5/22/53.

A SW666 x— SW1049 i / Plates no swarms. 24h. 5/27 6/9
B " " " /b tubes → 1 i: — — — ? a
2 i: —
3. —
C " " 1,2 Plates : b: 16 (sl. enx i in 1, 2) 10 ++
D " " " /b tubes 1: — 2: — 1,2: 3 ++ 4 ++, slen i, b.

E SW967 x— ~~SW1049 i~~ / gm tubes / SW 1031 a : b 1. — 2. — s/gm 3 (gm) v. wk. (swarm?) 1.0.
F " x— ~~" 1,2~~ SW 1031 a : b 1 — 2 — /enx
G SW1053 a : c x— 15C (abmy enx) / abc → enx : G 1 enx : 2 3
H " c : a x— 15C " " H 1 2 3 ~~see below~~ 5/26 6/5
HO → [illegible]

K SW1053 a → x 666 /b 2. (48h) a : a :
L " a → x 967 plates 1 sw, gm: → gm /gm 1. — 2. —
M " c → x 666 /b 1. 2. — c: → c b? Rev. mot.
N " c → x 967 plates 1 sw, gm: → gm /gm 1. —

Note: in above experiments, SW967 survivorships (and transductions) were very low. SW666x— yields were a few swarms / plate (.1 ml)

G.-H.

		isolated as	a enx/enx s.c.	b 5/27 enx/a enx	6/3	c	d
						a/a	a/enx. a
G	1	enx	: a	✓ wk. enx 48h →	a.	· enx	· c?? remot.
	2	enx	: a	✓ magg.		· enx	· maggl.
	3	enx	: a	magg [illegible] (after mot) 48h →	magg.		
				enx / c enx		c/c	c/c enx
H	1	enx	: c	✓ — enx		· enx	· C (wk.)
	2	enx	: c	✓ magg.		· enx	· enx
	3	enx	: c	✓ magg → magg.		· enx	· ~~magg. sw~~ no swarm 6/5

save some maggl. motile derivatives.
No evidence of a : c (: enx) variation.
Perhaps 1053 insufficiently variable to start. Review $H_1 : H_1$ available
Re- G1d after mot; s.c.i.

(over)

Q SW1054 (twoffate) enx → × TM2 1. ph' still i
2. ph2 enx :

R " 1055 " " → × 1. ph' still i
2. ph2 c: 1,2

SW105_

After re-motilization (second passage)

Q2 still enx+++, immobile in enx serum.

However, reacts slowly + lightly ĉ ~~i~~, not b, or 1,2

Compare SW986. (Edwards calls this i:enx)

1041-7

1041-7 (abney × T07 enx:i) moved overnight through enx

Q2 - immobile !! somatic?

Spot photo

1051C		1051M		
1	21	1	12	24
2	23	2	13	25
6	26	3	15	26
9	30	4	16	27
11	32	6	17	28
12	1051K	7	19	
16	1	8	20	
18	2	9	21	
19	3	10	22	
20	4	11	23	
	5			

6/18/53.

Q SW1054 enx → SW1046 / i: 1,2 — 3 tubes.
R 1055 " " . "

Q3. (4,5 nonswarm) → stelf i + 1,2.
R3 (" ") → enx or rough. S.O. picks smoothest colony and retest
T.O. others (no swarm) 6/26.

Q2 repeated had not swarmed in > 1 week. T.O.

→ enx +++ i ++ a − c −. Remotilize and pass through enx, i ...

single colonies i; enx esp. Check as broths from these.

Thus SW1055 is (at least) $H_1^c\ H_2^{enx}$ and SW1054 is confirmed tentatively as $(H_1^a)\ H_2^{enx}$

Rechecks: R3 s.c.: (key slide aggl.)

		i	enx	b	−
R3	1	++	−		
	2	++	+++		
Q2	mot	++	+++		
	stab	++	+++		

∴ confusion of phases may again be involved. (cf SW 986)

R3₀ moved rapidly through i, largely blocked in enx. T.O. in view of evidence of mixture. enx serum may contain secondary agglutinins: wait for shipment of minnesota serum

of SW1061!

S. abortus - equi strains 1052

5/30/53

½ 1042

Received from Edwards + Moran: ca 24 hours swarming. + = 1cm and density

RRE	A	WH2 vacc. 147	++	+
	B	Peru 818 ← SW1058	+	
	C	" 837	±.	
	D	" 830	±.	
A.H.	E	1967	++	
	F	1255		
	G	715B	+	+
	H	Peters 7-404	+	+
	I	Thomas	±	
	J	McLaren	+	
	K	M66	++	
	L	H1	+	+
	M	1966	++	→
	N	Coe	—	
	O	Schofield	—	
	P	763B	±	
	Q	C	+	
	R	B2	±	
	S	Peru 2	+	
also save	T	WH1 Rough		
	U	Platt "		
	V	PM764R		
	W	D7 Rough		
	X	D "		
	Y	Bonestein 556 "		

(K:) exp : b ev. not ab-equi
(M:) " " "

∴ choose among A, E, K, M. Melt off and reinoculate; streak out.

In second run:

	Mot tube	"smoothness" Edwards NA	14 cr Mot	Aggl.	(exp) repeat 6/9
A	+	±	+	++	✓
E	++	±	~~++~~	++	
K	++.	+		++	✓ diob?
M	++	++	++	++	
726 A-M	±		+++	++	
N	— no plates	} microscopically almost immotile	S.C.	—	b ✓
O	— "	} (occasional spinner)		—	

Use M particularly. s.c. after mot = SW 1056

22 → O dense slow swarms; (no trails seen initially) Edwards: immobile

← still slow after 24-36 hours.

N and O are essentially O-forms (but why do not occ. motile cells swarm? Temp?

Fix m

over)

PA22 + O 20 swarms: all enc

"No swarms on controls (2 plates, 48 hours)

Purify 4 for dysbiosity test. ⇒ enc absolutely immobile to 6/9/53.

N gave enc. late, very rough, slow swarms + spont

+ PA22 → ∅.

M taken as SW1056 for later study.

However, in enc serum → b! Repeat with single colony reisolates! (and purify somatic antigen i PRE)

In recheck of Edwards' cultures, B = Penn 818 served best. After motilization, use as SW1058

SW1056b in b serum 1. → —, later rough
2 → ≠33.

∴ enc → b: —

Resume. 6/10/53.

Triva. (N97)

1. 1046 various single colony isolates for consistency in extent of variation : of B1–B38.
But 3) s.c.i from B1, B2 (which had gone b:1,2:— and b:1,2;b:— respectively) → 1,2 all :— (1? b233).

46 FG. Some miggletinable phases. B2-1 is only example of b:1,2:b in this series.
Of 1046B1 = SW1043 and SW1047 ; former is b:1,2:(—)
latter is b:—
Suggests possibility of "extinction" of variability.

46 C : FA 22 → × SW1043 → 2 : i :1,2: i / i :1,2:— SW1049

DE SW1031 b → × TH 1046 → 2 cases { b:1,2:b / b:1,2:b } D — not tested further

a → × " { a:1,2:a / a:1,2:a } E

∴ SW1031 is interpreted as $H_0^a H_1^b$

JK. Entophasic or homology test
J. alcoy^2 → × SW1049 ($H_1^i H_2^- H_1^{1,2}$) < 2 b:1,2 not tested

1046
K " → × SW 1043 B2.2 ($H_1^b H_1^{1,2}$) → K1 enx:1,2:enx / :1,2
not tested in 1,2:enx

1049

Misc. tests on S. urei; dar-es-salam; salinates meanderine.

A-B FA3(altendorf c) → SW1031 a:b → SW1052 c:b : not test.
→ SW1053 c:a : ht

49 G abony enx → SW1049 / i;b;1,2 ($H_1^i H_1^{1,2} H_2^-$) → $H_1^{1,2} H_2^{enx}$
see 465

5 isolates enx : 1,2 : enx

Either phase in 1,2+enx → either enx, or inagglut.
Some are still very reluctant for i.
enx:c:enx SW 1054

1 51.G-H. abony enx → SW. 1054-3 → G 1-3
→ H 1-3
enx:a:enx SW 1055

Efforts to demonstrate c:a:enx, a:c:enx resp.
in c+enx, a+enx have given inagglutinable forms. cf. 49G.

Q SW1054 (a:enx) → TM2 ph2 → enx: monophasic!

1055 (c:enx) → → c:1,2

∴ While H,H, structure of java seems to be justified by SW1052-3 (c:b c:a), the final proof of a triphasic is not settled. Homologies of (enx → H,H,) → still to be settled. (Q-R large scale).

(over)

A more readily variable example of H, H, would be desirable. (SW1031 is perhaps the most distinctive).

Tests 1050 perhaps should be repeated. Try on a:enx.

Linkage $H_1 - H_1 \rightarrow P/a_1^-$

1051 Tests very limited ∴ Total actually only 5.

SW1049 (i: 1,2 $H_1^i H_1^{1,2}$) → SW666. 2 i: —

ph 1,2 → : b: 26 1,2: 7

SW1031 → SW967
1053 → SW967
) note: very low yields + apparent lysis why?

1053_a → SW666 a: — a: —

1053_c → " c: —

dontes-typi and paratyphi A.

