

JOURNAL OF CONSULTING PSYCHOLOGY

PSYCHOLOGICAL EXAMINATIONS OF EMINENT BIOLOGISTS

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NEW YORK, N. Y.

THIS paper gives the technical reports of Rorschach, TAT and a special verbal, spatial, mathematical test administered to 20 biologists. The men who served as subjects were chosen for their eminence in research. All of them have made significant contributions to understanding of basic, normal life processes. All were born and brought up in the United States and all are presently connected with universities or research institutions.

The tests were administered as part of a project to study the lives, personalities and work of these men in an attempt to isolate any common features in their personality structure which would set them off from other groups, and to investigate any relations that there might be between personality and vocational choice and performance. The study has been financed entirely by a grant from the United States Public Health Service (Research Grant MH-10), and will be continued during the coming year, with a similar study of physicists. Full details of selection of subjects, and results will be reported in a forthcoming monograph.

In addition to the clinical studies of the individual men, I have group Ror-

schachs of 196 members of 8 biological faculties in large universities and that of the National Museum which will also be reported elsewhere [4].

This group included 8 geneticists (4 each plant and animal) 4 botanists (plant physiology and taxonomy), 3 biochemists, 1 anatomist, 1 physiologist, 1 paleobotanist, 1 paleontologist, and 1 bacteriologist. That there are no zoologists other than those doing genetics primarily is a reflection of present trends in research. Selection of the men was by the following process. Members in biology of the National Academy of Sciences and of the American Philosophical Society were listed (omitting those over 60, foreign-born or now primarily in administration) together with a few other names of invited speakers at recent important symposia. These lists were submitted to a group of raters (Detlev Bronk, Hans Clarke, L. C. Dunn, W. J. Robbins, J. R. Schramm and G. G. Simpson) who rated them on a 3-point scale and added other names. The ratings were combined, and from these a list of 23 men was selected. Three of these declined to take part, and the others are reported here. Their average age is 51.2.

All of the men are married; only one has been divorced. Average age at marriage was 27.8, and they average 2.2 children each.

Most of them were able to go on to graduate work immediately following their B.A. work. Average age of receiving B.A. or B.S. was 21.8; Ph.D., Sc.D. or M.D. was 26.0. They hold an impressive number of honorary degrees and have received many prizes and

other forms of professional recognition. All but three are members of the National Academy of Sciences and/or the American Philosophical Society, our ranking scientific organizations.

It is of interest that of the 23 men asked to take part in the study, only three refused, although the time requested was a minimum of six hours. Actually, in most instances considerably more time was spent with each man, and many of them were gracious enough to invite me to their homes. Social contacts, particularly in the family setting, afford an invaluable check on interpretation.

The Rorschach was given and scored according to Klopfer's system, [1] and in addition Munroe's Inspection Technique [2] was utilized, this being, in my experience, the most useful means of dealing with these data for group research purposes. Responses during the test were taken down verbatim in shorthand; the inquiry was not always taken down verbatim.

At the beginning of the study, some variation in the TAT cards selected was made, but as the work progressed nine were settled upon and used for each man. These were, in the male series, 1, 2, 4 (introduced fairly late after late sexual development appeared to be common), 6, 7, 10, 13, 15, 11. For the most part these protocols were also recorded verbatim, although occasionally I fell behind a few who talk very rapidly and were difficult to slow down.

The Verbal, Spatial, Mathematical (VSM) test is one compiled for the purpose by Dr. William W. Turnbull of the College Entrance Examination Board. There was no test available which had sufficient ceiling for this group. In fact, it took two attempts to get a verbal section which would serve, although the spatial and mathematical sections are more than difficult enough. Whether they will prove so for the physicists next to be studied is another question. There are, of course, no norms for this test, but no standardized test

has norms which would be applicable to this group.

A life history was obtained, and each subject's research discussed at some length before any test was administered. They were always given in the order Rorschach, TAT and VSM.

THE RORSCHACH DATA

Quantitative data¹ are presented in Tables I, II, III and IV, which will not be verbalized in any detail.

That the number of responses is a little low for this level of intelligence is in general, I think, a result of the fact that professionally these men have arrived, although not all of them feel completely secure. Although for the most part very cooperative, most of them did not feel constrained to exert themselves to any great extent. I met with very little skepticism, expressed or not, over the nature of the technique. (One of them neatly turned the tables on me by presenting me, at our second interview, with several nicely done inkblots and a demand that I tell him what they looked like.) Except where time did not permit, or some other difficulty arose, I was able to go over the test findings with each man. There was practically no dissension, and frequent confirmation, sometimes of a rather dramatic sort.

The most striking findings are the prevalence of shading and color shock and the restriction of M. In view of the

¹Administration of the test to 20 was not very brilliant. It should have been repeated with a request for no anatomical responses. This was not done, because he was quite disturbed and annoyed that he could see nothing but pelvis and I felt that the suggestion would have been rejected, and might have prejudiced my being able to administer the other two tests. I am probably excessively unwilling to press subjects under these circumstances. I am not on the ground long enough, (nor sufficiently experienced in therapy to feel secure about it) to cope with any severe anxiety. This subject, incidentally, had gone out of town (not on business) and forgotten his original appointment with me.

TABLE I
RORSCHACH INSPECTION-METHOD DATA FOR TWENTY BIOLOGISTS

Subject:.....	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
R.....	39	33	41	26	23	16	19	11	16	26	11	15	23	17	23	29	20	10	28	15
T/R.....								+										+		-
Refusal.....								√				√			√		√	√√√		√
Location	W.....						+				+(BV)		B					+	+	
	Dd.....																			
	S.....	+		+	+	+		+	+						+	+	+			+
	Suc.....	11	1							1			1		1	11			+	
Content	P.....										B									-
	O.....	+											+							B
	At.....	+	+							+			+++		+		t			+++
	Range.....			-	+								t			t				t
Form	F%.....			+		+			(VB)	B										+
	F.....						v													B
Shading	ShSh.....	√	√		√	√	√	√	√√		√		√√			√	√	√√		?
	FK,Fc.....																	--		
	c.....																			
	C'.....				+						+								+	
	K,k.....	++								+		+								
Move-ment	M.....		--	+		--	-(M)	-(M)	--	(M)	--	-(M)	--	--	(M)		r			--
	FM.....		+++			--	+++	+	--				+		--	+				--
	m.....		+		+															---
	SM.....																			
Color	C Sh.....				√	√	√√	√		√√	√√	√√	√	√	√	√	√	√		
	FC.....		-					--										--		
	CF.....																			
	C.....																			
	S C.....				+					+	-									
	C:M.....			---	+		+++			+										
ITS.....	8	10	10	8	2	10	9	10	8	9	11	5	13	8	8	8	5	13	3	19
T%.....	23	27	10	8	13	25	21	18	19	4	9	7	48	0	4	10	5	0	0	20
W%.....	20	21	20	57	26	47	79	45	56	39	73	52	48	41	22	24	50	70	60	56
F%.....	46	45	63	35	48	59	32	36	38	31	36	47	48	59	48	34	45	20	25	67
F+ %.....	83	87	96	89	91	80	50	75	83	100	80	100	64	90	91	80	89	100	100	40

