8/23

PST — γ on B, growth of both

-150' .05 cc 24h aerated B → 20 cc broth, aerate at 37° = B_I

-10' new γ assay : 5×10^6 — 1 - 400, 2 - 532 — $[\gamma] = 2.3 \times 10^{10}$

-3' B, assay : 5×10^4 — 3 - 159, 4 - 164 — $[B] = 8 \times 10^7$

0' .02 cc γ → 1.98 cc B_I = B_γ, at 37° — in B_γ : $[\gamma] = 2.3 \times 10^8$

5' .02 cc B_γ → 1 cc broth cf tube, prewarmed

cf 4' sn, : 10^3 — 5 - 134, 6 - 155 — $[\gamma]_{free} = 7.2 \times 10^7 = 31\%$, Ads = 69 %, $[\gamma]_{ads} = 15.8 \times 10^7$

.1 → 20 cc broth — .1 → 10 cc broth

	:10 B	broth	:10 B	broth	γ ass	rel ass	B ass
7'		pure 7 - 93, 8 - 113	(mostly nibbled)				1×10^3
8'	9 - 169, 10 - 167				1.7×10^4	1.0	
15.7	11 - 202, 12 - 140				1.7×10^4	1.0	[illegible]
18'		(:10) 13 - 12, 14 - 7					$.95 \times 10^3$
21'	15 - 665, 16 - similar				6.7×10^4	3.9	
23	(:50) 17 - 479, 18 - sim				24×10^4	14	
27			19 - 130, 20 - 140		135×10^4	79	
28.5		(:10) 21 - 8, 22 - 15					1.1×10^3
30'			23 - 115, 24 - 130		122×10^4	72	
33'			25 - 97, 26 - 140		119×10^4	70	
38'			27 - 141, 28 - 142		141×10^4	83	
43.5			29 - 172, 30 - 146		159×10^4	94	
45'		(:20) 31 - 11, 32 - 13					2.4×10^3
50'			33 - 175, 34 - 155		165×10^4	97	
70'			35 - 196, 36 - 163		179×10^4	105	
100			37 - 193, 38 - 183		188×10^4	110	
102				pure 39 - 10, 40 - 14			12×10^3
185	185		41 -				
186	186		42 - 137	pure 43 - 165, 44 - 182 } few nibbled			173×10^3

Analysis.

In B_γ

$[\gamma] = 2.3 \times 10^{8}$ $\qquad B_I = 8 \times 10^{7}$

$[\gamma]_{free} = 7.5 \times 10^{7} = 31\%$ - $[\gamma]_{ads.} = 15.5 \times 10^{7} = 69\%$

$\gamma_{ads}/[B] = 1.94$ $\qquad [B]_{no\,\gamma} = 13.6\% = 1.16 \times 10^{7}$

$[B]_{survivors\,[B_\gamma]} = 10^{7} = 12.5\%$

step size = ~ 100

burst size = $\frac{1.7 \times 10^{6}}{7 \times 10^{3}} = 240$

$e^{-1.9} = 10^{-1.9 \times 0.43}$ $\quad .083\,E$ $\quad 1.16^{5}$

27 8 - 29 - 41

γ on B, test for $B_{no\,\gamma}$, and of growth of $B_{no\,\gamma}$

test whether transfer of B to new broth delays growth of B.

-150 .05 24h B → 20 cc broth, aerate at 37° = B_I

-10' γ assay : 10^7 1 - 248, 2 - 275

-3' B_I assay : 5×10^4 3 - 42, 4 - 51 7.3×10^7

0' .02 cc γ → 1 cc B_I at 37°

5' .02 → 1 cc br. in cf. tube, prewarmed

cf. 4' sn: 2×10^3 B 5 - 220, 6 - 235

$2.2 \times 10^2 \times 50 \times 50$

5.55×10

.2 cc → 10 cc broth

9' pure 7 - 20, 8 - 25 (n.c.)

19' 9 - 23, 10 - 21 (n.c.)

30' 11 - 10, 12 - 19 (n.c.)

41.5 13 - 15, 14 - 16 (n.c.)

105' :10 15 - 18, 16 - 25 (n.c.)