1052. Screening of Hoan strains leaves doubts on several of these concerning identity, esp one are cnx: b.D E (1967 · relation to 1966) not yet tested.

Fix on 1052B (Edwards) as authentic strain.

1045. Several attempts → a:− unsuccessful.

However, SW1048 seems more transducible (for F/a+) by FA(PB)., though not by TM.

Note: F.K. records SW1048 as I−, 948 as I+.

(1045J1) SW1047 as I+ SW694 as I−.
Transduction?

Perhaps should check other transductions → 1048 for restoration of I.

Gal – Lac diploids. 1054

6/3/53 (z/EHL)
W2981x H245
40 colonies streaked out., ~~replicate to~~ pick 1 apparent Gal v. to EMS Gal. Replicate to EMB Gal, Lac, Mal, MH.
Pick 8 as most likely still Mal v., Lac v.
of original 40, all were Lac + (v) exc. 2, 8, ~~32~~, 40.

	Lac	Mal	MH	Gal	
4	v	+v	+v	+v	
7	v	v	v	+v	
14	v	–,v	+v	+,– ?	} not –. not Gal v.
23	–,v	v	v	+v –?	
27	v (+/–)	+v,–?	+v	+v,–?	
28	v	v	v	+v	
29	v	v	v	+v	
39	–,v	+	+	+	

14, 23, 27 must be ~~retested~~ re-tested to verify whether Gal v or Gal +v (latter is assumed Gal +/. or +, modified by other segregations)

Esther later isolated H324 from this cross. T.O.
This material

6/6/53.

by PDS - W2284 from W1895 / motility passage.
In his hands, F⁻ and not re-injected by W1817 or by W1895.
(However, entiols not retain).

1. W2284, W1802 grown with W1305 3 hours. Mixture (F) then streaked out (→F1) and plated directly with W677, W1896:

			D/O) 48h.	EMBlac
1	W1802	× W677	—	—
2	W1802	1896	++	++ +>-
3	1802F	677	2	3 -
4	"	1896	+	
5	2284	× 677	—	—
6	"	1876	++	++ +>-
7	2284F	677	+±	+± ->+
8	"	1896	+	
9	W-6	677	+	+ ->+
10	"	1896	+	

Thus mixture of W2284 (or W1802) with W1305 is clearly F+

F1. Isolate Lac+ from initial mixtures with W1305. (ca 10-20 colonies from EMBlac pooled in broth + read after incubation overnight).

W1802' × 677	+
W2284' × 677	4

F2. Lac+ from mixture overnight. Pool incubated 4-6 hours.

1802' × 677	+
2284' × 677	+

Retreak on EMB. Lac to check purity
2284F1-2 pure Lac+ some ?mucoid.
1802F1-2 may have some Lac-
Repurify and check single colonies of 2284F2

(over)

55A W2284 + W 1941 in broth overnight.
s.o. EMBlac ca =. Isolate, test, rep. lac+
x W677
sterile

B. Do W1802. Came out ca 100:1 - : +, rep. lac+ and test as above.

Repeat 2284 ... F x 1956 Repurified (pool still)

1802	x 1956	—
1802F1	"	++
1802F2		+++
2284F1	"	—
2284F2	"	+ (few)

may be either sterile or unstable

Try passing back to W677.

2284 x
x
2057

prot. test as Hfr, F⁻ ...
4 Mal+
3 Mal⁻
test by SRP

10557:
6/10/53.

On retest 6/14/53

	W677	W1816
2284F2 pool	—	++
s.c. 1	—	
s.c. 2	—	
s.c. 3	—	
W6	++	

∴ pool has become F⁻!
Test for transfer to W677!

6/19/53..

W2284 "F2" + W1956 overnight, s.o.n. EMB Lac⁻ sus to recover
H. "exposed" 1956 as Lac⁻ SR. Incorporate to Pneumoco.

I. (W2284F2 + W1305) × W1956 10 prototrophs
2284F2 " 0.
∴ 2284F2 does not become grossly
infectory after losing F⁺ quality.

JK J (W2061 (MTL-Hfr) + W1956) × W1802 40 prototrophs
K. (W1305 MTL-Hfr + W1956) × " 80 " .

J. Transfer from Hfr? Temporary or heritable? or recombination.
Lac⁺ V_1^R Mal⁺ S^S Lac⁻ V_1^R Mal⁻ × Lac⁺....

no other markers at hand.

Repeat: (W2061 + W1607) × W1956
Lac⁺ S^S (Lac⁻ Gal⁻) Lac⁻ S^R
S^R

or (2061 + 1956) × 1607.

Recombinate K.

L. (W1956 + W2061) × W1607 D/O) heavy growth →
v. low yields.
Test all 8 prototrophs on EMS Lac.

M. (W2284F2 pool + W1956) W1956 recovered, + W1607 no prot.
infer no P⁺ in 2284F

Controls W2061 × 1956 } no prototrophs
× 1607
1956 × 1607 }

H24[redacted] x W.

6/9/53

A. H24[redacted] from S. c'son EMS Lac in Benassay (TLB,-) x [redacted]2. gave ca 50 prototrophs mostly Lac+ ✓stock: H24[redacted] ca 1% Lac v.

6/9/53 B. aerated in D(Lac, HC) } 1. x W1321 $M^- F^- S^R Lac^- Gal_4^- \lambda^S$
C. standing in " . } 2. x W1486 F^+ " "

yield
B1 no prot. —
B2 ++ → Replate to Gal no -
C1 ca 10 prot. Lac - streaked on EMS Gal. all Gal -
C2 + < Lac+ to EMS Gal Lac / Lac- to " Gal

✓stock: B 90% v. Rare +
C 70% v 1% +

This stock therefore seems to behave as F^-, especially when aerated.
Lac+ should be uniformly Lac v.

C1. 3 Gal? 9 Gal - λ^S Restreak 3.
plaque noted on 1.

C2. Restreak possible Lac v or Gal v.

	Lac	Gal
33	—	v?
34	v	v or +v?
35	v	+v
36	v	+v
37	v	+v
38	v	+v

(over)

C2

	Lac	Gal
1	v	+v v?
2	v	v?
3	v	+v
4	v	+v
5	v	v H327
6	v	+v
7	—	+
8	v	+v
9	v	+v
10	v	+v
11	v	+v
12	v	+v
13	v	+v
14	v	+v
15	v	+v
16	v	+v
17	v	v+v?
18	v	+v
19	v	+v
20	v	+v
21	v	+v
22	v	+v
23		
24		
25		
26		
27		
28		
29		
30		
31	—	v +v?
32	—	—

(over)

459: ✓

	Lac	Mal	Gal
1	v	—	
2	v	—	
3	—	(wkv?)	— λ^v $Lp^{2/3}$
4	—	+v	v λ^v
5	—	+ +v	

Re ✓ single colr.

#3 is Lac v Gal − (H.s.c. test ✓)

	Lac	Mal	Xyl	Gal	MR	D(o)
	v	—	v	v	v	+
	v	—	v	v	v	+
	v	v		− λ^v		+++
	− ? or mitrac.	v	v	v	+v	+
	−	+ fairly middle?	+	−	+	−

Assume 5 as segregant. Save #3 as Lac v Mal v Gal = Lp^v H326
#5 may have been misjudged as from Gal = $Lp^{2/3}$, or may be crossover.
(over)

Next requirements are

① Hexotype rearrangement

② Lp^s Lp_2^s rearrangement. (perhaps better from a Gal+ revertant ??)

③ Gal+ revertants (cis and trans)

④ Gal+ transductants ....

Most Lacv from C2 are Gal+ mottled. H327

Retain #5 as Galv Lacv and check other markers

also check "Galv" from 1, 2, 17, 34.

H327: Lacv Galv Mal+^{v} S^s (S^s/S^R ...)

Lp_2^s Lp^+

No immediately overt Lac+ : does this segregate Lp^s?

↳ Later finds Lp^+/Lp^-, Lp_2^R.

? Lp_2 status must be rechecked.

no S^R with heavy inoculum on EMO plates

C. 1-5 : #1,4 are evidently Lac^{v}; may be useful later as Hfr IF^{-} ?
#2,3,5 show peculiar mottling is definite evidence of segregation.
Could look for evidence of mutational segregation. Store in NA's tubes.

		Lac	Mal	
A	1	+^{v}	+	E1
Residuals of presumably	2	+	+	
	3	+	+	
	4	+^{v}	+^{v}	
s.c.i	B 1	+^{v}	+^{v}	
	2	v. light +$^{v?}$	−	
feamplating	3	+^{v} or v ?	+^{v}	E2
	4	+^{v}	+^{v}	
on EMSlac	5	+^{v} and −	+	E3

presumably Lac^{v}.

to EMSlac.

C	1	+^{v} and −	+	E4
	2	+^{v}	+^{v}	
	3	+^{v} −?	−	
	4	+^{v} +,−?	+ −?	
	5	+^{v} −?	−	E5
	6	+	−	
	7	+^{v}	−	
	8	+^{v} +−?	−	E6
	9	+^{v} +,−	−	
	10	+^{v} +	− occ+	
	11	+^{v} −?	−	
	12	+	−	
	13	+	+	
	14	+,− $^{v?}$	−	
	15	+,−	+	E7
	16	+^{v} −	+	E8
	17	+^{v} −?	−	

have presumably been reisolated

Remarkable mottled appearance of all of these. Same EMS originals protein; choose for further study:
A1; B5; B3; C1; C16; C15; C8; C5.

