The following is a true copy of my laboratory notes, Volume 1, covering the period October 5, 1951 to July 7, 1953, pages 1-218a, with a number of unnumbered pages included.

There are two additional volumes of my notes, one of which is labelled "Summaries".

In this first volume there are a number of unnumbered pages at the front which represent an index, but it should be noted that at page 110 there is a statement "not indexed beyond here".

The chief interest in these notes will be for the specialized transduction produced by the bacteriophage lambda and its discovery. However, many of the notes deal with other matters. Each of us in the Lederberg laboratory had some side assignments and some of these, such as isolation of mutants in E. coli strains believed fertile with K-12, radiation resistance as a function of ploidy and lysogenicity for phage, phage induction by UV, and others were my assigments.

The discovery of the special transduction by lambda was not planned. It came shortly after the discovery of generalized transduction by phage PLT22 in Salmonella by Zinder and Lederberg, and was followed several years later by the generalized transduction in E. coli by phage P1 by Lennox.

As I was producing large amounts of phage lambda is some radiation experiments I was curious as to whether lambda transduced any genetic material. I tried my first transduction (for methionine independence) on March 26,1952 (page 47) and of course it didn't work.I tried the same experiment again a few days later (pages 48,50).

It is my recollection that Norton Zinder and I were alone in the lab while the Lederbergs were at a meeting at Rutgers University in March or April of 1952, when Norton and discussed the possibility of lambda transducing genetic material. I recall that Norton said he thought that Esther Lederberg had tried some experiments with lambda but he did not know what they were. Since I had a lot of lambda preparations I suggested that we try and so we took all the selctive medium plates available, and appropriate recipient strains and mixed lambda and cells and plated them out.

I have always thought that chance played a big part in Norton Zinder's failure to discover special transduction. Norton worked with Salmonella which do not metabolize lactose and therefore he had no EMB lactose plates, on which the first lambda tranductions were observed.

It was my good fortune to have had the EMB lactose plates which provided the selective environment for gal^+ clones.

However, it was still baffling in that the papillae on EMBlac produced by lambda and quantitatively related to the amount of lambda used - proved to be lac^- on further examination. I spent much of April 1952 trying to resolve this confusion. It was at this point that Esther Lederberg suggested, on the basis of her prior knowledge and experience with lac-gal interactions and the strains that I was using, that I should look at lambda transduction in terms of selection of gal^+ clones, So on May 5, 1952 (page 71) I began studying lambda transduction of gal genes on EMB galactose, and it all began to come out. Much more was needed to be done: lambda as vector had to be established;the heterogenotic character of the transductants elucidated; the identification of the alleles involved in the segregants when the donor and the recipient were gal-; quantitative relationships established; the discovery of high frequency (HFT) transducing lysates; that the phage in some of the transductions was a defective phage, and other things.

It was an exciting time and it was an exciting experience and the stimulation by the people in the crowded lab helped - the Lederbergs, Zinder, Alec Bernstein, Tom Nelson, Bob Wright, Luca Cavalli-Sforza, Gaylen Bradley, Tetsuo Iino, Dorothy Gosting, and probably others I overlook.

Prior to writing this introduction I made an audio tape that discusses the rest of my notes in Volume 1, and perhaps when it is transcribed it can added to this copy.