TABLE II
RORSCHACH DETERMINANTS USED BY TWENTY BIOLOGISTS

Subj.	R	M	FM	m	k	K	FK	F	Fc	c	C'	FC	CF	C	W	D	d	I	S	P	O	T
1	39	3	5	1	6			18	2			2	1		8	17	5	7	2	5	13	9
2	33	1	8	1				15	7			1			7	17	7	2		6	6	9
3	41	9	4					26				2			8	24	3	6		6	2	4
4	26	3	4	1				9	2			4	2		15	8		3		4	7	2
5	23	3	4					11	2			3			6	16		1		6	5	3
6	17	1						10	2			3	1		7	6	1	2		6	5	4
7	19	1	3		1			6	1		1	2	2		15	4				6	2	4
8	11	1	3					4	2	1		1			5	5		1		4	4	2
9	16	2	1		1	1		6	3			2			9	5		2		3	5	3
10	26	3	3	1		1		8	3	1		3	3		10	14	2			3	2	1
11	11		1	1			1	4	2			1	1		8	3				3	4	1
12	15	1	2		1			7	1			2	1		8	7				6	2	1
13	23	1	4	1				11	2			4			10	11		2		4	11	11
14	17	2	2					10	1		1	1			7	8	1	1		7	2	0
15	23	6	1					11	3			2			5	11	2	5		5	3	0
16	29	3	7	2				10	5			3			7	15	3	4		8	5	3
17	20	4	1			1		9	2			2	1		8	8		4		6	0	1
18	10	2	3		1			2		1		1			7	2		1		6	2	0
19	28	5	6	1	1			7	3		1	4			17	7		2	2	8	6	0
20	15							10	2			2	1		8	4		2		2	9	3

TABLE III
RORSCHACH DETERMINANTS (IN PER CENTS), TIME, AND TURNING OF CARDS
BY TWENTY BIOLOGISTS

R	W%	D%	Dr%	F%	F*+	F†+	Last	T/	Ave.	RT	RT	RT	d%	
					%	%	A%	3	Turning	R	RT	Range		
1	39	20	44	18	46	83	85	36	36	no	—	7.9	5-14	13
2	33	21	51	6	45	87	85	45	39	no	9	7.4	5-17	21
3	41	20	58	15	63	96	98	49	36	no	25	9.6	3-25	7
4	26	57	31	12	35	89	81	29	42	on I	30	17.5	8-27	0
5	23	26	69	4	48	91	96	39	56	yes	—	19.1	4-64	0
6	17	47	35	12	59	80	88	47	41	yes	57	19.5	4-40	6
7	19	79	21	0	32	50	42	48	27	yes	45	11.1	3-29	0
8	11	45	45	9	36	75	73	55	36	VIII & IV	65	28.3	3-100	0
9	16	56	31	13	38	83	75	38	31	no	30	10.5	1-30	0
10	26	39	54	0	31	100	81	31	35	no	28	2.5	1-4	8
11	11	73	27	0	36	80	63	46	36	no	49	8.7	1-19	0
12	15	52	48	0	47	100	80	47	47	on IV	44	33.5	8-102	0
13	23	43	48	9	48	64	74	39	48	yes	31	11.9	1-45	0
14	17	41	47	6	59	90	94	59	35	IV, V	39	9.6	2-22	6
15	23	22	48	22	48	91	95	26	43	no	39	26.8	1-79	9
16	29	24	52	14	34	80	79	55	28	yes	31	13.9	4-45	10
17	20	40	40	20	45	89	90	50	40	yes	36	22.9	1-65	0
18	10	70	20	10	20	100	70	60	20	no	78	28.6†	4-53	0
19	28	60	29	4	25	100	96	39	39	no	38	11.1	2-25	0
20	15	56	28	14	67	40	60	13	27	no	28	17.0	2-35	0

*F+ % of form responses only

†F+ % of all responses

‡On 8 cards only.

TABLE IV
CONTENT IN THE RORSCHACHS OF EMINENT BIOLOGISTS

Subj.	H	Hd	A	Ad	Aobj.	At.	Sex	Sci.	A. At	Obj.	Pl.	N	Geo.	Art	Des.	Mask	Abs.	Snow Ice	Blood	Expl. Fire	Cl.	Wind	Emb.	X-Ray	Other
1.....	4	2	8	6	1	2	1	6		1	2	5													1
2.....	1	1	13	2	1	5	1	3	2	1			1				1								Puddle
3.....	9	5	11	9	2			3	2																1
4.....	3	1	5	3	1	1		3	1	1	3		2				1	1							
5.....	3	3	8	1	2	3						1	1			1									refuse
6.....	1		7	1	2	1			1						3										1
7.....	2		7	1	1			1	1	2	2				2										
8.....	1		6	1	1	1									1										
9.....	2		5	1	1	1	1	1			2		1									1			
10.....	3		6	2	4	1	3		1							1	1		2		1	1			
11.....			5	1	2							1				1									
12.....	3		7		2			2			1														fountain
13.....	1		9			7		4	1																1
14.....	1	1	6	4	3				1		1														
15.....	4	3	4	2	2	4	1	2		1	1														
16.....	2	1	10	6	1	2		3	1						1					2					
17.....	3		10		2			1		1		1	1												
18.....	1		6		1			2									1					1			
19.....	3	1	10		2	1	1			3	5	1												1	
20.....			2		1	10		1											1						

importance of the former, I have listed below the responses of all of the men to Card VI on which shading shock is usually clearest, when it occurs. I am inclined to think that eventually a distinction will be made between shock determined by grayness or blackness and shock determined by tone variations, or texture. The latter is the commoner form in this group.² Material from the inquiry is indented.