Repick single colonies and spot EMSLac, brush EMSLac/sm; streak out EMSLac again. Handle as E1-8

Check 56 C 2, 3 ✓

2 Lac ✓ Mal ✓ Gal + ✓ + ✓

"

3 ✓ "

←

6/9/53

A. H310 (from S.Z. EMB Lac to Penassay)

× W1801 EMB Lac Pred. Lac − — H: mostly Lac v.

Pool plated on EMB Lac, Mal. Ca 5% Mal−, 70% Lac−. Mark possible Lac, Mal v for later pick. Plates may have been moist. growth very rough + spreading.

B. × W1802 EMS Lac. Pred. Lac +

Pool: almost pure Lac +

yield very high. >> 1000/plate pool growth and restreak for sampling.

See 57E

C. H310 × W2209 (P⁻ G⁻ F⁻) Dilute plating. >> 100/plate. Streak out weaker Lac+ on EMB Mal. 24 tested: 16 Mal− 1 +,− 7 Mal+

Repick Mal+ which might be Mal v. (2 from rare + among −; Mal+ v).

Replicate to check Lac pos.

Transfer possibility to EMB for repeat

	Mal	Lac
1	+ v ?	+, + v ?
2	+ v	+ × v ?
3	+ and −	+ and −
4	+.	+

Replicate streak plate (24 cols - C):

	Lac	Mal	Lac S
1	+		S
2	+		S
3	+ only rough	+, −	
4	+	(+ colony about)	R
5	V?	−	R
6	+	−	R

(replica quality?)

	Lac	Mal	S
7	+	−	R
8	+	+	S
9	+	—	R
10	+	—	R
11	+	−	R
12	+	+	S

No Mal v indicated.

	Lac	Mal	S
13	+	—	
14	+	—	
15	+ v ?	—	
16	+	—	
17	+	—	R
18	+	—	R

	Lac	Mal	S
19	+	—	S
20	+	+	S
21	+	—	R
22	+	—	R
23	+	—	R
24	+ v ?	+	S

Recheck #1, 2, 5, 15, 24 on EMB Lac, Mal, MH; spot on S Lac.

Remember C1-5.

	Lac	Mal	MH
1	V	+ v	V ?
2	+ v	+ v	+ v
3	+ ✓	−	−
4	V	+ v	+ v
5	+ v	−	+ ✓

some Lac + might be v.

C: Repeat: 20 ~~tested~~ streaked on B Lac; save 12. = 6-17

D H310 × W1911 EMS Lac v. heavy yield. Numerous speckled Lac⁻ TQ!

Replate H328:

7/8/53. all colonies photographed, including <100 lact, fuselac-negatives on two good plates.

SRP crosses c̄ 1057E (J.L.)

Penassay (7.5 ml) cultures of the following were made and grown up overnight:

1817 57E 1,2,3,4,7
1177

Half a ml each of the 1057 E and 1817 or 1177 were mixed in Penassay 1.5 ml(?). Incubated 8 hrs, centrifuged, washed twice, recentrifuged, resuspended in sal ½ ~~ml~~, plated on S lac 8m 7/7/53

	X 1817	X 1177	control	S.O. on B lac
57E1	lac±	lac−	—	lac+ (light + dark)
E2	lac+, few lac−	lac−, few lac+	—	lac+ (light + dark)
E3	lac±	lac−, few, against solid − background	—	lac+, lac− (fewer −)
E4	lac+, few lac−	lac−, few lac+	—	↓
E7	lac±	lac−	many cols, all lac−	
control	—	—		

E7 unreliable; E1-4 evidently Hfr. Test lac − segregants.

H310 x ...

1057E

6/16/53.

		Restreak S.c. EMB lac	MH (from suspn)	Mal (from suspn)	SM
x1801	1	+ (rough) only	+	+	S
x1802	2	+, sectored or smoothed +, and occasional — (similar to H310)	+	+	S
x1802	3	" v. rare —	—	+	S
x2201 = 1678	4	" occ. —	+	+	S
H328 ←	5	" , 1 definitely sectored +/−	+	—	R
	6	app. pure +	—	—	R
	7	+, s, sm, occ. —	—	+	S
	8	pure smoothed +.	+	+	S

all prototrophic on EMS lac.

non-demand of MH/S.

#2,3 2n from H310; Mal, S from F⁻

4,7, 2n from H310; Mal, S from F⁺

5 2n from H310, Mal S from H310 (TL⁺ from F⁻)
↓ mutations; heterozygosity. H328.

Replicate each to D/O for nutritional segregation.

No auxotrophs noted in dominant cultures (very few segregants necessary)

Are these diploid or unstable lac?? (H310 + half?)

5 Mal+ from H328. Streak on EMB lac, Mal. of H328.

↓

All appear to be lac V Mal+ " ( ). Suggests H310 + half is Mal−1.

Attempts at H310⁺: plate on EMS Mal+ 1/100 hydrol. casein: ca 20 papillae after 3-4 days, but these are not Mal+!

Repeat — now small papillae: all Mal+ — ! Repeat papillae (over)

Proof that H310 is diploid: Lac is only segregating marker!
(pure TLB_1^-!)

a) Hfr 2n vs. F^- 1n.

b) On a single occasion α 1895 gave Lac+/Mal V Su.
(cf. 1057.) H313

---

for test for its own papillation:

1057E1.-2 papillae of H310 on EMS/Mal HC.

↓ Mal+ Lac V. save 1057E2[illegible] = Mal+ Lac V

∴ Mal hemizygous

Perhaps ~~57~~ 57E21 as Hfr.

and segregants.

57E21 x W1607 → dense yield of recombinants
parent controls —

6/10/53

A. (aerated H290) × } { 1. W1394] mEMSlac
B unaerated " × } { 2. W1918]
(D(lac,M))

yield
A1 6 colonies : 1 lac+ ; 1 lac+
2 10 " nonlac+ ; 20 rev.+) from:
B1 2 -
2 rec -,+ ; 0.

1058A. Streaked out A1 (1-5) B1 (6-9) mEMSlac
On replication, none were lac, Mal V. T.O. for more

Resuscitate H-...

6/9/53.

H290 from lyophil: direct streaking → to EMS lac. Grow in D lac HC...
(7/30/51)

H302: SiO_2 tube 1 → growth slowly: pure lac-
tube 2 → " " " invisibly

lyophil → heavy confluent growth, ca 50% Lac V.
→ 90% Lac V

H313: susp. inviable

lyophil: (3/53 → found all segregated)
6/53 → EMS Mal: → mostly Mal-, Mal+ Some V.
EMS Mal

H226 occ. Lac V from vial 9/52 → ✓ (some lac+!)

H267 Almost all lac- " " . Restreak on EMS lac; took from EMS lac to D lac) →

318 Inviable

319 Viable; rare lac+ (v. light, maybe V.)

913-14 13: pure lac+ 14. Reatr.

H304-5 Mostly +, — T.O.

W1940 x 1956
Hfr F⁻

1059

6/11/53.

A mEMS lac

B Inc together in broth; plate EMB lac., EMB lac

?

A: 30 lac+ from EMS lac to EMB lac. Re- possible lac v others are + (1-). Restreaks 10: all are Mal−, #14 lac v? others lac+, very rough!

B. Papillae eventually noted. lysis in streaks?
Not scored for lac v. Single + noted in each streak, probably revertants.

None show lac segregation. Repeat Expt., also streak for lysis.

59B/B: Investigate lytic appearance in B:

59C 6/16/53 -x- EMS, EMB lac after growing together 6 hours aeration. T.O. mixed & mixture.

BB: W1940 proved to be mixed Mal+ / Mal−
In plating of W1940 + W1956, Mal+ and Mal− lyt. are lyl+ ÷ W1940
Mal− normal are lyl− ÷ W1956.
all lac−.

= W2302 Isolate Mal− as presumed mutant of W1940 (This strain had been recovered from aerobic, dissected & put in broth to grow out slowly). Restreak lyophil and current cultures of W1940. Rescue W1942 also for further experiments.
Renew W1940 strain from lyophil (gave Mal+) and throw out others.

(over)

D W1956 x W1940 EMBLac

E " " SLac

F " W1942 BLac

G " " SLac

after growth overnight

Lac+ seen as papillae in streaks of D, F.

ca 1% Lac. + colonies in E, G.

Hold suspicious clones for later retest

7/4/53:

abandon in view of Cavalli's finding re Hfr - Gal linkage

Gal = Rearrangements ... 1050

6/11/53

H324-5. Treat in D(Lac..) c UV, 20 sec. Broc. heavily in Penassay saccharin, and plate on EMB lac. Replica to EMB Gal, Mal, D(c) for discordances. ca 15 Lac^{v}/plate : 5 plates

A = H324 deriv. 24 B = H325. 135

		Lac	Gal	Mal	Lp	Lp^2	D(c)
A	1 Gal− Mal−		−	−	−	R	−
Isolates	2 Aux.		V	V			−
as	* 3 "	H332	−	V	−	V	−
possible:	4 "		V	V			−
	5 Gal−V	H331	−	V or V$^+$	−		+
all Lac^{v}						S-(R?)	

