MENTAL TESTING IN MALE ADOLESCENT DELINQUENTS.*

By F. H. TAYLOR, M.D., D.P.H., D.P.M.,
Medical Officer, H.M. Prison, Wormwood Scrubs.

IN this paper an account is given of the results of investigation of the use of the Columbian group test in a series of 10,000 male adolescent prisoners between the ages of sixteen and twenty-two years.

For many years now great interest has been shown in intelligence tests, and even in the Bible reference is made to the possibility of rapidly assessing the relative intelligences of a large group. In Judges, ch. vii, v. 1–7, it is related how Gideon wished to pick 300 men out of a total of 10,000, and how he did so by ordering them to drink at a stream. He then observed the men who drank in such a manner as not to leave themselves unprotected, discarded the others, and overcame the Midianites with the small chosen band. The first scientific investigations were made by Galton, and subsequent workers followed his methods. In pre-war days many tests were performed on college students, particularly by Cattell and his co-workers. In 1917, however, group testing came into sudden prominence. The story of how it did so is well known. When America entered the Great War on April 6, 1917, a meeting of psychologists was being held at Harvard University. They claimed that by means of intelligence tests they would be able to pick out rapidly the recruits who were so stupid that they were not worth training, and they offered their services to the War Department. The work of Binet and his co-workers began in the 1890's. A group of mental examinations was arranged by Yerkes, Bingham, Goddard, Haines, Terman, Wells and Whipple, and was tried out so quickly that by August it had been proved that not only could the psychologists do what they predicted, but very much more. Between September, 1917, and January, 1919, 1,726,966 men were examined. The original scheme was enormously extended to eliminate not only the unfit, but to assess the intelligence of all ranks, and especially to pick out men of general ability for promotion or for special kinds of military service. Men were tested in large groups, often 500 at a time, and all who did not obtain a reasonable number of marks were tested individually on the Binet system.

This test was named the Alpha test, and in the formulation two factors were stressed. Care was taken that the tests were " fool-proof ", that is, that each question admitted of only one simple unequivocal answer. Secondly, a

* Published by permission of H.M. Prison Commissioners, though it does not necessarily represent their views.

time-limit was placed on each paper. A second series of tests, the Beta tests, were later introduced to cover the class of illiterates and Americans of foreign extraction who spoke little English. These series of tests were the parents of a large progeny of group tests which are still multiplying. It was Yerkes and his committee who led us in the right direction, and though tests were existent before their time, to them must be given the credit for first drawing the attention of the psychological world to the possibilities of group tests.

In England the full possibility of group testing has never been realized. Such tests as have been devised and used have not been designed as a means of determining scales of measurement, but rather as a solution of educational problems. Burt did much work on the measurement of intelligence, and is responsible for many valuable group tests. Education committees, particularly in Bradford and Northumberland, have adopted such tests for the selection of scholarship children. But probably the most noteworthy advance in this country is the adoption by the Civil Service Commissioners of intelligence tests in their competitive examinations. It has been explained how originally group testing was introduced in order to pick out poor material, but as its possibilities were realized, use was made of its ability to pick out the better material. In this country the latter possibility has been employed almost exclusively, but in the present series group testing was used for its original purpose—namely, of picking out poor material for subsequent individual examination.

The Columbian group test was constructed by Ballard on American principles, and is the final product of many trials and changes. In two respects it varies from the usual American group tests. Less stress is laid upon the time factor, and the differentiating factor is difficulty rather than speed. Indeed, I have found that in only the first paper do most young offenders have difficulty in finishing in the allotted time. There are also a larger number of tests that involve distinct elements of reasoning. In five out of the six tests the contents are new, though the form is old. The sixth test was devised by Ballard and was called " common sense ". As a result a very balanced series was produced, which brings into play various aspects of intelligence and gives the slow, plodding thinker as much chance as the quick and volatile.

The test was introduced into the Prison Service in 1925, and has now become a routine examination on nearly every male adolescent prisoner received into Wormwood Scrubs Boys' Prison. From May, 1934, until December, 1937, 11,301 male adolescent prisoners passed through the Boys' Prison, and of these 10,000 (= 88·49%) were examined. Of the 1,301 boys who were " missed ", 126 (= 9·68%) were suffering from medical contra-indications, e.g., vermin, itch, mental disorder, bad vision, venereal disease or were bed patients. 445 (= 34·2%) were bailed, discharged, went to court or were transferred, or paid fine before a test could be made. 50 (= 3·84%) were aliens. 571 (= 43·89%) were young prisoners or lodgers who were passed

over because of urgency of work. One boy only (·08%) refused the test, while only 108 (8·3%) were avoidably "missed". This 108 represents only ·96% of the total 11,301 (see Table I).