180 :100 17 - 80, 18 - 85

ni B_γ [B] 7.3×10^7

[γ] 5.2×10^8

free[γ] $= 2.3 \times 10^8 = 44\%$

$\gamma_a/B = 4.0$

$[B] = 2.9 \times 10^4$

$[B]_{no\,\gamma} = 2.2 \times 10^2 = .75\%$

$e^{-4} = 2\%$

$10^{-1.74}$ ~~7.826~~ ~~.87~~

7.26 1.8 %

2' 1 cc B_I in small tube, at 37°

7' .02 → 1 cc broth in cf. small tube, prewarmed

.02 → 20 cc broth, prewarmed

10.5 pure 19 - 257, 20 - 222

20.5 21 - 278, 22 - 265

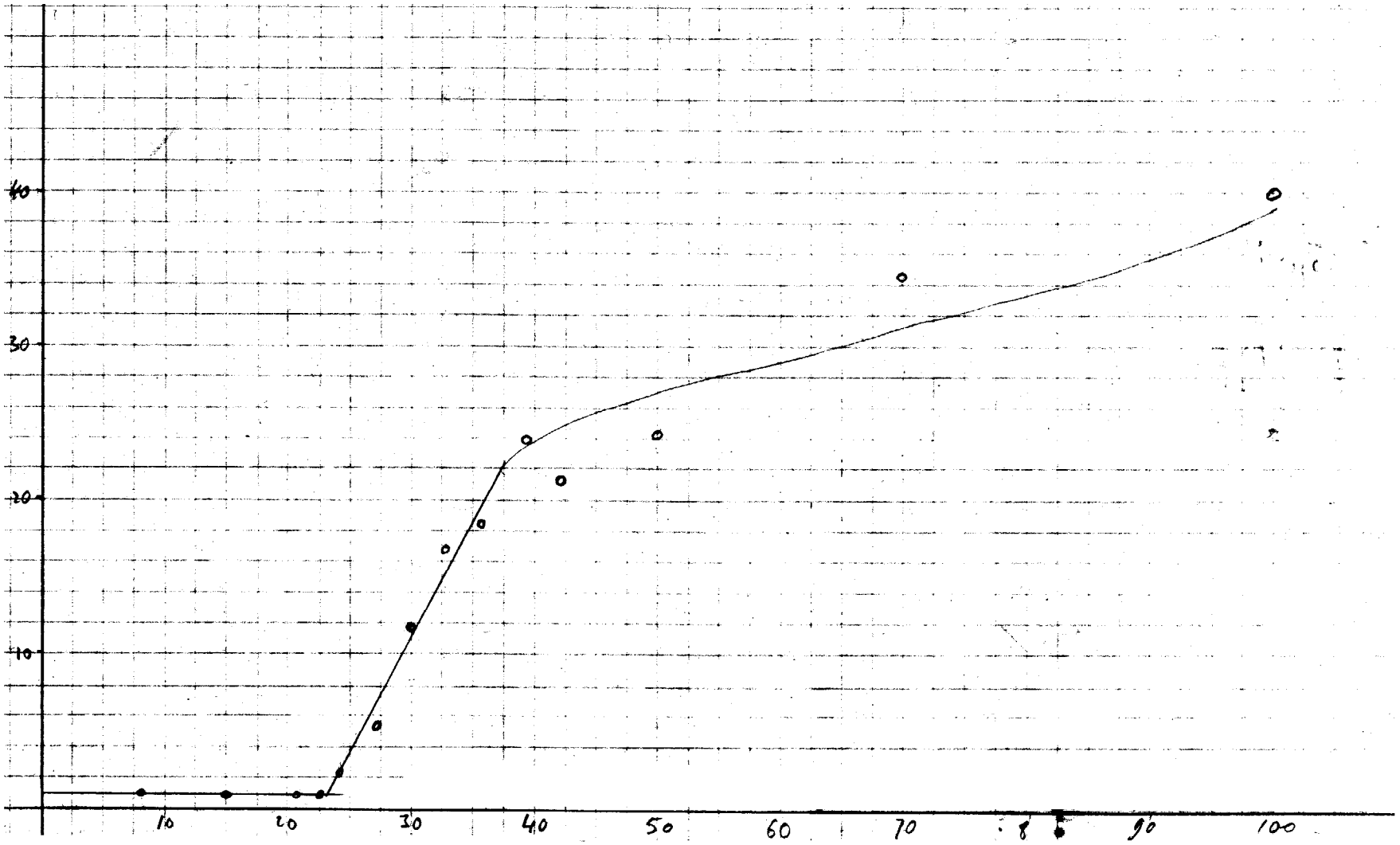
31' 23 333, 24 370

43' 25 - 402, 26 - 478

106 :20 27 - 292, 28 - 370

182 :200 29 - 317, 30 - 337

Delay of ~12


40
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80
90
100

γ on B, multiple infection 8/20

PST

150 .05 cc 24h aerated B → 20 cc broth, aerate at 37° = B_I

−10' γ assay : 5×10^6 1 - 295, 2 - 390, 3 - 147, 4 - 147 [γ] = 1.7×10^{10}

+2' B_I assay : 5×10^4 [B] = 7.4×10^7

0 .1 cc γ → .9 cc B_I at 37 = B_γ -

5' .1 cc B_γ → .9 cc broth, prewarmed -

.02 cc → 1 cc br. in cf. tube, prewarmed -

cf. 4', sm : 10^3 5 - 129, 6 - 144

I: .1 cc → 20 cc broth :10 | II: 1 cc → 9 cc broth :10 = | assay $\times 10^{-4}$ | rel. ass.

8	7 - 71 8 - 81		.75	1
15	9 - 75 10 - 74		.75	1
21	11 - 88 12 - 102		.95	1.3
22.5	:20	13 - 39 14 - (242)	.78	1
