W811 Found
Gal1⁻										
W ~~2343~~ λp^+	1/143	42	—		1/84	(3.5)	1	—	12/27	27
2373 λp^+	1/33	14	—		1/11	11	0/52	19.5	1/30	28.7
W750	1/46	(1.9)	—		—		1/92	0		
Gal2⁻										
W2175 λp^+	17/248	20.7	14/83	61.1	—		—		14/79	52.1
W1210 λp^+	4/29	6.3	2/65	(0)	—		—		5/52	(0)
W2281 λp^+	0/46	~~15.2~~ 11.6	0/214	26.7	—		—		0/98	3.9
Gal4⁻										
W578 λp^+	19/835	383	29/72	72	11/472	19.7	4/128	21.4	—	—
W811 λp^+	41/573	133	51/96	96	~~47~~/147	[illegible]	—	—	—	—
W1924 λp^R	31/330	127	—	—	31/238	49.6	—	—	—	—

$$\text{Stable expected} = \frac{\#\ \text{pap. cured}}{\#\ \text{pap. lysate plate}} = \frac{\text{spont}}{\text{spont + transd.}}$$

$$\text{Observed} = \frac{\#\ \text{stable obs}}{\#\ \text{in sample}} \times \frac{\#\ \text{pap transd. plate}}{\#\ \text{pap in sample}}$$

Nature of the Segregants

Lysates

Cells	Wild	Gal1- (W750)	Gal2- W902	Gal2- W1210	Gal4- W811
W2342 4p+	17 gal1-	—	18 gal1- 15 gal2-	—	no segregants found
W2373 4p+	9 gal1-	—	1 gal1-	6 gal1- 1 gal2-	1 gal1-
W750 4p+	16 gal1-	—	18 gal1- 1 gal2-	18 gal1- 3 gal2-	no segregants found.
W2175 4p+	20 gal2-	14 gal2- 3 gal1- 2 gal2- gal1-	—	—	8 gal2- 7 gal4-
W1210 4p+	15 gal2-	19 gal2 2 gal1-	—	—	22 gal2- 1 gal4-
W2281 4p3	16 gal2-	20 gal2-	—	—	21 gal2- 1 gal4 1 gal2- gal4-
W518 4p3	13 gal4-	no seg found	18 gal4- 3 gal2-	17 gal4- 2 gal2-	—
W811 4p+	20 gal4-	no seg found	16 gal4- 3 gal2-	—	—
W1924 4p2	29 gal4-	no seg found	15 gal4- 3 gal2-	—	—
	155		35		

Type Segregant

Transd. Lysate	Homotypic	Heterotypic	Homo-Hetero	Total
Wild	169	0	0	169
gal(-) on gal(-)	240 (.854)	37 (0.132)	4 (0.014)	281
Total	409 (0.91)	37 (0.08)	4 (0.0088)	450

Summary HFF direction - Analysis of Segregants by Transduction Test

Transducing Cell Genotype	HFF Lysate: Gal_1^-	HFF Lysate: Gal_2^-	HFF Lysate: Gal_4^-
Gal_1^- W780	—	18 { 10 gal_1^-; 2 gal_2^-; 1 $gal_1^- gal_2^-$	18 { 9 gal_1^-
Gal_2^- W2173	18 { 6 gal_1^-; 3 gal_2^-; 1 $gal_2^- gal_1^-$	—	18 { 8 gal_2^-; 4 gal_1^-
Gal_4^- W681	not done	18 { 15 gal_4^-	—

# cells	in pipette	# cells	$\times 10^{-9}$	in pipette
1.4×10^9	2504	0.59×10^{-9}	0.59	0.4×10^{-3}
7×10^8	1780	0.14×10^{-8}	1.4	0.5×10^{-3}
3.5×10^8	1472	0.28×10^{-8}	2.9	0.68×10^{-3}
1.75×10^8	1120	0.57×10^{-8}	5.7	0.89×10^{-3}
8.75×10^7	1683	0.11×10^{-7}	11.0	1.5×10^{-3}
4.4×10^7	561	0.23×10^{-7}	23.	1.72×10^{-3}
2.2×10^7	562	0.46×10^{-7}	46	1.75×10^{-3}
1.1×10^7	535	0.91×10^{-7}	91	1.87×10^{-3}
5.5×10^6	509	0.18×10^{-6}	150	1.97×10^{-3}

Extrapolation to zero point in cell graph

- reciprocal of pipette

$0.34 - 0.36 \times 10^{-3}$

$= 2780 - 2980$ pfu / 0.1 ml

$27800 - 29800$ / 1 ml

ave $= 2.88 \times 10^4$

From neutralization experiment - Back extrapolation

$\frac{5 \times 10^5 \text{ transd}}{2.6 \times 10^{10} \lambda} \cdot \frac{1.5 \text{ transd}}{10^5 \lambda} =$

In this experiment estimated titer $= 2.7 \times 10^{10}$

$\frac{2.88 \times 10^4}{2.7 \times 10^{10}} \cdot \frac{1 \text{ transd}}{10^6 \lambda}$

$\frac{1}{x} = \frac{3.6}{10}$

$3.6x = 10$

$x =$

$\frac{1}{x} = \frac{0.36}{100}$

$0.36x = 100$

$x = 278 \times 10^3$

2780

2980