TABLE I.—*Illustrating the Reasons for* 1,301 *Boys being Missed out of the Series of* 11,301.

Reason for "missing".	Number of boys.	Percentage.
Medical contra-indications, e.g., vermin, itch, mental disorder, etc.	126	9·68%
Bailed, discharged, paid fine, etc.	445	34·20%
Young prisoners or lodgers	571	43·89%
Aliens	50	3·84%
Refused test	1	·08%
Avoidably missed	108	8·30% (= ·96% of total)
Totals	1,301	11·51% of total

Of the 10,000 boys taken for the test, 322 were found to be illiterate, and the results of the remaining 9,678 are shown in Table II. An even clearer idea of the distribution of Columbian scores can be obtained by reference to Fig. 1, in which the Columbian rating in marks is plotted against the frequency. The Columbian rating is given in groups of five for convenience. It will be seen that a fairly uniform rise occurs in frequency up to a maximum in Group 60–65. The frequency remains about the same up to a score of 75 and then drops sharply away. The arithmetic mean of the series is found to be 61·182 marks, and the standard deviation is 18·73 marks. This gives a coefficient of variation of 30·614%. The median, or centre value of the series, is 63 marks, and the mode, or maximum, point on the curve which most closely describes an observed frequency distribution is 67·636 marks.

Ballard gives the following age norms:

Age	10	11	12	13	14	15
Norms	46	56	64	69	72	74

The present series suggests norms a little lower than those quoted, and the norm for the young adolescent prisoner may be taken broadly to lie between 60 and 70. In the graph the frequency of illiterates is included for comparison. The standard error of the mean is 0·19, and the standard error of the standard deviation is 0·135.

The test is conducted by a specially detailed officer, who thoroughly understands its principles. Boys are tested in groups of about eight, and throughout

TABLE II.—*Showing Results of* 10,000 *Columbian Tests.*

Number of illiterates = 322 = 3·22%.
Number below 40 = 1,160 = 12·00% (approx.).

Columbian score.	Number of boys in group.	Number in groups of 5.	Columbian score.	Number of boys in group.	Number in groups of 5.	Columbian score.	Number of boys in group.	Number in groups of 5.
1	0		36	44		71	218	
2	0		37	62		72	183	
3	0	4	38	28	384	73	190	978
4	2		39	25		74	168	
5	2		40	225		75	219	
6	2		41	128		76	181	
7	4		42	127		77	172	
8	12	46	43	106	611	78	181	884
9	12		44	116		79	166	
10	16		45	134		80	184	
11	7		46	127		81	155	
12	9		47	138		82	157	
13	17	90	48	120	652	83	158	728
14	23		49	124		84	145	
15	34		50	143		85	113	
16	24		51	157		86	132	
17	29		52	137		87	105	
18	24	140	53	152	773	88	112	521
19	39		54	176		89	107	
20	24		55	151		90	65	
21	42		56	162		91	71	
22	36		57	178		92	65	
23	22	183	58	172	892	93	52	256
24	39		59	177		94	36	
25	44		60	203		95	32	
26	33		61	184		96	21	
27	54		62	200		97	10	
28	41	220	63	217	986	98	1	32
29	44		64	191		99	0	
30	48		65	194		100	0	
31	66		66	196		Illit.	322	
32	70		67	219				
33	71	318	68	188	980	Total	10,000	
34	50		69	190				
35	61		70	187				

the test the boys are under observation. There is no possibility of cheating. Most of the lads enter with enthusiasm into the test, and the proportion who do not give of their best is very small. The first paper is given to the boys and an explanation given to them by the officer, who explains that a limit of five minutes is allowed, and also adds that though the boys are desired to do their best, there will be no disapprobation if they do not do well. The other papers are similarly dealt with except that papers 5 and 6 have no time-limit. The papers are collected and marked from a key, which allows of only one answer to each question, so that the standard is strictly constant.