24	:50	15 - 36 16 - 29	1.6	2.1
27		17 - 47	4.1	5.5
30		18 - 35 19 - 67 20 - 109	8.9	11.9
33		21 - 121 22 - 131 23 - 135	12.6	16.8
36		24 - 142	13.8	18.4
39		25 - 187 26 - 173	18.0	24.0
42		27 - 152 28 - 166	15.9	21.2
50		29 - 186 30 - 176	18.1	24.1
70		31 - 263 32 - 253	25.9	34.5
100		33 - 34 - 301	30	40

in B_γ : [B] = 6.7×10^7

[γ] input = 1.7×10^9
free = $.68 \times 10^9$
ads = 1.02×10^9 = 60%

γ ads/B = 15

B + γ free = 7.5×10^8
i.e. = 7.5×10^8

in tube I : [B] = 6.7×10^2
γ inj. = 1.7×10^4
γ free = $.68 \times 10^4$
step size = 24
final γ = 18×10^4
burst size = 260

PST

Adsorption and desorption of γ on B.

-150 .05 a 24^h B → 20 cc broth, aerate at 37° = B_I.

-10 γ assay : 4×10^6 — 1 - 129, 2 - 108 [γ] = 4.7×10^9

-3 B_I assay : 5×10^4 3 - 229, 4 - 222 [B] = 1.1×10^8

adsorption 0', 5'

(γ:20) .1 cc → .9 cc B_I = B_x

.02 cc B_x → 1 cc broth in cf tube

cf 4', m : 10^2 5 - 143, 6 - 107

dilutions

.1 cc → .9 cc broth cf. tube = B_q

desorption 6.5, 15

B_q : 50 9 - 105, 10 - 80

B_q cf 4', m : 10 7 - 149, 8 - 145

in B_x : [γ] = 2.35×10^7

[γ]free = 6.25×10^6 = 27%

[B] = 10^8

in B_q : γ = 4.7×10^4

γfree = 1.47×10^4 = 31%

γadsorbed/B ~ .17

The same with γ in excess, same B_I, all operations 2' later.