VI. 2" 1. Another peculiar kind of animal. I suppose it's the bilateral symmetry that makes me think of animals. Plants don't have it, nor do mountains. An impossible kind of monster, head like a caterpillar.

2. The rest is sort of amorphous, like a rug.

I suppose animal if torn up.

3. Lower down if you will pardon my crudeness, testes.

VI. It seems to me almost all are animal

²C' was never used as a determinant and FC' very rarely as a main determinant. In these men FC' seems to be associated with a certain amount of passive stubbornness and opposition which does not get expressed in S responses.

rather than plant life. I don't know what that looks like.

64" 1. Looks like an insect emerging from a skin on which it has perhaps been feeding. Maybe it hatched there and grew to maturity and is coming out. There isn't any insect of that kind, but I —

Belonging to the cat family (the skin)

VI. 14" 1. pretty . . . the front part looks like a very peculiar flying animal of some sort.

(Front?) Going in that direction, the wind alignment I guess.

2. The main part is like a rug, fur, animal skin rug.

Shape rather than anything, the legs and — sprawled out.

3. Rather good face on each side half way down with a projecting set of chin whiskers.

4. Top of middle part, two little embryos, heads and trunks looking at each other.

VI. 10" 1. Well that part here looks to me like the larvae that's been dissected, various parts of it but the rest of it doesn't come in at all, this part down here, just a lot of ink.

Such as a Drosophila larva. As marked. Of course the shading there gives you the

. . . . it suggests that different organs are present in the larva.

VI. 8" 1. Now this, the front part reminded me $> <$ (slowly) Δ somewhat of a flying fish, the shape, 2 of them opposed, whereas this I haven't diagnosed, it makes it difficult. . . .

It even has eyes. as fluttering, they don't normally hold their fins out otherwise. It's not a good image, especially the wings, they aren't tattered like that.

2. Because it looks to me so like a sacrum or that part of the bony structure. The wings are too broad. I think I'll let it go at that. (Starts to put card down but pulls it back.)

3. There are some flat worms that look something like that; some quite broad flat worms that are blotchy but not with a head like that or such pronounced appendages on the side.

VI. 12" 1. A sea robin escaping from a patch of sea weed.

A sea robin is a fish, rather good of it, it has wings and legs.

2. Also looks like a skin, very much, again upside down, the tail up.

It looks soft.

I don't seem to have so many ideas.

VI. 5" 1. A hide pinned out. A wolf pelt.

Wolf partly because we had been talking of them. The shading, too, and the spread legs.

VI. 24" 1. This part is certainly the skin of some kind of an animal, sheep skin for want of something better and

Sheep? Association with one I have on the blanket roll which is more or less that shape but is still not so dark as that.

2. This is an insect which I can't name. The larval form of a mosquito or something, an aquatic type. (Wings?) I don't think they have wings while in the water. Took the whole thing together with a large grain of salt.

VI. 17" 1. Again like a stretched skin except for that uppermost part, or a rug lying flat, from an animal skin.

Clear. It felt like the fur side.

2. Upper part like the head of a tape worm a little bit.

Nothing in the rest.

a. There could be two heads facing each other, might be worm or caterpillar or something of that sort. The whiskers would be more in place then.

VI. 7" 1. That's the skin of an animal. Whiskers. Has 4 legs. I don't know what kind, I never saw that kind, but some kind spread out. I suppose it could be used as a rug but would make rather a queer one but spread out in a rug fashion.

I don't think I would have thought of it as furry if I hadn't been struck by the shape in the first place. Wing effect is some kind of fur coming out of head.

VI. 20" $\partial \Delta$ 1. A coon skin stretched out on a barn door drying. He's got a funny head but

It's tacked out or it's been tacked out and been dried in position, nailed at the stretched out points. It's the shading a little bit, this pattern in here isn't quite right for a coon skin but a definite pattern that suggests a hide.

VI. 5" 1. A stuffed skin of leopard, or calls back African Hall at Museum.

I mean flat, not stuffed. It's stretched out, pulled. I don't know why I said leopard, some exotic animal.

2. Head of some sort of very indeterminate creature.

3. Contour map with a valley running down it.

4. A cleared specimen in oil of wintergreen to show the vertebral column. What annoys me is all this stereotyping. Wintergreen because that's used to make the specimen transparent.

VI. 40" 1. Could be the beginning of a medical drawing but it isn't very meaningful.

Just a vague form. You have differentiation up in here, there is something different both in shape and quality, and a little bit of a thing here in the center (Couldn't be more specific about what it seemed to him to be)

VI. 7" 1. This has much more of a face suggestion, a cat with whiskers, but also has insect relationships.

This diaphonous material is part of what suggested an insect, like a butterfly wing.

2. Primary node and streak of an embryo. Somewhat inaccurate.

3. Spread of a puddle; flow of something

spilled as though it was ink.

(Not including upper D)

VI. 29" 1. Well, the principal part suggests somehow a suture that might have been in the body of some animal that was laid open but that isn't a very strong suggestion (pause of 68"). That's the only thing that occurs to me as though it might be a suture and some kind of vein or gut or something of that sort exposed.

(Cutoff W). It gives a sense of depth as though there was a trough there, there is some perspective.

V a. This suggests possibly some of those sticks that the African medicine men carry in their hands.

VI. 5" A 1. Having spoken of a chick embryo, you get them everywhere with the neural plate at the end, in this case sprouting wings.

It's the axis and the differentiated region laterally.

2. Oh, I see, that looks like some sort of bear skin leaving out that front part here, spread out on the floor.

(Fc clear in inquiry)

3. Some sort of a jet-propelled missile going out here shooting out sparks laterally, suggested of something shooting out here from some sort of a take-off, you have the impression of a trough, but I don't know just what.

Something going out, not quite an animal, running along a trough spurting flame laterally. It suggests flame spurting out of something.

VI. Oh, heavens.

20" 1. A symbol that might be used by a Navajo to represent in a schematic way a growing corn plant or perhaps a highly schematic animal in a Navajo sand painting.

W. The symmetry of the design reminds me of the sand painting. Would have to be very schematic. It's the color and shading.

2. The top of it looks like an insect head with bristles, the rest of it doesn't remind me of anything.

Upper D. Side pieces could be wings or possibly ?