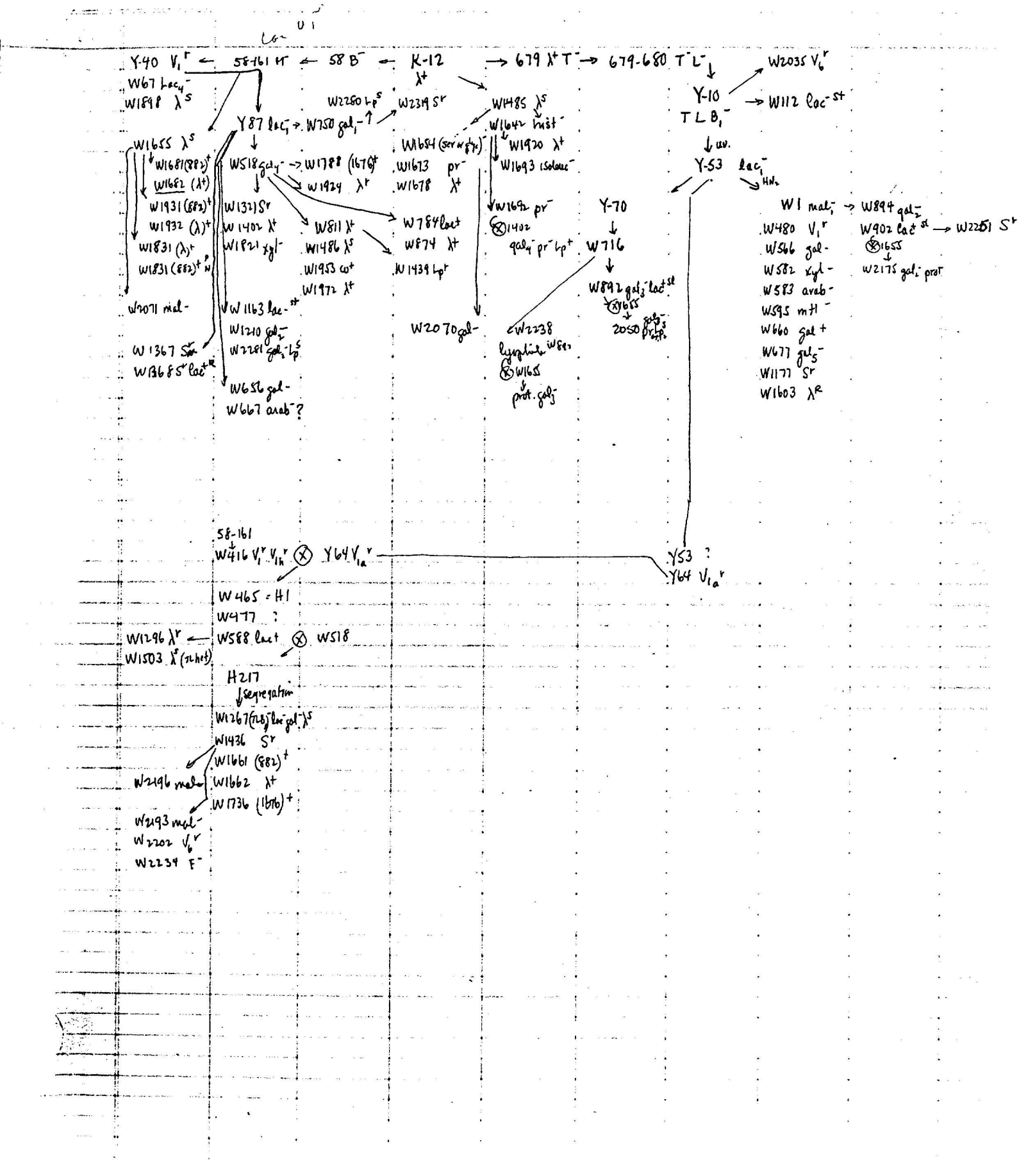
M. L. Morse

July 23, 1986.