All boys who obtain below 40 marks are further examined by the Prison medical officers on the Terman modification of the Binet-Simon scale. Of the

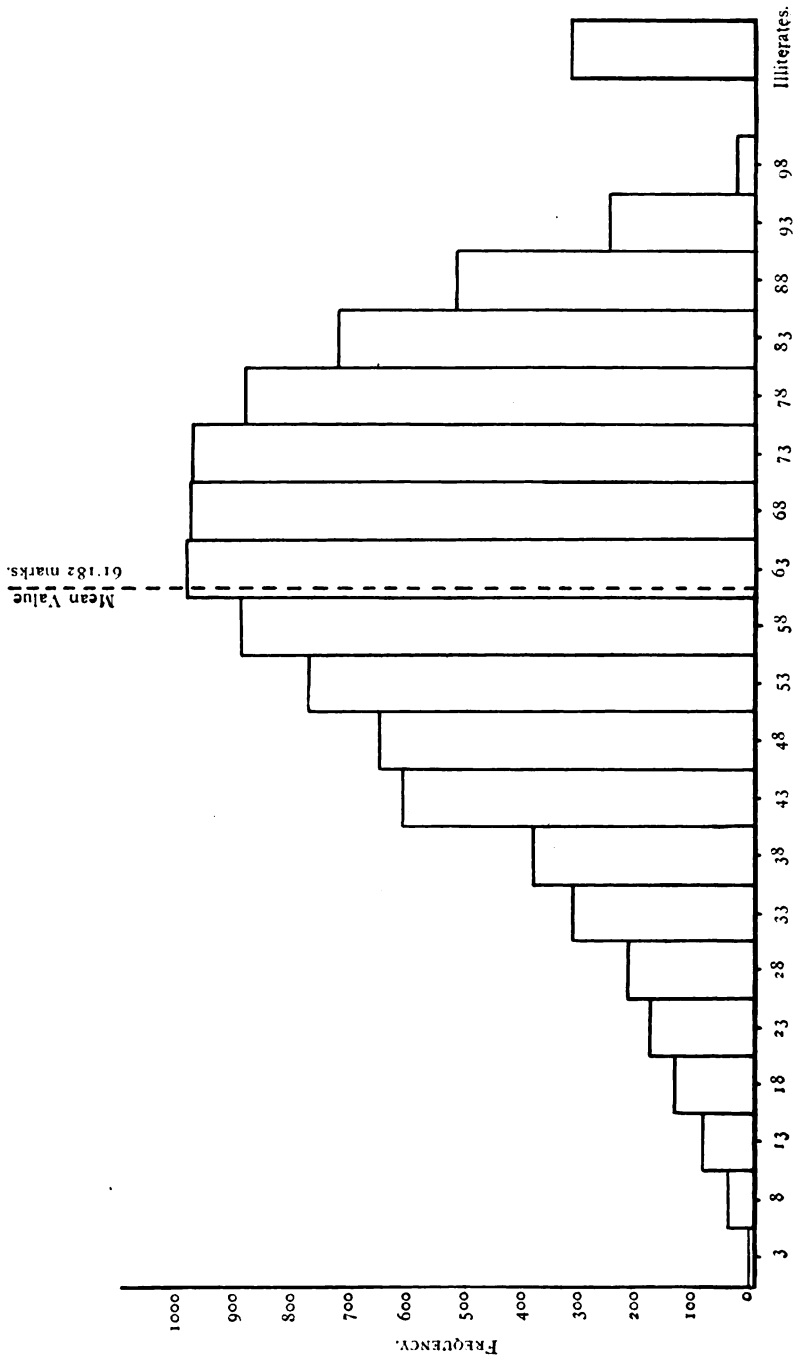

FIG. 1.—Diagram showing frequency of Columbian ratings in groups of five.

https://doi.org/10.1192/bjp.84.350-351.513 Published online by Cambridge University Press

10,000 boys in this series, 1,160 (= approximately 12%) were below 40. Some of these were investigated in hospital as a result of the request of magistrates for a report on their mental condition. It is my object, however, to demonstrate the value of a group test, such as the one under consideration, for