VI. 7" It doesn't look like anything

30" 1. Something with whiskers on and

Upper D. Can't specify animal, just something but sort of head here

2. This looks like a vagina but it doesn't fit with that.

3. This is like a piece of the United States flopped over or something but it very strongly suggests a pattern.

Flopped because it didn't fit any known coast line.

VI. 25" Well that doesn't look like much of anything I ever saw before 55" that has me stumped, I'm just trying to think what it could look like. Trying to make something out of the something with whiskers on.

100" I think that's a new species of (?) of illustration. I just see it as a *nice* symmetrical figure with out very much meaning. You can see a resemblance between certain parts and certain things but take the thing as a whole it doesn't look like anything I'm familiar with.

On inquiry said readily he had seen several things in it, and gave them as

a. head of tarsius, and

> b. Animal. A rigid pose, could be a lamb except for the face. See chart for both.

VI. 15" Well, now this doesn't remind me of anything. Are you interested in knowing how it makes me feel? 40" I never saw anything that looked like this, it has the old steer hide look, looking at this much but all the rest of this it doesn't look like anything at all; it doesn't remind me of anything.

Fur because of color, dark along the back, the color tone. Fc.

2. Except the designs you see on wall paper or linen, I never saw one like this of course.

V 3. Actually these look like the ovaries of a bird that makes it sort of a bird, beak, tails and feathers, but that's reaching for it, the answer is it doesn't look like anything.

If these were colored I might feel more, or have more answers. (This in response to inquiry into how it made him feel. Could not elicit any statement of feeling tone in reaction to the card.)

Mild degrees of color shock are not uncommon in normal groups. It is somewhat less prevalent than the shading shock and I think of considera-

TABLE V
ANALYSIS OF WHOLE RESPONSES IN THE RORSCHACHS OF BIOLOGISTS

Subj.	W	W%	Cards	Level			
				Combinatorial	Better than Popular	Popular or equivalent	Poor or vague forms
1	7	20	I,II,V,VI,VII	1	2	3	1
2	7	21	I-VI incl.	1	1	4	1
3	8	20	I-VI incl.	2	2	4	
4	15	57	all but X	2	6	3	4
5	6	26	I-VI incl.	2	2	2	
6	8	44	all but II & X		2	4	2
7	15	79	all		3	7	5
8	5	45	I,II,V,VI,VII		1	2	2
9	9	56	all but VI, VIII	3	3	2	1
10	10	39	all but IX	3	2	5	
11	8	73	all but III,VI		4	1	4
12	8	52	I-VII incl.		1	5	2
13	10	43	all but X		1	4	5
14	7	41	I-VI		2	4	7
15	5	22	I,II,III,VI,VII		3	2	
16	7	24	I,II,IV,V,VI,IX		2	4	1
17	8	40	I-VII	1	2	4	1
18	7	70	all but IV,IX,X	1	1	2	3
19	17	63	all but X	6	2	8	1
20	7	56	all but I,VII,X			2	5

bly less importance unless strong.

In their research it is difficult to argue that these men are not creative. Their major contributions have been, for the most part, too significant to be judged otherwise. Nevertheless, as was the case with the artists I studied, *M* responses may be very few, and when adequate in number are often remote in content or restricted in activity. This is almost as often associated with a corresponding lack of *FM* as it is with an excess. The *FM* responses also tend to be very mild.

Some other points are of interest. *W%* is not particularly high, although above average; excess of unusual details (almost always *dr*) is much commoner, although there are four protocols with none of these. The nature of *W* in this group is particularly interesting, and an analysis is given in Table V.

One subject gave many more combinatorial *W*'s than did any of the other men. His situation is a rather curious

one. It is difficult for me to assess his work in this respect, but he does not appear to have very broad interests. On the other hand (and he is the only one in the group who makes a consistent practice of this) he invariably starts a paper with a statement of the general background and a very lucid exposition of how this particular piece of research fits into it which enormously simplifies the reader's task. He stands apart from the group in a number of respects. For one thing he seems to have become a scientist because he couldn't help himself, having the sort of mind he has, with really extraordinary powers of organization, rather than because science met an inner need, as seems to be the case with most of the others.

It is rather presumptuous of me to rate these men in terms of the breadth of their abstractions and theories, but I have made an attempt in all humility in order to try to check this against some Rorschach data. If the group is

divided into two parts on the basis of a rough Rorschach measure, constructed of the number of *W* better than *P* but not elaborate combinatorial, plus twice the number of the latter, plus one point for *M* over 3, and compared with a rough division on the basis of more or less breadth of abstraction, only two men are differently placed on the two bases. One is a man whose emotional difficulties are likely adversely to affect his judgment and the other is one who does much less generalizing than he might (perhaps because he is so very well balanced and controlled a man). This is very crude, and there are so many sources of error that it is included with misgivings, but only to suggest an approach to analysis of these relationships. What is perhaps more significant is that I was able for three of the last men I saw, after reading their work and before seeing them, to make not too bad predictions of the percent and quality of the *W* responses which would be given in the Rorschach. Again, this is only suggestive. One should probably also consider combinatorial *Dr*. These are not common, but probably have a similar meaning, perhaps with a special significance for limitation.

Technical responses (*T*) are rather few in this group, and in general more are given by anatomists than the others as might have been expected. Some of them, e.g. pollinium of a milkweed to D 12 of Card X were given by several subjects. Responses scored *sci* are not always *T*, the latter designation being given only when technical knowledge is clear.

F% is not generally excessive, but it should also be noted that responses in which *F* is not the dominant determinant are very rare. All of the *C'*, e.g. are *FC'*. The *m* and the *k* are more often *Fm* and *Fk* than *mF* and *kF*. For the most part *F+%* is high. Qualitative-

ly, also, there are indications of greater than usual care with form in comments on inadequacies or inaccuracies, even though they may have been accepted. Also it was not uncommon during the inquiry to have a response recalled that had been rejected because it didn't quite come up to acceptable accuracy of form, e.g. two of these men considered but decided against frogs in the lower detail of VIII on this ground.

These men have much the same un-aggressive, rather restricted sexual development and limitations of its expression that appeared in the study of artists, and that seems to be rather typical of professional groups in our culture. There is one outstanding exception, who can quite accurately be termed a "wolf" and I should think a very successful one, but this is probably the obverse of the same basic situation. One of the others insisted he had never been shy with girls but I am not too sure of this. The rest all gave, or admitted to, if asked, a history of social awkwardness, shyness with girls, and very frequently no dating to speak of until late college or graduate school days. An interesting additional point is the very common failure to give any response for the lower *D* in cards VII and VIII.