Research Notes Vol. I

M. L. Morse
Department of Genetics
Room 200

M.L. Morse
Genetics 200
Research Notes



Cultures on Hand 8/20/53

- K-12
- 58-161
- W67
- W578
- W588
- W607
- W750
- W811
- W874
- W892
- W902
- W1177
- W1210
- W1368
- W1402
- W1436
- W1439
- W1485
- W1503
- W1655
- W1673
- W1678
- W1692
- W1808 (W4 31)
- W1821
- W1924
- W2035
- W2050
- W2062
- W2070
- W2071
- W2175
- W2196
- W2202
- W2251
- W2280
- W2281
- W2297
- W2319

Subject	Pages
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W518 (by K-12)	54,
W1655 (by K-12)	48, 49, 50, 51
W1736 (by K-12)	59, 61, 62, ~~69~~ (gal) 71 (gal), 72 (lac gal), 74 (lac gal), 75 (leucine), 76 (lac control), 77, 78 (lac), 80 (gal λ), 81 (lac), 82, 85a (aeration effect), 86, 87
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W1439 "	82
W1821 "	82 (xyl), 85 (gal, xyl BH), 87
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W112 X W1655 [λ+ TLB, lac stable x λs BH lac]	85a, 88, 97
W902 X W1655	95, 96, 98, 100 (Hpr R 4.5)
811 t K-12 X 1436	100, 101, 102 (2), 103 (2), 104, 105 (repeat), 106, 107 (stable gal+), 108, 109
518 t K-12 X 1436	100, 101, 102 (2), 103 (2), 105 (repeat), 106, 109
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1177 X 1655	109

Subject	Pages
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SB-161	36, 38, 39, 43, 92
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W1177	57,
W1661	59,
W1662	59,
W1736	59, 67, 90 (gal+)
W1682 (no effect)	63,
H267	58
902	92
W1821	90
W811	90, 90 (811 gal+),
750	94
W1939	98
by plaque count (see also λ prep.)	
K-12	22*, 23*, 53* (agar), 68* (syn. cult) 69*
K-12A, K-12B	34, 35
W1177	13,
W1678	58
W1932	62*
H267	60*, 68*
W1682 (no effect)	63
W1954 (wg3?)	69*
W1972 (λ+Ω+)	69*, 78*
W1998 (Wg28*)	78*
effected by post incubation	
K-12	24, 25, 26
W1177	13,
W1603	13
W1736 gal+	88
W811 gal+	88
518 E K-12	102
811 E K-12	102

Subject	Pages
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K-12 vs λ	51
K-12 L1 PX	-
L2 PX	32
L3 PX	32
L4 (PX + Syn.)	33
L5 PX	-
L6 (Pen)	43, 47
L7 (Pen)	51
L8 (3)(2)	62, 68 } combined filtered, 73, 80 (mod), 80
W67 L1	59, 68 (Filtered) L8-1 L8-2 61, 62
58-161 L1	37,
L2	-
L3 (Pen)	93, 93
W1177 L1	59, 71, 80
W1485	34 35
W1662	59
W1655	39, 44 (agar) 48 (agar)
W1736	59 71, 74, 80, 90 (soft)
W811	82, 84, 85, 85a, 90, 90 (soft)
H267 L1	58, 59
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Irrad. of λ 902	80, [illegible]
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W1655 (882)	33, 34, 35, 36, 39, 40, 41, 44, 48, 49, 51
W1831 (882)	24, 25, 26, 27, 29
W-1872 (λ[s] from K-12?)	17,
W-1805 Lac⁻ from W1681	
W-1806 Lac⁻ from W1681	8
W-1807 Lac⁻ from 58-161	
Bacilli	
WB-1	29, 34
WB-4	34
H-267	54, 55, 57, 58, 59, 60, 77, 80
892	98
750E ~~[illegible]~~ 1821	98