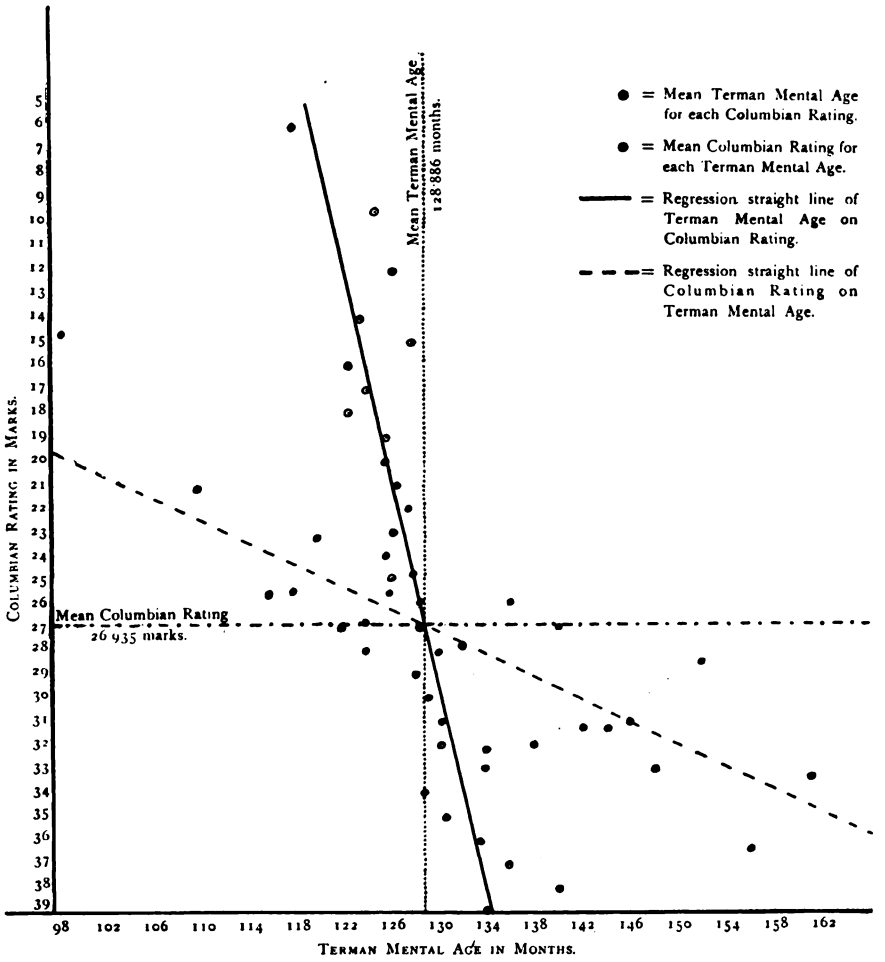

Fig. 2.—Diagram showing correlation between Columbian rating and Terman mental age.

picking out rapidly poor material for further more detailed investigation. 601 cases were taken at random whose subnormal mental condition attracted attention mainly on account of their low Columbian score or because of their illiteracy; 111 were illiterate and 490 had a Columbian rating of under 40. These 601 boys were examined individually by Binet-Simon tests as modified by Terman. The results are clearly shown in Tables III and IV. Table V shows mathematical data derived from these figures. Fig. 2 shows the

TABLE III.—*Showing Results of Terman Testing of* 490 *Boys with Columbian Ratings Below* 40.

COLUMBIAN RATING IN MARKS OUT OF 100.	TERMAN MENTAL AGE IN MONTHS.																																								Totals.
	92	94	96	98	100	102	104	106	108	110	112	114	116	118	120	122	124	126	128	130	132	134	136	138	140	142	144	146	148	150	152	154	156	158	160	162	164	
4		1																																						1
5															1						1																			2
6									1																															1
7																																								
8															1				1																					2
9																			1	2																				3
10														1		2	3	2																						8
11																			1				1																	2
12								1																	1															2
13														1	1			1									1													4
14				1											2		1			1	3																			8
15					1		1						1			2	1		3		1		1		2				1											13
16										1						1	1	2	1		1		1																	9
17									1			2			1	2	1	5	2												1									15
18	1												1	1	1		3	1	1		1			1																11
19													1	2	4	1	2		3	2			1		1		1												18
20													1		1		2		2	1			1																8
21						1						1	2	1	5		2	2	1		2		5		1		1	1												25
22										1			1			1	2	4	2	1	2				1						1									16
23														2	2		2		2		1			1	1															11
24												2	1		2	1	2	2	3		2		2		1															18
25											1				2	3	3	2	1	1	1	2	1	1																18
26													2			2		3	1	1			2		1				1											13
27									1			2		1	1	1	1	4	6	3	2	1		1	1	1	1				1									28
28												1		2	4	2	2	3		1			1				1												17
29														1	2	3	3	1	2	1	2				1		2	1				1							19
30													1			4	1		1	2	3		1		1								1						15
31														1	2	3	1	2	1	3	2	1	1		1	1	1							1					21
32													1	1	1	2	6	1	2	3	2		1		2	1	2										1		26
33													2	1		2	8	3	2	1	3	3	4		1		4	1	3	2					2				42
34															3	3	3	2	3	2	1	1		1				1								1			21
35									1			1	1	1	1	1	2	4	2	1	3	1				1	3		2				1						26
36													1	1			4	2		3	2	1		2			4						2						22
37												1		1		2	1	1	3	1	5	1	3	1	3		2		4		1		1				1		32
38																1					1	1		1			1	1	1				1						8
39																	1			1				2	1														5
Totals	1	1	..	1	1	1	1	1	4	2	1	10	16	18	37	39	58	47	47	31	41	12	26	11	20	4	24	5	12	2	4	1	5	..	3	1	2	490