There is a considerable element of egocentricity in many of them which is determined more by disinterest in other persons, social uncertainties and lack of warmth, which are characteristic of many of them, than by any aggressive introversion, although it may sometimes have the appearance of ruthlessness.

THE TAT RESULTS

After experimenting with several "systems", I finally scored the TAT protocols following Wyatt [5], with only a few changes or additions. The basic data are given in Tables VI to X, which,

TABLE VI
SUMMARY OF ANALYSIS OF THEMATIC APPERCEPTION TEST PROTOCOLS OF BIOLOGISTS

Subj.	Story				Perception				Time Trend			
	S	SD	DS	D	Omit	Distort	Descrip. Detail	Deviation	Past, Present Future	Past and Present	Present and Future	Present only
1	6	7,13	2,10	15,11		2 church	(1) accident	13 (11)				2,6,7,10,13,15
2	6	1,2,4,10, 15,11	7			10 sexes	(1) (2)	1,10,11			1,2,6,7,10,15	4,11
3	2,6,7,10, 13							(7) (10) 13			6,7,10,13	2
4	4,7,10,13, 15,11	1,2,6					2,4	(2) (4) (6),7,(13)		7	1,4,6,10,13	2,11,15
5	1,4,6,7,15	2,10,13,11						(1) 4,10	13	4b,6,15	1,2,10,11	7
6	4,6,7	2	13	1,10,15,11				(1) 7,13				All
7	1,2,6,7,10	4,13,11		15	2			(1) (7)	1,6		2,4,11	7,10,13
8	2,6,7,10 13,15,11	1			2	10,sex		(2) 10	2,10	13	1,7,15,11	6
9	10,13,15	6,7,11	1,2,4		1		1,2,4	(1) (4) (10) (13) (15) (11) 6	2,13	1,15	4,6,7,10,11	
10	1,4,6,7,10, 13,15,11		2					(6) (13) (15) 11	6,7,10	15	1,2,4	13,11
11	1,6,10	2,4,7,13		15,11	1			(2) 6a (10) (15)		6a	1,2,6b,7	4,10,13,15
12	1,2,4,6,7, 10,13,15		11		1,4		11	(13)	4	2,13	1,6,15,10	7,11
13	1,2,6,7,10, 13,15	11						(1) (2) (5) (7) (10) 13,15,11	1,6,7,10,13,15,11		2	
14	4,6,7,10, 13,15	1,2	11		1,2,4			(6a) (13)			1,2,4,6,7,10,15 11	13
15	2,7,10,13, 15,11	1,6			1,13		6,10,13,15	(2) (6a, b) (7) (10) 15	1,10,15		2,7	6,13,11
16	1,2,4,6,7 10,13,15		11		1			(4) (7) (15)			4,6,15	1,2,7,10,13,11
17	1,4,6,7,15	13	2,10,11		1	10 sex	13	2 (4) 7, 10 (13)	1		4,6,7,11	2,10,13,15
18	1,2,6,13, 15,11,10	7			1			(7) (15) (11)			1,6,10,13,15,11	2,7
19	6,7,13,11		1,2,10	15				2 (6) 10			2,6,7,11	1,10,13,15
20	4,6		2,7,10,13	1,15,11					2		4	6,7,10,13

again, will not be extensively verbalized. Entries in the table are the numbers of the cards.

Description was resorted to chiefly for Card 11. The vagueness of the card was unpleasant and rather disturbing for many of these men who have a decided preference for the nonamorphous and factual. It has been noted in connection with subject 20 that he showed considerable disturbance. His TAT is largely descriptive, but nevertheless indicated that the depression he was suffering was not psychotic. Subject 6 thought it was all the "bunk"; although he went through the motions, he was basically noncompliant.

The omitted detail, listed under Perception, was most often the sheet of

music in card 1. Distortions were: Subject 1, interpretation of barn in card 2 as church; Subject 2, reversal of usual specification of sex in card 10, and a woman leading a boy into evil; Subject 8, card 10 taken as mother and daughter, whereas Subject 17 took it as a monk and a boy.

Entries in parentheses in the column head *Deviation* refer to stories which are not uncommon themselves but have an unusual twist. Other entries are for unusual stories. It should be stated that the reference point is my own experience, which is pretty well limited to superior normal adults.

The time trend is extremely curtailed, more so for the past than for the future.

Level is dominantly concrete-factual;

TABLE VII A
SUMMARY OF ANALYSIS OF THEMATIC APPERCEPTION TEST PROTOCOLS OF BIOLOGISTS
(Continued)

Subj.	Level					
	Concrete factual	Endopsychic	Symbolic	Mythical	Make-believe	Conditional
1	6	2,7,10,13	15		11	
2	1	2,6,7,10,15 (1)	11			4 (1)
3	2,6,7,10,13	(10)				
4	1,2,4,7,10,13,11 (6)	6 (1) (13)	(7), (11)	15		
5	2,4,6,7,10,13	1,15 (13)			11	(1),(4),(7)
6	1,2,4,6		15			7,10,13,11
7	6,7 (13)	1,4,10,13	2,15?	11		(1)
8	7,13	1,2,6,10,15 (13)	(15)	11		(1)
9	1,2,6,7,10,13,11 (4)	4,15				6,13
10	1,2,4,6,7,10,13	15 (1),(4),(10)	11			(1)
11	1,2,4,6,7,10,13	(1) (10)	15			(6), (7)
12	2 (1), (4)	1,4,6,7,10,13,15		11		
13	1,2,6,7,10,13,15	(1),(2),(3),(10),(13)			11	(2),(6)
14	1,2,4,6,7,10,13,15	(1)			11	(6)
15	1,2,6,7,10,13,15	(1), (10)			D11	(6)
16	2,4,6,7,10,13,15,11	1 (2),(6),(7),(15)				
17	1,2,4,6,7,10	13,15 (2),(7),(10)				11
18	6,7,10,15a (1)	1,15b	2 11?		11?	(13), (15)
19	2,10,13,11	1,6,7,15				(1), (10),(13)
20	2	1,4,6,7,10,13 (2)				(7)

TABLE VII B
SUMMARY OF ANALYSIS OF THEMATIC APPERCEPTION TEST PROTOCOLS OF BIOLOGISTS (Continued)