H332

Repeat λ-2 tests on A1, 3, 5

1 apparently R

3 RS?

5 S-R?

(over) Try inputting A5. c λ.

from replica of streaks: V / V$^+$ not certain

Lp tested on EMB/c)

streaks may segregating

B	1. Mal−Gal+		+	−			+
	2 Aux		V	V			−
	3 "		+	V			−
	4 "		+	V			−
	5 Mal−		+	−			+
	* 6 Gal− ?		−+?	V		+	−
	7 "		+	V			−
	8 Aux		+	V			−
	9 Aux		V	V			−
	10 Mal− "		+	#V			−
	11 Mal−		+	+			+
	12 Gal+ Mal+		V	−			+
	13 Aux		+	−+			±
	14 "		V?	V			−
	15		V?	V			+

all are + or V

A lac, pick, pos and plate papillate Lac$^+$ which may not have registered on replicas. ~~most papillate were apparently~~ Add 2 possible discordances to above es A 5; B 15

On initial restreaking A1, A5 gave light + Lac^{v}. Transfer to EMB lac plate and replicate for characterization. * No overt lysis in A1 streak; present in A5.

C. H326 Gal$^+$ revs. conspicuous from lac or Gal, streaked on EMB Gal, Lac. — to EML. Some typ. Gal^{v} noted; others are slow+. For further study, streak out H326 on EMB and obtain Gal+ from separate "^{v} colonies by replica to EMS Gal Lac ...

over

λ-2 tests on A1, 3, 5

EMBIMal D(6)

1 R

3 Mal+ S Mal R

5 Mal+ S and R? S!
(can't tell background action)

λ

5 H332

∴ presumably S/R
but Mal+/+

H324. In EML tetrad segregation #1-7 appeared to be segregating Mtl+/−, but #8-55 were all Mtl+ (including many Xyl−). Fermentor confirmed 6/17!

Check with T6: #1-10 ~~Mtl~~ Gal− were T6^S. H324 T6^S
H325 T6$^{S/R}$

H324 as now available is Mtl+/+.

The bulk of EML's data must return to this "secondary".

Except for auxotrophy, H332 is most suitable for infection of Lp^S/Lp^S ..... Now need to obtain Lat$^+$ version.

H331 also OK; not segregating Mal

G1 H325. v. slow lac v? — restrict + test prototrophic λ^- $\lambda_2{}^R$ Gal$^-$ Mal

H H329 1 Mal v lac v Gal v lysogenic autotrophic
2 " " "
3 " " "

G1 might be Gal$_1^-$ lac v, but is apparently $bp_2{}^R$ and presumably unsuitable for present purpose. H1-3 might be used by crossing to Gal$_4^-$ bp^S. On the whole Gal$_2^-$ (H326-331-332) seem technically most suitable. Check G1 by transduction to Gal+; if insusceptible, probably unusable.

Don't bother.

H325A appears to be as given. (See 1062) Grow on D(Glu)

6/15/53.

A H302 grown in D(M, Lac) × Y10
B " → aerated (aerated), into D(M Lac) 7 hours not aerated × Y10
C A) aer. × W1918
D → not aer. × W1918

plate on EMS lac.

A. 2 plates No prototrophs

B 20-30 lac+/plate 1022 ?lac-/plate (H-302 paralytic)

C 3-400 lac+/plate 1-2 ?lac-/plate (H-302 orthotypic)

D very heavy background 5-6 ? prototrophs/plate.

B. Streak 72 lac+ on EMS lac for lac v. C. Hold!

Pick to EMS lac. Not all grew out.

	Lac	Mal
1	V or v	V
2	V	V
3	V	V
4	V	V
5	V	V
36: 6	+	+
7	V	+
45: 8	+	+
9	+ v?	+ v?
10	V	V
34: 11	+	+
12	+	+
13	+	?
14	V	V
15	+ v?	?+?
16	+ V	V
17	+ v?	+ v
18	V	V
19	V	V
20	V	V
21	+ v	V
22	+	+
23	+	+
24	V	V
25	V ?	V
26	V ?	—

Prelude as probably lac v

∴ in sum: 1- Mal
23 probable lac v ← 3+ ? 19 v
(not fully characterized)
33 lac+ ← 1- 22+
(6 were not prototrophic)

27-56 picked as supp. lac+ 25-

	27	28	29	30	31	32	33	34	36
lac+ : Mal+or-	+	−	+	+	+	+	+	+	+

	37+	39	40 +-?	41-44	46-48
lac+ Mal+or-	+	+	+,−	+++	+

	37?	38?	38	45	54
lac	~~37~~	~~38~~	v	v	v
Mal	~~−~~	~~+~~	V	V	V

	49-52	53, 55, 56
lac+ Mal+,-	+	+++

Re-collect possible v and streak with sm, etc.

Mal v usually crossed on basis of +, − being present.

Elimination evidently does not occur in 2nd F+ × 1st F−
Remember 38, 45, 54 as 6-8-11

previous

Include 1-23 are likely Lac v. (Mal v). ~~Rec hypothesizing the following~~ Restreak entire series of 23.

EMB Lac, Mal
Brush on EMB Mal / SM.
EMB Mtl

		Lac		Mal		→ sm Mtl		sm Mal		
1 ✓	4	+ ✓		+	−	+S		+S	−S ✓	
2 ✓	A	+	−	+	−	+S	−R	+S		✓
3 ✓	A	−	✓	+	−	+S	−R	+S	−R	✓
4		+		+	✓	+S		+S		✓
5		~~+✓~~		−	✓	−R		−R		✓
6		+	✓	+	✓	+S		+S		✓
7	17	−	✓	+	✓ +?	+S		+S		✓
8	21	+	✓	+	✓	+S		+S		✓
hap 9		? +	✓ +	+	+	+S		+S		✓
10 ✓	A	−	✓ ✓	+	−	+S −R		+S	−R	✓
11		−	✓	−	✓		−R		−R	✓
12		+	✓	+	− ✓	+S		+S	✓ (−S 2d time	
hap 13		+	✓	+ ✓	+	+S		+S		✓
14			✓	+	✓	+S	+R ✓	+S	−R	✓
15 ✓	A	+ ✓	✓	✓+	?	+S	−R ✓	+S	−R	?
16 ✓	A	+ ✓	+ ✓	+	−	+S	−R ✓	+S	−R	✓
hap 17		+	+	+	+	+S		+S		✓
18 ✓	F?	+	−	✓	✓	−R		+R	−R	✓ + S also pres?
19		+		✓	✓	+S	+R	+S	−R	
20 ✓	E	+	−	✓	✓	+S		+S	−S ✓	
21		+	−	✓	✓	+S	−S	+S	−S ✓	
22 ✓	A	+	−	+	− ✓	+S	−R	+S	−R	✓
hap 23		+ ?		−	−	−R		−R		✓

colonies picked may have segregated.

A) ∴ Lac v Mal v S v Mtl v number : 2, 3, 10, 15, 16, 22 — 6

B) Lac v Mal v S v Mtl + " : 14, 19, — 2

C) (Lac + Mal + Mtl + S^s) : 4, 6, (7), 8, ~~9~~, (12), ~~13~~, ~~17~~ — 8

D) Lac $\pm$ Mal − Mtl − S^R : 5? 11, ~~23~~. — Is H302 Mtl− or Mtl v? 3

E) Lac v ✓ Mal v Mtl + $S^{s\,\checkmark?}$ 1 20

F) Lac v Mal v Mtl − S^R 18

(7) Lac v Mal − Mtl + S^S

Recheck: for Mtl v. B)
C): haploid: find diploid D.

G) Lac .. Mal v Mtl v S^S 21

1061C

from EMBMal → /sm

(from replica to EMBlac ± sm) ↓ ear...

+ = + or +, –

	Lac	Lacsm	Mal	Malsm	MtL	D(o)		S	
H 1	++	+	+	–		–			R haploid
2	+	√	+ –	–		–			R
3	+	√	+ –	–		–			R
4	+	√	+ –	–		–			R
5	+	√	+ –	–		–			R
6	+	√	– +	–		–			R
7	+	√	– – +	+	– +	+			R
~~8~~	+		+ –	–		–	–	– √	√
9	+	√	+ –	–		–			not prot
~~10~~	+		+ –	–		–	–	–	R
									not prot
11	+	√	+ –	–		–			
12	+	√	+ –	–		–			R
13	++	+	+	+ –	–	+ –	±		R (+R?) √
~~14~~	+	+	+ –	–		–	–	– √	not prot
15	++	+/–	+	–		–	±		?
16	+	√	+ –	–		–	+		R
17	+	√	+ –	–		–	+		√
~~18~~	+		+ –	–		–	–	±	R not prot
19	+	√	+ –	– +	– +	+ –	+	√	R
20	+	√	+ –	–		–	+		
21	+	√	– +	+ –	– +	+ –		√	√
22	+	√	– +	+	– +	+ –		√	√
23	+	√	– +	–		–			R
24	+	√	– +	–		–			R
25	+	√	– +	+	– +	+ √	±	√	√
26	+	√	– +	+	– +	+ √	±	√	√
27	+	√	– +	–		–	±		√
H 28	++	+	+	–		–			R haploid
29	++	√	+ –	–		–			R
30	+	√	+ –	–		–			R
31	+	√	+ –	–		–			R
32	+	√	–	++	– +	+ √		√	√
33	+	√	–	++	– +	+ √		√	√
34	+	√	–	++	– +	+ √		√	√
H 35	++	+	+	–		–	±	√	R haploid
36	++	+	+	–		–	±		R haploid
sic 37	+	√	+ –	+ – √	+ 1	–		R	R?
38	+	√	+ –	–		–			R
39	+	√	–	++	– +	+ √		√	√
~~40~~	–								

∴ all other S^R or S^v

all "Mal+" are Mal v S^v

√ are probably painted H20?.

not prot ∴ 35 prototrophs

all evidently segregating

all other pred. 1

most lac var. prod: +/- / +

some are +/-

7, 13, 19, 21, 22 are evidently MtL v Mal v S v

25, 26, 32, 33, 34, 39 may be (MtL+ or MtL v) Mal v S v

37 is Mal v MtL – S?