TABLE IV.—*Showing Terman Mental Ages of* 111 *Illiterates.*

	TERMAN MENTAL AGE IN MONTHS.																																		Total.
	92	94	96	98	100	102	104	106	108	110	112	114	116	118	120	122	124	126	128	130	132	134	136	138	140	142	144	146	148	150	152	154	156	158	160	162	
Number of illiterates			1	2	3		3	1	1	2	7	8	5	6	7	3	9	4	5	4	13	4	3	2	2	1	8	2	4				1				111

correlation between the Columbian rating and the Terman mental age. The mean Terman mental age for each Columbian rating was calculated and the results plotted as a scatter diagram. Similarly a scatter diagram of the mean Columbian ratings for each Terman mental age was made.

TABLE V.—*Data from Correlation Tables.*

	Terman mental age (x).	Columbian rating (y).	Illiterate Terman mental age.
Number of cases	490	490	111
Mean	($\bar{x}$ =) 128·886 months	($\bar{y}$ =) 26·935 marks	124·847 months.
Standard deviation	(σ_x =) 10·482 ,,	(σ_y =) 7·792 marks	13·101 ,,
Coefficient of variation	$\left(\frac{\sigma_x \times 100}{\bar{x}} =\right)$ 8·13%	$\left(\frac{\sigma_y \times 100}{\bar{y}} =\right)$ 28·93%	10·49%
Regression coefficient	$\left(\frac{r\sigma_x}{\sigma_y} =\right)$0·430	$\left(\frac{r\sigma_y}{\sigma_x} =\right)$ 0·238	..
Regression equations	T.M.A. = 0·430 C.R. + 117·307	C.R. = 0·238 T.M.A. − 3·689	..

Correlation coefficient r_{xy} = 0·32.

Standard error of $r\left(\frac{1}{\sqrt{n-1}}\right)$ = 0·045.

N.B.—The Terman mental age is a discontinuous variable and is illustrated in groups of 2 months.

The mean Terman mental age was 128·886 months, and the mean Columbian rating 26·935 marks. From the other mathematical data two regression equations were calculated as follows:

T.M.A. − mean T.M.A. = Correlation coefficient ;

$$\times \frac{\text{Standard deviation of T.M.A.}}{\text{Standard deviation of C.R.}}$$

$$\times \text{(C.R. − mean C.R.)},$$

where T.M.A. means Terman mental age and C.R. means Columbian rating.

$$\text{T.M.A.} - 128{\cdot}886 = {\cdot}32 \times \frac{10{\cdot}482}{7{\cdot}792} \times (\text{C.R.} - 26{\cdot}935)$$

$$= {\cdot}430 \times (\text{C.R.} - 26{\cdot}935)$$

T.M.A. = ·430 C.R. + 117·307.

From a similar calculation C.R. = ·238 T.M.A. − 3·689 (see Table V).