Subj.	Tone											
	Indifferent	Detached	Contemplative	Cheerful	Serene	Melodramatic	Unhappy	Tense	Anxious	Morbid	Aggressive	Sardonic
1		6	2,15?			13,11		7,10				(7) (15)
2				2			10,15	4,7,11	1,6			
3						7,13	6,10		2?			(12)
4					2	15	6,10,13	1	4,7		11	
5	1a					10,11	6,13,15	2,4a,7	1b		4b	
6				11		2,4,6,7 10,13,15		1				(15)
7			2		1	11	6,13	10,7	4			
8					7,10	11	13,15	1,2	6			
9							10,15	2,6,7	4,11	1? 13?		
10					2	11	4,10	6,7,13, 15	1			
11			2?, 15?			4	1,6,7 10,13					
12					(10)	15,11	4,6,7 10,13	1,2				(15)
13				1,2, 13,15		11		7,10	6			(15)
14			1			11	3,10,13, 15	2	6		7?	
15							1,2,6b, 10,13,15,11		6a		7?	
16							1,10,13 4,6,7	2,15,11		15?		
17	11					4,6	7,10,13	1,2				15 (4)
18					2,7,10		13,15	1,6 (7)	11	13a		
19	1					11		2,7,10, 15	6,13			
20	1,11			2			4,10,13	6,15	7			

TABLE VIII
SUMMARY OF ANALYSIS OF THEMATIC APPERCEPTION TEST PROTOCOLS OF BIOLOGISTS (Continued)

Subj.	Quality							Personal Relations				Presses					
	Simple→ Literate	Simple	Literate	Cliché	Col	Cr	Ev.	Formal	Emotional	Not Stated	None	Friend- ly	Un- friendly	Impersonal	Internal	?	
1			2,6,7,10, 13,15		(7)	(6)(7)		2,6,7	13	10	15	7		10,13	2,15	6	
2	1	6	2,4,7,10, 15,11					1,2,6	7,10,11	4	15	2,6,7	10,11		15	1,4	
3	2	10 (7)			6,7,13			6,10	2,7,13				7,13	2,6,10			
4	All	2						1,2,6,10, 15	7,13,11			1	11	6,10,13,15	4	2,7	
5			All			(10)		6,13,15	2,4,7,10, 11			1	4a, 7b	2,3b,7a	13,15,11	1	6,10
6	11				1,2,4,6, 7,10,13,15	(1),(7), (10),(13)		2,6,7	2,4,10,15	13	1,11	4	2	7,13	1,10,15	11	
7	10	4,6,7	1,2,15,11			18(4)		6,7	4,10,13	2	1,15,11	4,6,7	11	13	1,10,15	2	
8			All					1,2,6,7,10, 13		15	11	1,2,6,10	7	13,15,11			
9			All			(2)		2,10,15	2,4,6,7, 13			7	6	1,10,11	2,4,13,15		
10			All					1,2,4,6,7, 10	13,15			1,4,6,7	15	2,10	13	11	
11	7,10,15	1,2,6,13			(6)	(2),(4), (6),(7)		1,2,6b,10, 13	4,6a,7		15,11	1,4,7		6a,10,13,15	2	11	
12	1,2,4,13, 15,11	6,7,10						1,2,6,7	4,10,13,11			1,6,7	11		2,4,10, 13,15		
13			All					2,6,7,10, 11	1,13,15			1,2,7, 13,15		10			
14	1,2,15,11	4,6,7, 10,13				(7)		2,6b,7,10, 13,15	4,6a		1,11		6a,7	2,10,13,15,11	1,4		
15	1,2	7	6,10,13, 15,11	(7)		(7)		1,2,6a,10, 13,15	2,6b,7			11	1	7	2,6b,10,13,15		11
16	1,2,4,15	6,7,10, 13,11						6,7,13	2,4	10	1,15,11		2	6,7,10,13,11	1,15		
17	15	1,2,4,10 13,11		6,7 (4)				1,6	2,4,7,10, 15	13	11	1,10	2,4	6,7,13	15	11	
18	All							2,6,7,10	13		1,15,11	6,7,10	13	15,11	1,2		
19	6	1,10,13, 11	2	(7)		(2)	(15)	6	2,7,10,13	1,15	11	1	2,7,10	6,11	13,15		
20	All							2,6,10,13	4	7	1,15,11	4,7,6,7		2,10,13		1,15,11	

PSYCHOLOGICAL EXAMINATIONS OF EMINENT BIOLOGISTS

TABLE IX
SUMMARY OF ANALYSIS OF THEMATIC APPERCEPTION TEST PROTOCOLS OF BIOLOGISTS (Concluded)

Subj.	Outcome						Certainty of Outcome			Personal Reference	Refused	Personal Opinion
	None Possible	Success	Defeat	Unsolved Tension	By rule	None or ? given	Certain	Probable	Possible			
1	15,11					2,6,7,10,13					1 (11)	
2		1,2,6,7	10,15?			4,11	1,2,6,7,10,15			1,2,6,7		
3		13	7,10			2,6	13	7,10		10?		6,7
4		4,10,11	1	6	13	2,7,15	10,11	1,4,6,13		1		4,7
5		10,13 7,4b	11	2		1,4a,6,7,15		4b,10,13,11	2			(4)7
6	1,6,7,10,13,15,11					2				All but 15		
7	7	1,2,4 man 11	4 girl 6 11 others			10,13,15	2,6	4,11	1	7		4,13
8		2,7,10 for 1	11	15		6	10	2,7,11,15				
9		2,11	13	6,7	10	15,1		2,4,6,7	1,10,11,13			2,6,7
10		1,2,10,11	4,7,13	6		13,11,15	6	1,4,7,10	2			
11	6a,13,15	7,2	1,6b			10,11,4	1,2	7,6b		1,7,10,15	(11)	2,4,6
12		6,15		1,4	10	2,7,13,15,11	1,6,15	4,10				
13		1,2,7,10,13,11		6 (7), (10)		15	1,6,10, 13,15,11		2	7		
14	13	1,6,7,10	4,11	2,15		(13)	1,2,6	4,5,11	7,10	1		7
15	6b,13	1		2,10,15	7	6a,11	15,2	10	1,7			
16	13	4	6	15		1,2,7,10	6	4	15			
17	13,15	4,6,7,11		1,10		2	6	4,7,11				
18	2,7	1,6,10,11	15	13	11		13,11	1,6,10	15			
19			7,11	2	6 (2)	1,10,15,13	6	2,7,13, 11				2,7,10,13 11
20	1,13,15	2,4				6,7,10,11	4	2				

the exceptions are men who are presently most concerned with specific emotional problems. Entries preceded by a plus have the meaning of additional scores on the Rorschach.