1, 15, 28, 29, 35, 36 may be lac haploid.

– Replate to EMBlac
✓ EMBlacsm
to verify S^R pur.

Only exceptions for ✓:
13, 15, 17, 27

10613B

Conclusions from results

Comments.

	Lac	Mal	Mtl	S	
1	·	v	+	≠ S	
2	·	v	v	v	
3	·	v	v	v	
4	+	v	v	S	
5	v	v	v	v	
6	v	v	v	v	
7	v	+	v	S	
8	·	v	+	S	
9	+	+	+	S	haploid
10	·	v	v	v	
11	v	v	v	v	
12	·	v	+	S	
13	+ v?	+	+	S	haploid
14	·	v	+	v	
15	•	+	v	v ≠	
16	·	v	v	v	
17	+	+	+	S	haploid
18	v	v	—	v ≠	
19	·	v	+ ~	v	
20		v	+ ~	S	
21		v	v	S	
22		v	v	v	
23	+	—	—	R	haploid

Lac+ mottled !

Mal+ S^R / Mal− S^S

some probably Lac+/−

18 seemingly Mal−, Malv no Mal+ segregants. Restreak apparent Malv for more material: 4 colonies gave same pattern. Most Mal− are S^S Mal+ probably include some +.

Summary: 56 prototrophs. 19 ultimately diploid (Lac+ or Lacv)
Most probably Lac+/− rather than +−/−+.

Lacv	Mtlv	Malv	Sv	:	8	2 3 5 6 10 11 16 22
+	v		S	:	4	1 8 12 20
−	−		R S	:		haploid only (9, 13, 17, 23)
v	+		S	:	1	7
v	v		S	:	2	4 21
+	v		v	:	2	14 19
v	+		v	:	1	15
−	v		v	:	1	18

2n "F-" x n F+ 61cc

1/2/53

Recap. of types (provisional class. of 13, 15, 17, 27 as S^V).

A. 16 Lacv (+-/-+) MH- Mal- S^R : 2 3 4 5 6 9 11 12 16 20 23 24 29 30 31 38

B. 1 Lacv (++/--) ~~V~~ ~~V~~ ~~V~~ : 13

C. 10 Lacv (+-/-+) V V V : 7 19 21 22 25 26 32 33 34 39

D. 1 " MH- Malv Sv : 37

E. 1 Lacv (++/--) Mal- MH- Sv : 15

F 2 Lacv (+-/-+) Mal- MH- Sv : 17, 27

31

haploid : 5 1 28 35 36 40

aurotr : 4 8 10 14 18

9

36 prototrophs tested. 31 diploid Lacv : 29 (app.) Lac+-/-+

2 Lac++/--

(may be incorrect).

Malv : 12

MHv : 11

Sv : 15.

#2 maybe ++/-+ #3 +-/-+

Compare:

(Major types only, Mal − S).

			B		C	%
1	Mal V	S^V	11	58	12	39
2	Mal−	S^R	0		16	52
3	Mal+	S^S	1	5	0	
4	Mal V	S^S	6	32	0	
5	Mal−	S^V	0		3	9+
6	Mal+	S^V	1	5	0	
			19/ap. †		31/30 part †	

B = $2nF^+ \times$ Y10

C = $2nF^- \times$ W1918.

H302 = M-Lacv MH - Mal-S^R.

Inferences: 1. 2n parent functions as such whether F^+ or F^-. If $2nF^+ \times nF^-$ depended on polarity reversal, there would at least be some Mal$^-S^R$. Split (B:C)(1:2) is certainly significant.

2. "No" Mal+ S^S in B, suggests that "none" of these diploids are hemizygous in this region. If elimination occurs from the F^+ side, it must involve only 1 of two strands, and the eliminated one may be discriminated against in zygote formation. It is possible that elimination does not occur at all from the F^+ side of 2n. Note high incidence of BH. (Mal/S) crossovers!

3. High incidence of C2 suggests usual elimination from $2nF^+$ side. ? are these homo- or hemizygous? Need tests on these random C5. Nearly half are S^V. Note: in B, only S^S and S^V; in C only S^R, S^V.

61C hemizygosity tests: (EMS Mal)

17: numerous Mal+ (pinty??)

2: 2 papillae } → Mal v.
3: 5 papillae }

15: 2 plates ~0 Mal+ 7/10
2 plates: 3 Mal+ 7/18: → Mal v.

#17 initially a pur Mal v. Re-isolate Lac v Mal — and test
(mutants?)

None of this is inconsistent with pre-elimination, if it occurs. Would need a Hal/S crossover (Hal-S^2) or a Hal-hemizygote in B to substantiate it. Presumption of elimination is based on polarity differential.

Immediate requirements: hemizygosity tests on C1, C5 classes.

Later: Look for Hal-diploids in B. (should occur by crossover).

→ X Val⁻ 1062

6/19/53

A. N1–X H326 on EMB Val

B N1–X H331 " " .

several thousand est. Val+ from 1 hyp. Pool and streak out on EMB Val
background ca 4-5 papillae

check for lac V Val+: pick lac v to EMB Val. mostly lac⁻, but most Val⁺ are definitely variegated.

2 lac v Val+ selected from A, B resp. Spots of lysis in org. from each. Further screening indicated.

C. N1–X H325A (Val⁻ lac v) → UV Val+ ($4p_2^{x}$!)

of EML

→ × S. abortus equi
SW1058.

6/16/53

A. SW1058 (mot.) in eux serum. See 1042, 1052
Previous tube had not moved in 4 days.

6/16 1
2
3

7/9. All immobile! T.O.

B. FA18 → ×
6/17 1
2.

C FA22 → ×
1.
2.

6/26. no swarms in any of above! (Try IV serum!)

6/26 SW 1058 mot (fermdant) = D and TM2 = E.
1. mot
2. IV
3. IV V XII (/ Typhi O)
4. IV XXVII XII

24h.
D 1 ++
2 + (definite inhibition)
3 ++
4 +++ stimulation? or fresher medium

E 1 24h. +++
2 +++ → still ~~IV XII +++~~
3 ++
4 +++

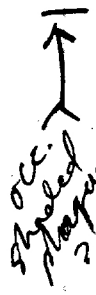
Recover D2 after 48 hours. Streak out and test for transd., leux etc.
Mot c purification 7/1/53. leux c,o FA18, FA22

62D2 / leux ± FA22 ~~Repass in IV.~~ no mot. 7/9/53 T.O.

7/2/53

Cross-streaks on EMB bac, ϕ stock ϕ as received from WBc.

B: ϕ:	FA10	PB-1	PB-3a	PB Taunton	PB Bendix	TM ϕ PRE
TM2	++	—	—	—	—	++ lytic
1057A (PB1)	++	++ semi lytic v. few plaques	—	—	—	—
SW730	—	—	—	—	—	— (Sudeney stock)
SW887A1	—	—	—	—	—	+ not lytic (Napoli stock)
SW957	±	—	—	—	—	+: inh? (0901)
Sudeney: 1074E1	—	—	—	—	—	—
3	—	—	—	—	—	—
4	—	—	—	—	—	—
5	—	—	—	—	—	—
6	—	—	—	—	—	—



titer? shoulder on PB1

ϕ perhaps should first be grown to higher titer. Try TM ϕ PRE / TM2 SW887 SW957.

PB1 / PB1.

Try other ϕ on Napoli, Sudeney, etc.

Grow Taunton ϕ, ~~Ex~~ PB2 ϕ.

Test ϕ preps → SW666

FA22	+
control	—
TM / TM2	—
/ 887	—
/ 957	—
PB2	—
PB1	—
PB Taun	—

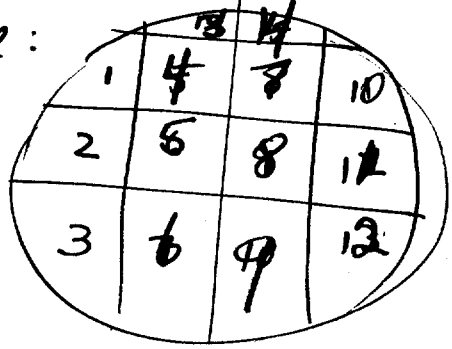
ϕ maybe n.g.

Use PB2, PB BAOR, PB Bendix as basic stocks. (over)

7/5/53
From results over, ϕ's have not been made to adequate titre.

Test loopfuls for φ activity.

PBφ:



Bact. = (PB1, PB2, 666 (Jersey), Taunton)

For later study,
2
BA0K
Dundee
represent types of phage.