adsorption 0, 5.3

.1 cc γ → .9 cc B_I = B_y

.02 cc B_y → 1 cc broth cf tube

cf 4', m : 2×10^3 11 - 259, 12 - 246

dilutions

.02 cc → 1 cc broth in cf. tube, B_ψ

desorption 7.5, 13

B_ψ : 50 13 - 329, 14 - 449

B_ψ cf 4', m : 50 15 - 208, 16 - 245

in B_y : γ = 4.7×10^8

γfree = 2.52×10^8 = 53%

B = 10^8

in B_ψ : γ = 1.9×10^5

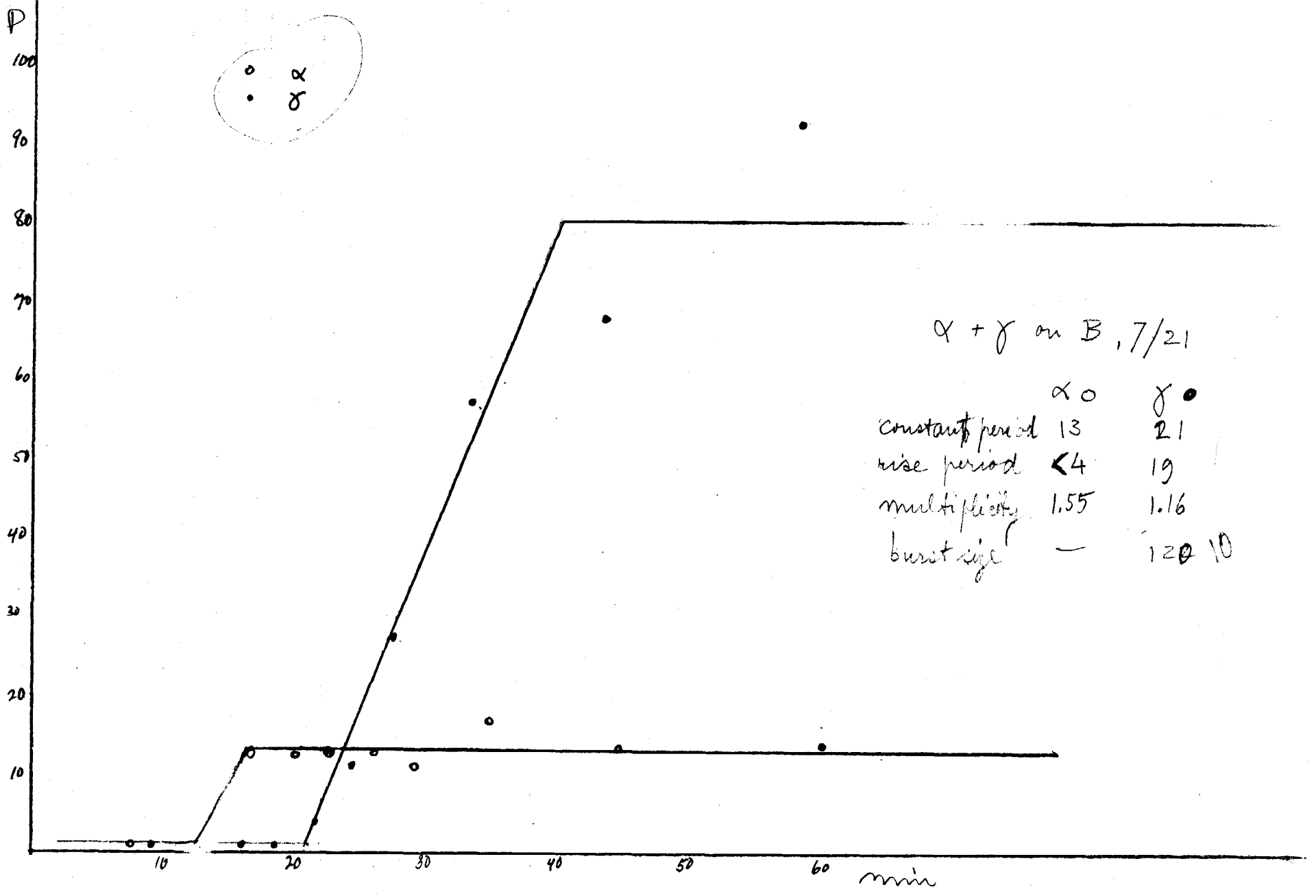
γfree = 1.13×10^5 = 60%

γadsorbed/B ≈ 2.2

Results: Small amount of desorption is well within the experimental error.

Percent adsorption ~ 1/2 in case of multiple infection than in case of B excess.

Adsorption is less than in other experiments. This may be on account of all adsorption tubes being cooled under running tap water.


P
100
90
80
70
60
50
40
30
20
10
10
20
30
40
50
60
min
α
γ
α + γ on B, 7/21
α ○
γ ●
constant period 13 21
rise period <4 19
multiplicity 1.55 1.16
burst size — 120 10

32 7-21-41

α + γ mB

PST

-150' .05cc 24h aerated B → 20cc broth = B_I, aerate at 37°.

-2' assay B_I : 5×10^4 1- 93, 2- 124

0' .1cc α + .025 c.c γ + 1.9 cc B_I (phage mixture prewarmed) = $B_{\alpha\gamma}$, keep at 37°