Tone is dominantly unhappy and tense. Melodramatic stories are usually limited to cards 11 and 15, and reflect their way of handling stimuli which seem to them rather unrealistic. This group for the most part, draws a very sharp line between fact and fancy, and they take a rather caustic view of the latter.

Quality is chiefly simple to literate.

Personal relations are somewhat oftener formal than emotional; presses mostly impersonal. I have introduced the category "internal" here to take care of situations in which the protagonist is impelled by inner needs.

Outcomes that are given are more often successful than not, but for many in which no outcome is given a continuation of tension is implied. Degree of certainty is usually not great.

Cards invoking specific personal references or opinions of the characters or their behavior are also noted.

Themes for each card have not been listed. Instead it has seemed more useful to give all of the responses to one card, and I have selected card 10 for this purpose. These are reproduced as they were taken down.

Qualitatively, outstanding aspects of the protocols are the generally non-aggressive attitudes, the mildness of heterosexual interests and feelings, and at the same time the importance of and security in marriage. Paternal attitudes are sympathetic. Some of the protocols have a strong feeling of determination and resulting success; but not all show this. There is, however, an almost total lack of any expectation of or reliance on luck, or fate, or any other nonpersonal intervention as an aid. The nonaggressive

attitudes are firmly entrenched, but there is a hint of underlying resentment or rebelliousness, which, however, is generally attached to characters in early maturity, and which is usually not expressed in action and if it is, results unfortunately for the one expressing it. On the whole, there is a strong conventionality in most of the protocols, the only common break in this being in connection with religion, conventional forms of which most of them have discarded.

I should like to comment on the longest story reproduced below. Long, rather dramatic narratives were the rule in this protocol, which is completely different from all the others. Furthermore there were several stories which show this same repetition of the scene which is unique in my experience and of the significance of which I am not certain. It may be an indication of the repetition compulsion which is characteristic of many neurotics, although I do not have life history data of a sort to indicate that this is particularly strong with him. He has more, and more obvious difficulties than many of the men, a more irregular professional history, and certainly a much richer affective life.

Responses to Card 10.

10. I don't know why I think it's Russian, it's in the face of the woman and the eyes of the man, Central European. The age of the individual involved bespeaks an affection lasting late in life. That she isn't young is shown as skilfully by the way her hair is done as by her face. It is, however, a story of very firm irrefragable affection. Maybe he is a Russian general going off to war (?) I don't think the author need be concerned with that because he has no answer to that.

10. (Long pause.) My first reaction is a bit of resentment that the drawing is so bad I can't tell if this is a man or a woman. The first reaction is that this is ardently erotic, affectionate kissing, but it's more idealistic. I took at right a man, at left a woman, kissing brow rather than lips, a certain amount of childish-

ness in that R with rounded cheeks, the pose of the hand like a child's hand on the mother. But the left looks wicked. Something not right about this pose. This a question of evil is some way? This gives me much vaguer images than the other one. (?) This one on the left will take charge of that one and lead him into evil. Not a contemporary though the bad companion. Older woman taking charge of a childish boy and he's being misled and will fall for it because not strong enough to resist it.

10. 15". These are getting progressively no better . . . Is this a graded series and they get worser? . . . 1' 15" I don't get much of this one, well I'd say it was a husband and wife scene in a family with pretty complete confidence and considerable affection among the members although they have been married for a long time. The husband has been having physical difficulties or he has been ill or something and has just been told he has a disease there isn't much hope for and is breaking the news to her. She is broken up but bucking up and taking it in good style. She needs comforting from him. I haven't any future, I expect he is going to up and kick the bucket sometime fairly soon but this is a matter of months.

10. I think this is probably not a romantic scene because the man and woman involved are not very young any more. I think they are probably married and have been for some time and probably have a considerable family which she has to stay home and take care of still. The husband is departing on a long trip to foreign parts and possibly from the nature of his expression he might be an army officer and might be an explorer. In any case he's going away for a long trip and as he leaves his family he is embracing his wife and she is clinging to him and they aren't kissing each other with sensual enthusiasm, but they are just clinging to each other while they say good bye and I think the wife is feeling worse than the husband is. I think it's all going to come out all right. He'll come back home. I might say by way of explaining that last remark that I say that because he isn't young and whether an army officer or explorer he will not do anything very dangerous. If an army officer he won't get into anything dangerous because he is a big shot and if an explorer he has been around enough and he will come home perfectly whole.

10. (Long pause, turns the card around)

That's a puzzler. Well we have here a lady who is respectable but not too determined and a gentleman who is old enough to know better. The lady has a comfortable nest egg laid away. The gentleman has learned about it and has reached the point of making a proposal to the lady that they marry and he is kissing her quite chastely on the forehead and she has laid her hand up on his chest, closed her eyes and I think is going to consent. The shadows are not quite right in this picture which makes it a little bit difficult. The shadows here. (Points out that the deep shadow on her face would indicate that the light is coming from a different direction than seems to be the case from the rest of the picture.)

10. That's quite a good drawing. The black background leaves an awful lot to the imagination the way the faces are cut off. Well, it could either be very chaste and respectable or heavy necking as far as I can see. A fond farewell. It need only involve the higher passions. I don't care much for a girl with such short fingers. If I were in such a clinch I'd rather have a different girl. But it doesn't matter much to them. (?) They don't seem particularly happy so that's why I think it wasn't the grand passion.

10. This gets worse and worse. These are only details. Well, these are two lovers that don't have much of an opportunity to see each other and now they have met and have sunk into oblivion. That's about all I can say for that. You could spin any number of yarns before and after but it isn't suggested by the drawing itself.

10. The lower figure is definitely a woman. The upper figure I think probably is, too. uh. . . That's possibly, well, I'm not sure whether to call it a prodigal daughter, well, we'll call it that. Perhaps a daughter who has been away, has gotten into difficulty, has lived on the Bowery or that sort of environment and has finally come back home and mother has taken her to her arms and is forgiving her so that it is a reconciliation and forgiveness and all happy there ever after.

10. Um, oh, they are a married couple and something has happened, maybe her mother has died. I don't know what, anyway she has come to him for comfort. And I assume that time will lessen her distress. If you would like me to think up more lurid situations I can.