	PB1	~~BA0K~~ Taunton	SW666	~~Dundee~~ PB2	TM2
1 φPB1 (Ch.)	++	— sic!	—	—	
2 " 2 "	~~+~~ ++	—	—	++	
3 " Taunton	—	1sol. pl.	±	— sic.	
4 " BA0K	—	—	—	—	
5 " Dundee	+	± mephages?	++ fine plaques	±? v. fine	
6 FA10	++	++	++	+ 0.	++ 0
7 φ1/1 S.L.	+ isol pl	—	—		
8. φ2/2 S.L.	+ isol pl		1sol pl.	few pl.	
9. φT/T S.L.	—	1sol. pl.	isol pl.	—	
10. Jersey (Ch.)	++	—	++	—	
11. 3a (Ch)	++	—	—	—	
12. 3a1 (Ch)	++	—	—	—	
13. 3b (Ch)	++	—	—	—	
14. Bexley (Ch)	? fine pl.	—	+	fine pl.?	

Ch. pups??

φ's not prepared to adequate titer.

In first preparation, PB2, PB BA0K cleared; Dundee did not. Re-grow Dundee on 666, PB2 and Dundee

7/5-6/53

Cherry phages.

Ch:	TM2	SW688	SW966	PB1	SW730	SW887	SW957
1.	−	−	−	±	−	−	++ + (lytic ++)
3.	−	−	−	−	±	−	−
4.	−	+	−	−	−	−	+ lpl. lyt.
5.	−	−	−	−	−	−	−
7.	± dvabd	−	−	−	−	−	−
8.	−	−	+	−	± sh.	+	− ±sh?
9.	−	−	+	−	+.	−	±
10.	−	−	−	−	−	−	−
(12) ~~11.~~	++ T.	−	−	++ T	−	++ T	−
17.	−	−	+	−	+	−	± lytic ++

From point of view of survivorship, #12 seems most likely.
Label on this vial reads: S. luciana #12. Cherry's letter refers to S. luciana #18 as v. specific for group XI. Presumably not these ϕ.

Grow #12 on TM2, SW887 to test transductions. Also grow
#1 /957; 9/SW730; #4/957; #17/666, 957.

Need to find better hosts for 3, 7: try smotypes strains (enterids, citrobacter and gallinarium).

#1 seems to differ from 01 in host range. Called para A phage!

Ch2 grown on TM. spot: OK. / TM
on SW887 " "
on 730 " "

Hershey 6/5.

v. small plaques
Titres not too high.
but worth trying on
O4010; SW967
etc.

PB2 /2 large + small plaques. Moderate #
BAOR 1 ✓ small plaques. "
Bundle 1 ✓ " " "

/ PB1

Regrow for higher titer.

Ch Hershey repeat spots: Taunton, BAOR, Bundle: not discernable / PB1.
May not be host sources.

#7 SW764 (enteritidis) - +++ (lytic) and scattered survivors
967 (dublin) —
957 (0901) + (overgrown)

BAOR PB1 + shaded
666 ± shaded
730 —
887 ± shaded
957 ± shaded.

Treated. BAOR —x 666 → b, Gal—
~~=1063 A1~~ in b serum b: —

Repeat 7/8: BAOR —x 666 → b
statistically checked. —x 967 → (gm) +
—x H901 → —.

Repeat, looking for tracks on plates —x 666

Clumps: test ster. 7/764 1/H901 ster.
(heated) PB1— Bender-BAOR (mw) but —x 666 possibly traces. ++
7/8/53. 12/ TM2, 887, PB1 not sterile. ① melt off and test
4/H901 ② chloroform & and
17/H901 retest.

---

7 —x 666, 967, 957 all — in 24h. Titers?
ch2 —x ~~887~~ 957 (ch2/TM2, 887, 730) all — in 48h.

B1 (Ch12/PB1 not str. → x SW600 not) → Gal+ doubtless.
B2 Ch12/TM2 " ") → Gal+ contaminating bacteria resist. ?
B3 " 1887 " "
7/8. Repeated after $CHCl_3$ treatment → x 666, 957, 967 all —.

A. BAOR → x SW666 / motility → v. numerous swarms + trails
B. = FA90 / EMB Gal → ca. 100 Gal+ / .1 ml
Purify.
controls: each 0, 0.

Ⓐ ① Pool motile transductants (>730) all Gal−.
② Individual " " (8) : all Gal −. Pick to broth for subs. lysogenicity test.

Ⓑ. 1. 20 streaked out: none unstable, all pure Gal+. Test pen. for lysogenicity, motility.

∴ as before, no Gal: H, Fla, linkage

Ⓒ FA90 → x SW950. / Gal same (ca 5-10/plate).
/ D(Meth) ± FA. no evidence of transduction).

ch2 TM2 → x 666 } ≡
1730 → x
1887 → x
also obtain spont M+ SW950.

132 → x 6,, —
Dundee → x 666 —

(over)

Lysogenicity tests on 63A-B.

A:1-8 all are lysogenic on BAOR ; sensitive to FA10 ;

SW666 not " " " ; " ;

SW928 " " " " ; resistant ;

all are resistant to FA90.

no control, BAOR/FA90. By 90 + SW666 these have evidently became lysogenic for BAOR indicator. In transduction platings, only rare plagues were seen. Save A1, B1 for further study.

B:1-20 15 lysogenic on BAOR. Suggests that BAOR might also be lysogenic on many of these. 5 may be sensitive. In initial streakings a few were noted as possibly mixed lys/sens.

BAOR lysogenicity. 1063

7/18/53. Reciprocal lysogenic cks...

	BAOR	PB2	SW666	FA90.
1063 A1	++ ·	—	—	—
B1	++ ·	—	—	—
SW666	— ·	—	+—	— (shaded)
SW918	— ·	—	+	—
BAOR	—	—	—	+
PB2	— ·	—	—	+

note difference of 1063A1/PB2 and FA90/PB2. Suggests 63A1 may be lysogenic for a phage other than BAOR!!

· v. small plaques in A1, B1.

BAOR lysogenic for 4 carried by 1063A1 = 63C1.

Streak out BAOR/90, PB2/90; and 63A + BAOR.

BAOR may be lysogenic for another phage which attacks PB2, C66..., but this is probably distinct from the lysogenizing phage in 63A-B.

---

4 on benzyndorf SW1060 (Cherry, 305-50): cross-str. on ETMB Lac

	SW1060	PB1
Taunton (Ch. strk)	—	—
Beules (" ") 4 plaques		—
Dundee / Dundee	11 plaques	ca 30
Dundee / SW618	—	++

After 48 hours, SW1060 swarmed in 1, 2, 3 zones → SW1060' (

Try to grow Dundee, Beules on SW1060.

63C1 FA90 × 63B1 / not
63C2 FA10 × 63B1 / not — hold 6 colonies for later lysogen. test

Tom's ?? Mal v.

7/1/53...
TCN 174-95 for further study. From W1325 × W1394
streak out 2 colonies from EMS lac. 1 → pure lac+ Mal+; poor growth on Slac
2 → lac, Mal +, − and ? ↓
Restreak 4.? on Slac: many satellite pinpoint colonies
1,2,4: variable colony size on EMBlac; no −
3: Mostly lac−, Mal−. Occ. small +?

7/4. A. Restreak + colonies from 1,2,4 on EMB, EMS Mal /sen.
→ no overlap of sensitivity on EMB. of EMS; e.g. on EMS! edges of many colonies look lysed (or lac v?)
~~all pure lac+!~~
Test parents, intact +, − for sensitivity to "ϕ".

B. Restreak 6 colonies from 3 (pres. + or v, not −).
all mottled + on EMB lac → pure lac+!
Replica of 1-2-3-4 above: 1, 2, 4 and lac+ 3 are S^R Mal+
lac− 3 = S^S Mal−

C. Tests for ϕ: using parents, 2+ 3− and 4+ as indicators, and parents, mottled + as donors: no signs of ϕ in cross-streaks on EMB-O

maybe diploid or more likely, contaminated prototroph + pseudomonad satellites.
Try Mal + prototrophs on EMS Mal /sen.

Mute p.v.?

7/8/53.

N97 s.c. to broth

A1. — } in b plates (pair b, and minnesota b)
B UV 30 sec (washed cells)
C Δ - 48 10 min.

Numerous swarms – more in B than A? – in b (pair b)

None on b (minnesota)

note A4: b, 1,2 ++? Subculture pur. isol.

7/11/53. (UV – 40 sec.) standardize inocula.

\# swarms/plate 24 hours. (two bluishes)

A 8, 3, (5)

B 2, 10, 2

C 1

Too variable for any clear result!

D: after 48 hours, A and B 1 each in b mini. & b+ 1,2++? vs.c.

Inoc 7/14 in 1,2.

A1, A4

B1 B2

C1 C2

D1 D2.

7/19. a few beginning to swarm, very weakly

7/20. C1, D1, D2 → inagg.

Inoc 7/19 in 1,2

No prompt swarms through 1,2 serum in all tests!

7/26 Refrig.

Serine assay for Singer. 1066

6/18/53 W-1975, 1977 in D/O) + glycine or serine r/ml in 10 ml tubes
24 hours P17.

