October 17, 1940

My dear Taylor,

I have just completed the job of work on scoring of which I told you earlier, and enclose you copies of a few tables, (a) scores for 56 combinations based now on both A and B readings, between which there is no sign of a significant difference. This may be important as indicating remarkable physical similarity between the physical systems determining the absorbtion of α and β on red cells. For the moment its chief point is that I can use the whole body of data to give a rather accurate set of scores. The second table (b) gives nearly equivalent titrations, the effects differing by .1 of a two fold dilution, i.e., by about 7% antibody concentration, the standard error of a single titration, using these scores, being just [redacted] about 33%. I give a third table (c) which I use to calculate the variance between these three successive readings used in each titration, regarding these as independent estimates - which they may or may not be, for the analysis shows that there is less variation between these even than the small residual found by comparing different cells with different sera, as would be expected even with independent readings or if there were any specific residual affinity between cells and sera, or any variation in technical procedure capable of affecting ~~the~~ a whole dilution series similarly. I do not imagine that there is here anything more to follow up, but the analysis so far is of some interest.

I have further rescored the 60 titrations which you gave in your paper on Weak A reaction. Here the residuals may be obtained from the three expressions

$A_1 - A_2 + A_1B - A_2B$ or, briefly, $A_1 - A_2$

$A_1 + A_2 - A_1B - A_2B$, or, briefly $O - B$

and, finally, the interaction

$A_2 + A_1B - A_1 - A_2B$

On the enclosed ~~mss~~ Ms sheet I give these in three columns and derive from each the total mean and sum of squares of deviations from the mean, i.e. the contribution to the residual variance for which these 14 degrees of freedom are responsible; finally the variance of a single titration inferred from each set. These are all rather large, i.e. .20, .15, and .26, as compared with .11 from the very large material obtained two years ago. Why they are large may be worth discussing; I mean they may be readings by different people instead of all by Miss Prior as was the case with the material on which the scores were based, e.g. there are no symbols? However, whatever the cause, the surprising thing is that the contrast $A_1 - A_2$ is not more variable than the others, as I think it should be if the 15 different sera differed at all in the proportion of α and α_1 which they contain. It suggests, in fact, that possibly these two substances occur naturally very nearly in a fixed proportion, so far, that is to say, as really rather refined tests can show. On the view that these 15 sera differed appreciably in the ratio in which these two substances occur, we should have expected something like a variance .30 for $A_1 - A_2$, and perhaps .11 from the others. I believe we never used an A_2 [for cells] in the titrations two years ago, but if we did there would be some further data for checking up this point, which I think you will agree has some theoretical importance. Perhaps also you have now more data of the kind which you published, which could be included in the test.

Even if α and α_1 occur in fixed proportion, the impression you have that a preliminary titration will give an idea that a particular serum is specially suitable for absorption to produce α may [well] be well founded relative to the individual cells to be used for absorption. It may, in fact, depend on such residual affinities as might also explain the greater agreement of readings in the same titration as compared with readings when several different sema and cells are compared.

I think this aspect of the subject is ripe for discussion between us, with a view to publishing what has been learned so far.

If you check my scorings, as I hope you will, or have them checked, you will notice that in three cases only two readings wer are available, and in those I have inferred what the one behind would be from what happens in other cases. In fact, before the readings ## () - I find in seven cases a ## and in one case a V, and give a compromise score accordingly. Before a sequence + () - I have seven cases all ## , and before the reading () w - I have 19 cases, of which 8 are ##, 10 + and one (). These frequencies are taken from the 60 titrations concerned, so I imagine they afford a rational basis for compiling the score in these three doubtful cases.

Yours sincerely,

a)

Scores for 3's combination using both A x B and B x A matrices

<u>Absolute method</u>

3	V ·97006
a	# ·65458
b	+ ·52816
c	() ·37983
d	w ·19009
e	? ·00000

V	V	V	V	V	V	V	V
V	V	V	V	V	V	#	#
V	#	+	()	w	?	#	+
2·91	2·59	2·47	2·32	2·13	1·94	2·28	2·15
V	V	V	V	V	V	V	V
#	#	#	+	+	+	+	()
()	w	?	+	()	w	?	()
2·00	1·81	1·62	2·03	1·88	1·69	1·50	1·73
V	V	V	V	V	#	#	#
()	()	w	w	?	#	#	#
w	?	w	?	?	#	+	()
1·54	1·35	1·35	1·16	0·97	1·96	1·84	1·69
#	#	#	#	#	#	#	#
#	#	+	+	+	+	()	()
w	?	+	()	w	?	()	w
1·50	1·31	1·71	1·56	1·37	1·18	1·41 ~~1·03~~	1·22
#	#	#	#	+	+	+	+
()	w	w	?	+	+	+	+
?	w	?	?	+	()	w	?
1·03	1·03	0·84	0·65	1·58	1·44	1·25	1·06
+	+	+	+	+	+	()	()
()	()	()	w	w	?	()	()
()	w	?	w	?	?	()	w
1·29	1·10	0·91	0·91	0·72	0·53	1·14	0·95
()	()	()	()	w	w	w	?
()	w	w	?	w	w	?	?
?	w	?	?	w	?	?	?
0·76	0·76	0·57	0·38	0·57	0·38	0·19	0·00