2' $B_{\alpha\gamma}$: 5×10^4, plated with C 3- 194, 4- 187

4' $B_{\alpha\gamma}$: 10^5, plated with A 5- 178, 6- 172

5' .02 $B_{\alpha\gamma}$ → 1cc broth in cf. tube, prewarmed

cf 4' sn : 10^3 mA 7- 180, 8- 176

sn : 5×10^2 mC 9- 118, 10- 130

.1 → 10cc broth .1 → 10 cc broth

	:20 A	:10 C	:20 A	:10 C	Assay α	Assay γ	rel. α	rel. γ
7.5'	11- 94, 12- 113				2.1×10^4		1	
9'		13- 148, 14- 134				1.4×10^4		1
16'		15- 145, 16- 145				1.45×10^4		1
17'			17- 10, 18- 15		2.5×10^5		12	
18.5'		19- 146, 20- 118				1.32×10^4		.95
20'			21- 11, 22- 15		2.6×10^5		12	
21.5'		23- 70, 24- 120 (:50c)				5×10^4		3.5
23'			25- 12, 26- 16		2.8×10^5		13	
24.5'				27- 12, 28- 19		1.6×10^5		11
26'			29- 14, 30- 23		2.7×10^5		13	
27.5'				31- 40, 32- 38		4×10^5		28
29'			33- 10, 34- 14		2.4×10^5		11	
33.5'				35- 85, 36- 74		8×10^5		57
35'			37- 19, 38- 17		3.6×10^5		17	
43.5'				39- 85, 40- 103		9.5×10^5		67
45'			41- 17, 42- 12		2.9×10^5		14	
58.5'				43- 130, 44- 133		1.3×10^6		92
60'			45- 15, 46- 15		3.0×10^5		14	

7-21-41

Analysis of $\alpha + \gamma$ on B.

The adsorption mixture, $B_{\alpha\gamma}$, contained

$[B] = 5.5 \times 10^7$/c.c. $[\alpha] = 17.5 \times 10^7$, $[\gamma] = 9.5 \times 10^7$

after 5', $[\alpha]_{free} = 9.0 \times 10^7$, $[\gamma]_{free} = 3.1 \times 10^7$

$[\alpha]_{ads} = 8.5 \times 10^7$ 50% $\quad [\gamma]_{ads.} = 6.4 \times 10^7$ 67%

$\frac{\alpha_{ads}}{B} = 1.55 \qquad \frac{\gamma_{ads}}{B} = \text{[redacted]} = 1.16$

$e^{-1.55} = .21 \qquad e^{-1.16} = .32$

Calculate the B with no phage. $= B_0 = 6.5\% = .36 \times 10^7$

α, no γ $= B_\alpha = 24.5\% = 1.35 \times 10^7$

γ, no α $= B_\gamma = 14.5\% = .80 \times 10^7$

$\alpha + \gamma$ $= B_{\alpha\gamma} = 54.5\% = 3.00 \times 10^7$

100%

The α assay at 7.5' gave 10.4×10^7 c.c.

This should consist of α free $= 9.0 \times 10^7$

$+ B_\alpha = 1.35 \times 10^7$

10.35×10^7

perhaps $+ B_{\alpha\gamma} = 3.00 \times 10^7$

13.35×10^7

The γ assay at 9' gave 7.0×10^7

This should consist of γ free $= 3.1 \times 10^7$

$+ B_\gamma = .8 \times 10^7$

$+ B_{\alpha\gamma} = 3.0 \times 10^7$

6.9×10^7

Step size: α: actual step size = 13.5

absol. phage increase $= 1.3 \times 10^9$

burst size calc. $(B_\alpha + B_{\alpha\gamma}) = 30$

" " " $B_\alpha = 97$

γ: actual step size = 65

absol. phage increase $= 4.4 \times 10^9$

burst size calc. $(B_\gamma + B_{\alpha\gamma}) = 115$

" " " $(B_\gamma) = 550$

7-24-41

α on γ infected B

PST	
-150'	.05 cc 24h aerated B in 20 cc broth - aerate at 37°
-10'	[α:100] : 2×10⁴ assay (on A) 51 - 170, 52 - 183
-2'	B assay : 5×10⁴ 41 - 115, 42 - 121
0'	.05 γ + .03 [α:100] + 1cc B = B_I
5'	.02 B_I → 1 cc broth cf. tube
	cf 4', sm plated with A : 10 43 - 125, 44 - 127
6'	:10 A 45 - 153, 46 - 134

B assay 6×10^7

α in B_I = 11.0×10^5

α in sm = 6.25×10^5

α in 6' (B_I) = 7.2×10^5

[~ 3×10^8 γ - If adsorption 60% ~ 3γ/B B without γ ≃ 5%]

Infect. centers − free ph. = $[7.2 - 6.25] \times 10^5 = .95 \times 10^5$

Bacteria with phage 4.25×10^5

$$\frac{\text{Infect. centers} - \text{free ph.}}{\text{Bact. with phage}} = 4.5$$

Results: Only about 20% of the adsorbed α showed up.

It seems that α adsorbed on B + γ does not form plaques.