From these formulæ two regression straight lines can be drawn. The method of calculation of the coefficient of correlation ensures that the regression straight

https://doi.org/10.1192/bjp.84.350-351.513 Published online by Cambridge University Press

line is drawn through the plotted points, so as to make the sum of the squares of the differences between the actual figures and the corresponding predicted figures as small as possible. No other straight line drawn through the plotted points could make the sum of the squared errors of the estimates have a smaller value, so that on this criterion the estimates are the best possible. If the two regression straight lines coincided, correlation would be perfect and the coefficient of correlation would be 1·0. If, on the other hand, the lines intersected at right angles the correlation coefficient would be 0. The coefficient of correlation between the Terman mental ages and Columbian ratings is low, 0·32 ; but as it is many times greater than the standard error of the coefficient, 0·045, the figure must be taken as significant and not due to chance. The figure is lower than those published by American workers for other group tests. It will be seen, however, that many cases with a low Columbian rating had a comparatively high Terman mental age, and if these boys had been treated as illiterates the correlation coefficient would have been much higher. In my opinion, in most of the cases just mentioned the low Columbian score was undoubtedly due to the inability of the boys to read the questions and commit the answers to writing quickly enough to complete the papers. It will be noticed that in only one case was a Columbian rating of over 30 accompanied by a mental age of under 9½ years. In this series of cases no occasion arose in which a boy whose Columbian rating was over 40 was certified as a feeble-minded person under the Mental Deficiency Acts.

It must be concluded, with good reason I maintain, that group testing is a very useful and fairly reliable means of rapidly classifying the intelligence of large groups of youths. The Columbian test has proved invaluable at Wormwood Scrubs Prison, and without some such test the probability of overlooking many retarded boys would be great. A retarded person rarely scores over 30 in the test, and almost never over 40. The test is easily applied by a careful but nevertheless non-medical examiner, and the method of marking is simple and standardized. Most boys enjoy performing the test and enter into it conscientiously. It is imperative, however, that the test be co-ordinated with individual testing on the lines described above.

Summary.

(1) A brief history of group testing is given.

(2) The Columbian group test and the principles of the various tests is described.

(3) The method used in the present series is described, and the results of testing a series of 10,000 youths between the ages of sixteen and twenty-two years is shown with the aid of tables and a graph.

(4) The correlation between the test and the Terman test is discussed and illustrated by tables and a diagram.

(5) It is concluded that the Columbian group test is a most valuable means of rapidly picking out retarded youths, with a view to further more detailed individual investigation.

My thanks are due to Miss L. Verling-Brown, B.Sc., Assistant Medical Statistician, H.M. Prison, Wormwood Scrubs, for her advice and assistance in dealing with the mathematical data.

BIBLIOGRAPHY.

BALLARD, P. B.—*Group Tests of Intelligence*, University of London Press, London, 1935.

BRADFORD HILL, A.—*Principles of Medical Statistics*, The Lancet, Ltd., London, 1937.

CATTELL, J. McK.—" Mental Tests and Measurements," *Mind*, 1890, xv, pp. 380, 373–380.

Idem and FARRAND, L.—" Physical and Mental Measurements of the Students of Columbia University," *Psychol. Rev.*, 1896, iii, pp. 618–648.

CATTELL, R. B.—*A Guide to Mental Testing*, University of London Press, London, 1936.

FINCH, F. H., and ODOROFF, M. E.—" The Reliability of Certain Group Intelligence Tests ", *Journ. Appl. Psychol.*, 1937, xxi, pp. 102–106.

OTIS, A. S.—*Self-administering Tests of Mental Ability*.

SOUTH, E. B.—*An Index of Periodical Literature on Testing, 1921–1936*, N.Y. Psychol. Corporation, 1937.

TERMAN, L. M.—*Measurement of Intelligence*, G. Harrap & Co., London.

Idem.—*Group Tests of Mental Ability*, G. Harrap & Co., London.

THOMPSON, G. H.—" The Northumberland Mental Tests (for Pupils of Scholarship Age)," *Brit. Journ. Psychol.*, 1922–3, xiii, pp. 72–75.

THORNDIKE, E. L., *et al.*—*The Measurement of Intelligence*. New York. Teachers' College, Columbia University xxvi, pp. 616.

WEISENBURG, T., ROE, A., and MCBRIDE, K.—*Adult Intelligence*, The Commonwealth Fund, 41 East 57th Street, New York, 1936.

WHIPPLE, G. M.—*Manual of Mental and Physical Tests*, third edition, 1924.

YERKES, R. M.—*Psychological Examining in the U.S. Army*, Memoirs National Academy of Sciences, Washington, D.C., U.S.A., xv.

YOAKUM, C. S., and YERKES, R. M.—*Army Mental Tests*, Henry Holt & Co., New York, 192c.