Subject	Pages
Ultraviolet effects –	
Survival	
K-12	12, 17*, 19*, 20*, 22*, 23*, 25*, 26*, 53(agar) 45(agar) 68*(syn cult) 69*, 71(cult Plaque fork), 73*(syn)
58-161	6, 8, 9*, 10*, 11*, 15, 18*
W 518 λ^s	2*, 30*
W-811	1*, 90
W-1177	13
W-1985 λ^s	12, 17*, 19*, 20*, 22*, 23* 64
W-1603	13
W-1655 λ^s	6, 7, 8, 11*, 15, 18*, 20* 70*
W-1655(882) = 1931	46*
W-1673	12
W-1678	58*
W-1681	6, 8, 15, 53
W-1682	6, 8, 15, 63*
W-1831	18*, 55, 64
W-1831(882)(λ)(P)	29*, 45*, 55*
W-1931	54*
D_A [58-161(882)]	15
W-1932	62*
H267	57*, 59*, 60*, 64*, 66*, 68*, 73* 75(sugar gradient)
W1736	66
W1959 (wg31)	69*
W1972 (λ^+ 52)	69*, 78*
W1898 (λ^s)	70*
W1503 (λ^s)	69a
W1998 (wg28 λ^+)	78*
W1436 (λ^s)	81
λ	80, 81
W1953 (ω^+)	81
W1661	80
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K-12	3,
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W1931 for E.L.	76
Plaques from λ on W112	77
W1736 gal+	80
Lysates streaked out	104, 106

λ Phage Stocks – lysates

#	Source	titer	
1.	750 (gal_1-)	$>2.4\times10^{10}$	
2.	902 (gal_2-)	4.9×10^{10} ←?	
3.	K-12	1.9×10^{10}	← discarded
4.	58-161	1.8×10^{9}	
5	811 (sp. galt)	4.0×10^{10}	(contam?)
6.	1821 (gal_4-)	1.0×10^{10}	(contam?)
7	K-12	2.3×10^{10}	heated
8	1485 (galhate)	-	
9	750 t 1821	6.5×10^{9} ←?	(contam?) 0.1 ml / EMB gal gave no col 10/9
10	1439 (gal_4-)	1.1×10^{10}	
11	811 (gal_9-)	1.7×10^{10}	
12	811 (gal_9-)	?	
13	1736 (sp. galt)	?	
14	892 (gal_3-)	3.8×10^{9} ←?	
15	K-12 (HEATED Δ)	-	
16	1954	$>140\times10^{8}$	
~~17~~	2046	2.1×10^{10}	

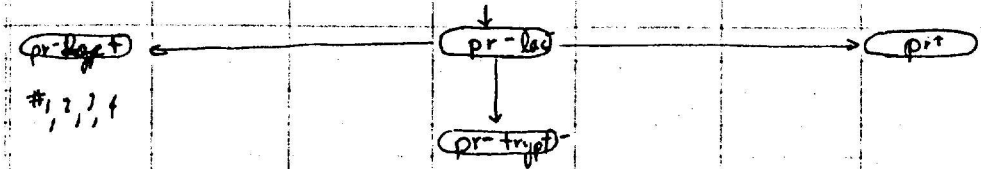
Subject	Pages
Wq-14	27, 28, 32, 34, 35, 36, 38, 39, 40, 41, 42, 56, 57, 57, 60, 61, 66, 67, 68, 85a
pr^- verified	35
pr^+	36
pr^- $tryp^-$	35, 44, 46, 78
" " crosses	50, 52
lac^- verified	45
lac^+ (*1, *2, *3, *4)	60, 61
pr^- $tryp^+$ lac^{st}	75
Wq-16	27, 28, 36, 37, 38, 39, 40, 41, 42, 55, 66, 67, 68, 75
pr^-	42, 47, 48, 49, 52
pr^- x^- (1)	53
pr^- x^- (2)	56 - not so on retesting
Phage sensitivity	
1682/1681 = λ	
880/1503	

W1584

Wq 14

pr⁻ F⁺ lac⁻ Mal⁺ Suc⁺⁺ Gal⁺ cells⁻ rhamn⁺ Acrif.^{R} Indole⁺ V_1^R, V_2^S V_{3-7}^R λ^R ρ^R λ^{370R}

stock



#1, 2, 3, 4

W1716

F⁺ lac⁺ sac⁻ gal⁺ cells⁻ rhamn⁺ acrif^S indole⁺ V_{1-7}^R λ^R ρ^R λ^{370R} lys-for K-12

Wq 16