		1975	1977	
0		−	−	
L-serine	1	+	+	
	5	++	++	
	10	++	++	
	100	+++	++++	++++ est 10^9
glycine	1	+	−	
	10	++	−	
	100	+++	−	(+++ est. ca 3×10^8)

confirms previous conclusion that W1977 is specific for serine.
In both cases, 100r serine showed early inhibition — serine itself or impurity?

6/20/53. W1977

X.	~~100r~~	·
	14r	·
	40r	· +
L-serine	1r	·
	10r	·
	20r	·
	100r	·
DL-serine	200r	·
	—	.005
Small samples	100r (X)	·
	50r (X)	·
	10r (X)	·
serine	50r	·
L-	10r	·

(over)

X in sol 2 mg/ml
10r/ml in 10 ml tube
≙ .05 ml

Later: Singer's compound has about 10% activity of L-serine.

200r dl-serine ≐ 100r l-serine.
Inhibition of early growth at serine > 50r/ml.
Might be possible to select resistant mutant, not tried.
Occasional (ca 1/10) tubes at low serine adapt. (W1977)

Full wild growth not achieved for either W1975 or W1977 with 100r serine, or 100r glycine. Mixtures not tried in this expt. Recrystallized L-serine used for these expts.

Szent-Györgyi later stated his
compound was mostly
aspartic acid! (Activity for semialdehyde?)
~~asp decarboxylase?~~

TM2 morphescript 2

1067

7/17/53. SW1061 received from Edwards 7/16.
Both it and silent or broke TM2[2] did not migrate in 1, 2, 3. Serum.
=67A1

Cf. also Tube-stab "TM2" pls 1, 2 5/12/53., and TM 2 pls i
=67A2 =67A3

67A1
67A2
SW1061 } unstable in 1,2 serum!
all 1,2 ++ i −

67A probably came from 1039-1; confused history, but likely a single NSA colony i → 1,2, while looking for absence of cross reaction.

Save SW1061 for further study.
Prepare FA 22/1061.

67A3 = TM2[i] : i++ 1,2 −

67A3: 1-4 (s.c.) all react 1,2 +++ i ++ promptly!
i serum
Represses 67A3-1 in i

[illegible] 1 → 3 s.c. from NA
to both } all 1,2 +++
1 ++−
i − or ±
1,2 +++ b −
from NA with

1061 [illegible] → 1,2 +++

67B1 = 22/SW1061 → * SW666. No [illegible] nor b in tubes though numerous swarms in plate and not in tube. Not to be repeated! ∴ H[1]⁻ → H[2] 1,2

In 1,2 serum, A1, A2 and SW1061 are each unmotile.
TM2 (A3..) passed readily through both i and 1,2 → i++ 1,2+++
22 → × 1061 also unmot. → i++ 1,2 −

S. bunzendorf transduction

7/18/53.

SW 1060 from Cherry reported to be susceptible to PB phage ~~Dundee~~ Boules, Taunton. In my hands, Dundee ++.

~~Boules~~ ① in 1,2 serum → c phase. This was tested as follows.

FA10 (122B)	— lpl?
FA90	—
FA18 (122M)	+ spotting of plaques
Dundee	+
Dundee/618	—
PLT7	+

680 1 Dundee/1060c
2 Taunton / "
3 Boules / "
↓ T-0.
no activity on 1060c.

This strain seems to be ~~susceptible~~ susceptible to PLT22 and PLT7 as well! Attempt to grow these phages on it.

Slide agglutination SW1060 (from E.M.B. Agar unit):

—	—
IV V XII	+
IX XII	—
VI VII	+++
VI VIII	++
II XII$_2$	—
II XII$_3$	—
IV XVII XII	—
c	—
1,5	—
ρ	+ grain
Vi	—
V	—

definite reaction with S. paratyphi B. serum

cf. other bunzendorf and cholerae suis.

No overt lysis of PLT7/1060c; PLT22/1060c. "Lysates" still active on TO12 (carryover?). Try × SW666.

7/20
68A1 7/... × 666) no motility
68A2 22/... → 666) SW1060c itself partly motile: motility
↓ not! → i (probably carryover of Fla) type preceding

SW961 also reacted slightly with B serum, C_1 ++
SW853, 732, 737 reacted poorly with both in first test.

853 also showed plaques (?) vs. P7, P22.

- T.D. and start push after summer.

68B.

in C_1 (somatic) or C (H) serum as indicated

7/21 – 7/26. Initial motility not checked. Initial check in C_1 (.01 ml or .02 ml/tube), about same.

7/26:

1. SW1060C /C → 1, 5
2. " ← PA22 /C → 1, 5
3. SW1060C /C_1
4. " ← PA22
5. SW1060 /C_1
6. " /C_1 2×
7. " ←
8. " ←

Vi + Typhi ×—×.

Misc. φ → × 0901

9-10/53. See 1071.

ca 9/10. Motilize SW 759, 760 through plates of semisolid.

After 2-3 passages, both cultures were actively ~~motile~~ motile ~~and~~ but reacted Vi+ d–, except for an original SW760 which was Vi–. Passage strains of SW759 M2 tested × in semisolid tubes ± d antiserum.

A. 1 no serum +++ in 24-48 hours.
2 d " 2 tubes Complete inhibition.
3 FA10 →×, " no outgrowth
4 PA22 →×, " " ".

Discard after two weeks.

B. Use A1 as inoculum— found not very motile.
Repeat passages.

?/15. C. Various det't phage from Anderson, rather low titer. Test × SW957 in tubes: (820, 63, d1, d4, d6, 25', 28', 26', 30', f2, and no φ control) all negative. Retransfer to fresh tubes for recheck.

10/19. 29' swarmed. Repeat test.

However, "controls" PA22, FA85 gave no swarmes: former a few trailers? On recheck, 28' and 820 swarmed in second tube but not the 1st. Appearance of multiple sites of initiation??

Try other inoculums × Vi.

Hfr - Gal.

Hfr - wj 28.

7/27/53.

W1895 x W1321 in Penassay, then streaked on EMB Lac sm, EMB Gal sm. 5 plates each.
controls OK.

1 full lac+ 1 full Gal+ (ca 1% est. of all lac+ S^R).
Restreak on EMB Gal sm. Held as 1070 A1, A2 — to HLB to test. (Should be M-) Hfr ... 2

HB*3	x 1177	control
1070 A1	800-1,000 cols/pl	—
1070 A2	"	—
control	—	

10/6/53. W1895 + W2333-8 in broth overnight. Streak on EMB lac sm: All showed lac+ S^R ca 1-3%.

W 2333
~~2334~~
2335
2336
2338

Use 2333 for further expts.

2337 gave few or none. Mutant itself slow +.

R —x SW666
22 —x ....

September 5, 1953.

A. SW957 x—
B. SW666.

1. Control
2. FA22
3. K (Anderson strain)
4 φ's.
5. FA8.
6.

Plates

Tubes.

A 1 —
2 no sw on plate — no sw.
3 vv numerous sw. 6 all d. — no sw !!
1 +, 1 —

B 1 — — vv no sw
2 ✓ numerous sw — — ✓✓ sw
3 ✓ 3 ~~swarms~~ scorable. swarms or tracks. 3: < 2 d, 1 b (all 3: not lysogenic, not 51 R, Gal–) — 1 +, 1 —
4 k — ✓ sterile
4 22 — ✓ sterile

5. 5–6 swarms ca 100 tracks. Picked and isolated swarms = 71 A5.

∴ k functions as transducing phage. FA22 appears to have lost titre in part. Use 71A5 for x— gallinarum in d serum. (cf. H901)

1071A6. 957/k (not motilized). Tested and v resistant to FA51, k.

9/9/53. k —x ... sw.   n motility agar   1 plate each

C.

1	550	—
2	1063	—
3	1064	—
4	1066	—
5	1067	—
6	1068	—
7	71A6	numerous T + S.
8	1072	+ → 1,2+++ i++ (2)++ (5)+ !!

D1.	FA51 (01) —x 71A6			—
2.	53A	"	"	1sw ?
3.	53	"	"	2 sw
4	—		"	—

swarms: significance ?

(0751)

Note reactivity ⑤ as well as ②.