(b) Nearly equivalent titrations

A × α and B × β together by absolute method

	.				*		
V	V	V	V	H	V	V	
V	H	+	V	H	H	H	
?	()	+	?	H	()	w	.0
?	-	-	?	-	?	w	
?	-	-	-	-	-	-	

.	.			
V	V	V	V	
+	+	()	V	
+	()	()	w	.1
?	w	()	-	
-	-	-	-	

		*	*	.		
V	V	V	V	V	V	
H	V	H	H	+	V	
+	w	+	()	+	w	.2
-	?	?	w	w	?	
-	-	-	-	-	?	

			.		
V	V	V	V	V	
V	H	V	H	+	
()	H	()	H	()	.3
-	-	?	?	()	
+	-	-	-	-	

	*					
V	V	V	V	V	V	
V	H	H	+	V	V	
w	+	()	+	()	w	.4
w	w	()	()	?	w	
-	-	-	-	?	?	

	.		.		
V	V	V	V	V	
w	V	V	H	V	
+	+	()	H	+	.5
-	?	w	w	?	
-	-	-	-	?	

		.		.		
V	V	V	V	V	V	
V	V	H	+	V	V	
H	H	+	+	()	w	.6
-	?	()	+	w	w	
-	-	-	-	?	w	

					*	
V	V	V	V	V	V	
V	V	H	H	V	V	
+	()	H	+	H	+	.7
w	()	()	+	?	w	
-	-	-	-	?	?	

		*			
V	V	V	V	V	
V	H	H	V	V	
H	H	w	()	()	.8
w	+	?	()	w	
-	-	-	?	w	

			*			
V	V	V	V	V	V	
V	V	V	V	V	V	
V	V	+	+	+	()	.9
-	?	()	()	w	()	
-	-	-	?	w	w	

C -

V =	2.91018
	1.96374
+	1.61448
( )	1.13949
w	.57027
?	

Sums of Squares for individual readings for each of 56 combinations i.e. frequencies

out of 1380 titrations

V V V (0) 2.000	V V # (0) 0.704	V V + (5) 0.528	V V ( ) (6) 0.549	V V w (5) 0.970	V V ? (3) 1.826	V # # (1) 0.704	V # + (10) 0.307
V # ( ) (28) 0.029	V # w (21) 0.091	V # ? (14) 0.587	V + + (1) 0.528	V + ( ) (24) 0.138	V + w (40) 0.068	V + ? (24) 0.431	V ( ) ( ) (6) 0.549
V ( ) w (16) 0.298	V ( ) ? (18) 0.481	V w w (4) 0.970	V w ? (4) 0.936	V ? ? (1) 1.826	# # # (6) 2.000	# # + (16) 1.383	# # ( ) (36) 0.804
# # w (48) 0.508	# # ? (23) 0.643	# + + (12) 1.383	# + ( ) (47) 0.694	# + w (98) 0.260	# + ? (95) 0.267	# ( ) ( ) (13) 0.804	# ( ) w (78) 0.195
# ( ) ? (115) 0.017	# w w (13) 0.508	# w ? (46) 0.114	# ? ? (3) 0.643	+ + + (3) 2.000	+ + ( ) (11) 1.200	+ + w (33) 0.639	+ + ? (40) 0.509
+ ( ) ( ) (7) 1.200	+ ( ) w (41) 0.458	+ ( ) ? (146) 0.148	+ w w (15) 0.639	+ w ? (70) 0.112	+ ? ? (14) 0.509	( ) ( ) ( ) (0) 2.000	( ) ( ) w (14) 1.078
( ) ( ) ? (29) 0.587	( ) w w (5) 1.078	( ) w ? (49) 0.370	( ) ? ? (13) 0.587	w w w (0) 2.000	w w ? (7) 1.076	w ? ? (3) 1.076	? ? ? (0) 2.000

d/f	Sum of Squares	Reduced to titration basis	Mean square	
2760	525.759	175.253	.063497	Within titrations
1025		112.825	.11007	Residual between titrations.