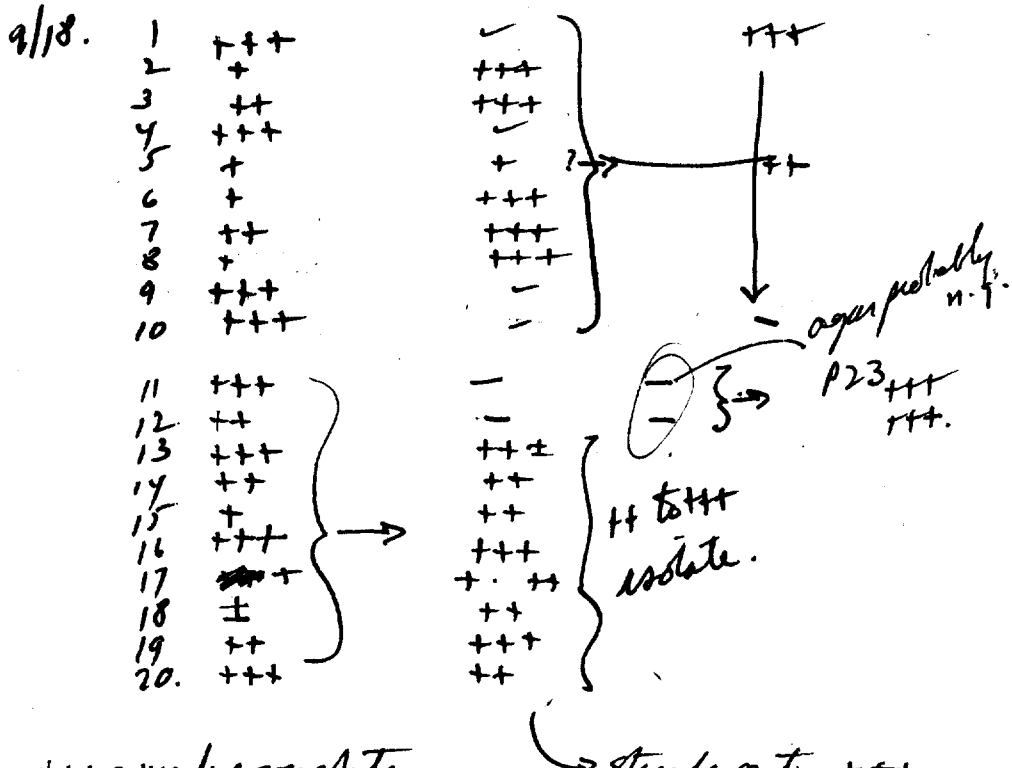
Note ⑤ = S. berlin/S. para B. X-Rs may be related to ③.

September 15, 1953.

58-161 from stock (MLM) streaked out. Pick one colony = 1072-01 (ETOH sec)

9/14/53. Restreak 01 for reisolated, single ~~cells~~ clones.

9/15/53. Save samples; inoculate motility tubes and plates. 1-10 11-20



+++ = nearly cover plate or through tube.

~~Remove + + to fresh plates.~~ all to SP 18.

hold tubes addl. day.

P23: A10 only non motile culture. Remoculate from top.

store streak plates to 10/5. Pick single colonies at A, B. (inoculum and aftergrowth of second motility selection) for compatibility tests. Note sectored nucleoids at ~~#~~ 16, 19 A-B, 20B (some A) ~~+++~~ #1, 17, 18 B. Relation thereof to selection? Restreak variegated colonies from 19B. Note noticed in series A.

not apparent with

10/8. Test large loops of concentrated mixtures

c̄ W1177, WJ896 on EMB lac.

for compatibility scoring

10/10. Most X ~~[illegible]~~ overgrown! check this parent!
W1177. (contaminated ??)

	× W1896 yield	predominant lac + or −	
1	X		
2	X		
3	X	−	
4	+	+	
5	++	ca =	sic
6	++	+	
7	X	−	
8	X	−	
9	X	−	few +
10	X	−	"
11	+++ ?	−	
12	++	−	sic.
13	X	−	
14	++	+	
15	X		
16	X		
17	++	+	
18	++	+	
19	X	−	few +
20	++	+	
W1607	++	all −	
78A1	X		

note ratios might be distorted by growth.

X confluent

all × 1177 are X.

Repeat 11/1/53. (test — B)

	W1177	W1876
A1	+ heavy backg.	+
B1B	2?	+
2	~~4~~ 5?	+
3	−	+
4	−	++
5	−	+++
6	−	++
7	+	+
8	−	++
9	−	+++
10	−	+++
W1607	−	++
−	−	−

of 1-10, 1,2,7 may be F+ still. Recheck 3.

Some platings may have been too heavy. unless Hfr!

5,12 should be rechecked after compatibility is contained.

Motility selection.

1072
summary.

11/7

SB-161 stocks streaked out. Individual colonies = 72A (1-20) grown (at 37°) in motility tubes (1-10) or plates (11-20). Mass inoculum for second passage. Also streak out these inocula and save s.c.i. = 72B(1-20)A. Streak out second passages and s.c. = 72B6(10)B-, for F test. Tests on 1-10 by JF (allogram separately, washed and plated D(0)) 11-20 by TCN (grown together, plated on EMSlac Th SM, DO Th sm').

Results on B×B series: All F− except 1, 2, 6, 7, 14, 15. 14 may be fersi Hfr (cf. W2206 = 1022 C3). Showed up by reduced fertility ♀ F+ as well as ~~[illegible]~~ conjugatability. Four prototrophs were recovered on EMSlac: 1: $^{1+}_{1-}$/2 2 $^{1+}_{3-}$/5 6 1+/1 7. $^{3+}_{3-}$/.. and thus are probably bona fide. Should be recovered, and further selected.

Series A should also be renewed.

S. gallinarum → x.

A. FA84 → x H901 mot. B .. → x 71A6 mot. / d see 1043.

9/15/53

A: 4/5. 9/18. → all gm +.
B: ditto ....

Previous failure maybe attributed to insufficient motility of the H901 used.

B control: ~~motant~~ nonmot. T.O: 9/19.
A control → j+++, pv − gm −

A4: maybe mixture of j, gm.
rx: pv+++ j++ gm ±

A5: j ++ pv ++ gm? d?
B5: gm ++ pv+++ j − d −

purified A0: j+++ d − gm −. = SW1096

A1: s.c. = SW1097 6/6 gm ± j+ ! (gm orig or X-ed?)
A4: s.c. 4/4 gm± j+
But note: A1 reacts ++ in pv / A0 − " in cross test. cf. SW 1041

Regrow FA85/SW775
84/SW774

9/17. 84A, 84B } S. gallinarum; 85A, 85B } S. pullorum → x 0901. few trails. 4T; 1S. few trails. 2T

Trails too short to isolate for selected higher transmission.

0901 no T or S.

later checks c fresh dilution of gm serum (1/60 of 1:5000)
pembrook SW1041, 1097 gm ++ pv++ j −
" 1096 gm − pv ± j ++.

10/10/53.

A. Test SW1028 = orig. N97b → × S. marini, b:1,5 in b,5 serum for occurrence of 1,2 phase. 1: stock culture 2: motility passage

B. SW1~~[illegible]~~ 1043 (~~[illegible]~~ FA86b) → × SW874 (Lorica bovida) / a, enx [for b(:12): enx]

1, 2, 3, 4 } stock culture — 3/4 migrated → b (wk. growth). #4 late – still enx. ~~Sec~~ s.c.i / b. benx
vb✓ in → enx. see orig.

C. FA15 SW803 enx (abnorm²) → × ~~[illegible]~~ N97 original / b; 1,2 for (b:12) enx (cf. SW426 1051–1055)

6/6 tubes migrated in 24h. 10/11 PM streakout.
all enx: ~~Sec~~ s.c.i. in enx, benx
(poss. contamination — abnorm in phage? Re FA15B, 15C) stability → in all b.

P11. Purify B1–3 C1–6.

A17. A1. → 1,... → s.c.i $1,^{2}$+++ 5++ 2– 1,5++. Probably had gone 1,10
A2 no migr. yet

C2,3. slow buds. Others still almost stationary.
in b, enx

B, C / b, env.

10/16 — C3 b+? z_{33}+? 1,2 – env – somewhat rough.

C4 still env +, b – ~~z33~~ 1,2 –

These were enlarging buds, not swarmers.

recheck on s.c.i.

10/17 swarmed to bottom B3

C1

Retest single colony isolates:

10/19 C3 : b. z_{33} ? + 1,2 – env – Remotility?.

C? : env + b; 1,2; env –

C4 : env +.

B3 : Rough. b?

1074

A) 976 → x main → b; 1,5 / b, 5 → 0 ✓

B) sw1043 → x Si lama hindg → b → eux ✓
a : eux

c) dbny eux → x N976 → eux → b → 0. ✓
b: eux

~~note~~ no; 2
(tighen)

---

pure eux of eux → x $H_1^{1,2}$ H_2 eux is still H_2?

---

pullorum, gallinarum → ✕

ca 10/10/53

Note: 1043: pullorum was tried extensively on SW1040/a and failed. Other pullorum ✕ should be tested → ✕ 957 for highest activity.

A. ↙ → ✕ 957 Test n.g. 3/4 owing to overgrown contaminant. All others gave numerous tracks. Also swarms in P2, 9, 12. P2 probably most active. (Test each on ½ small plate)

✕ B. P, G1 → ✕ Lowestoft 874/9, enx no swarms. test 2·P and 1·G anyhow 10/18: steel

✕ C. P, G1 → ✕ Eastbourne 770/chx; 1,5 2 each. No swarm.

1? D P, G1 → ✕ SW967 (dublin o) G1: few long tracks, 1 swarm. P1 single tracks!

✕ E P, G1 → ✕ SW989 (TM o) no T or S i either

✕ F P, G1 → ✕ SW991 (dublin i)/i 2 each

✕ G. P2 → ✕ SW1004 (Swinton)/a, 1,5 ca 10/14. } 2 each no swarms 10/19.

✕ H G1 → ✕ " " " }

J P2 → ✕ SW1040/a No swarms 10/19. Held to..

C, F poor migrators, rough. C still 1,5... F still i.

✕ ① SW1028/b+5. → slow bud: b- 1,2 +++ 1,5 ++ 2- 5÷ 1,10??

② (metalyst) v. slow spread noted 10/19.

(on next transfer → 5++ again)

S. typhi seemingly only receptor for phage from gallinarum. Results of pullorum equivocally negative.

✕. not finished.