10. Hmm. Well, this is a husband and wife

who just heard of a very terrible tragedy that has happened to one of their children probably and they turn to each other. They probably have been married long enough and have gotten along and will share each other's grief. They probably will have other moments like this in their lives and will share it and keep getting closer to each other because of it.

10. Well, this I'd say was a goodbye, farewell scene. A man is leaving on a trip, maybe called into the service, mobilization, or something and that's his wife and she's just realized what a hell of a fine fellow he is after living with him all these years, so she's very heartbroken and of course he's very sad too about leaving his family. A very nice picture. Yes a touching scene. Reminds me of a picture which was in *Life* a while ago, a man coming home, it was the real thing. . . . (?) Pfft. A matter of probability, what are the odds of getting killed?

10. Oh, gosh, you are getting them more difficult, aren't you? Gee, you ought to give me some that aren't so sad, these all look sad to me. Well, this is a woman and her husband or equivalent, her man any way, and she is very sad about something and he's trying to comfort her. I don't know what she is sad about. It could be a million things and I don't know what is going to happen. I suppose she will get over it, people do. I can't say how they got into this situation or what the outcome is going to be.

10. It's a little hard to see just what's there, it's going to be a little difficult. This woman is such an indefinite age that I don't know whether it's meant to be his sweetheart, wife, mother . . . or even sister. (His voice dropped on this.) You see he looks somewhat younger than she (is it she or her? I can't remember) and yet one can't see him very plainly either, so—(E: You can have it the way you want it.) Well all right, she's not quite the type I'd pick for a sweetheart. This looks like a much more commonplace story to me. One could imagine that . . . that they are a married couple and that he has had some. . . well at any rate it might be that he's got to go away somewhere and leave her and that they are pained at parting. His work probably is taking him away; we won't say it's war but any way some work that takes him far away and he might be for instance, be a . . . it's hard to make it plausible I wanted to say that he had succeeded in getting a position on a ship that

he long had been wanting to get and that they had been living together in town at some clerical work he didn't like and he had always longed to get away and get some work in which he had a real interest. He has perhaps been working in the office of a shipping company he hardly to me looks the type for an engineer. They look like rather commonplace people, that is commonplace occupations, and he has had a desire however to have a job on a ship as, let's say as purser, and has finally gotten this job but it's a ship that takes him to the orient and will take him away on long journeys. He's perhaps gone on short ones but it's painful parting because she has meanwhile become pregnant and he will be away for many months and the baby will be born in the meantime and she regards it as dangerous because there is danger of war breaking out and all ships will be in danger so they have mixed feelings. Both of them. He is glad to have the job but is sorry to be away when the baby is being born. She doesn't like that either and is worried about him being in danger. Then we pass on from the picture. He does go off from her on his ship. He writes to her but the letters take a long time. . . and she to him. . . and. . . shortly before her baby is to be born war does break out and he is interned by the enemy let's say in Japan but she has no news of him and doesn't know what has happened to the ship. She has a terrible time in childbirth and doesn't know whether her child has a father or not, alive, but the son is born, she receives payment from the company and manages to get along and years pass by and she hasn't been able to get any news of him . . . until one day before the war is over a wild looking man with a beard rings her door bell and she finally recognizes him. He managed to escape from internment and get off on a Chinese junk and through very exciting adventures around the world gets back, and then the question arises what he should do and she doesn't want him to go again but now he is resolved to go and after being a little while at home together he starts off again because the merchant marine is very important and there is another parting but this time he's determined to help . . . to help his country is dominant in him and he, he has even a feeling of joy in going. Now we might perhaps leave at this point.

10. Trying to settle on the age, there, that's a main problem. Well I would guess that that is a, — that they aren't too young. It's presumably a husband and wife and there has

been some difficulty, shall we guess with the child? Possibly died or there has been some accident and they are comforting one another. As for the future I guess they will get over it.

10. (Long pause.) I would say that the events preceding the picture were these. This seems to me to be a young man here on the left and that he had been away from home for a long time either in some hazardous undertaking such as war which isn't indicated at all by the picture so far as I can see, or that he had not been heard from and it was feared that he was in bad company or getting into trouble one way or another. This picture shows him returning home with the great relief of his mother, I would say, greeting him while he still has a rather jolly, carefree expression as much as I can see of his face, so she's the one expressing emotion as far as I can see, he just shows a little awkwardness, so he's not so completely carefree. I would suspect if my guess about the earlier part is correct the outcome would not be so happy. He would be likely to get into the same situation again unless it was a case of war which is also likely again but not for the same reason.

10. I can't even be quite sure of the sex of the various people involved here. I suppose a man and woman here but not sure of that, first impression wasn't that. He's kissing her cheek. Well, I suppose you could say that they have heard bad news and he's trying to comfort her, something of that sort I'll let it go at that (firmly.)

10. Oh, that's tougher. (Long pause) Well I suppose they intentionally leave out enough so you can't be sure what it's intended to be. I'm going to guess that the left hand character is a monk or a priest and that he's trying to provide some comfort for this broken hearted lad on the right but that is a poor diagnosis, it doesn't fit much of anything. I don't know whether priests are in the habit of comforting young men who are in trouble or not, my experience being so limited.

10. Well there is a great deal of affection here. I presume this can be interpreted as a husband and wife, at least it would be a characteristic pose, the wife with her head on the shoulders of her husband. Whether happiness or grief they are certainly sharing the situation. (?) I should think favorable outcome, I should think those two would find strength in each other.

10. I don't think it's happened yet but I think it will before very long. I don't just see why they should have such a brilliant light. Might be a headlight of a car that arrived at an unfortunate time such things do happen. I don't think any one would stand there on purpose. Might even be one of these flash-light pictures that gentlemen with low minds take sometimes.

10. I would interpret that as grief stricken parents after the loss of a baby. They seem to be relatively young which would fit that idea. To me the attitude indicates they are trying to comfort each other.

THE VERBAL-SPATIAL-MATHEMATICAL TEST (VSM)

This test was compiled by the College Entrance Examination Board from several of the most difficult of their tests. The verbal section consists of two parts, comprising 79 items in all. The second part was added when it was apparent that the first did not have enough ceiling for this group. It had been hoped that this would be an adequate power test, but in some instances at least, it is primarily a speed test. The problem in each set is to find the antonyms; in the first part four words are given, from which the two antonyms must be selected, in the second part 6 words are given, and the task is to find which of the last five is opposite to the first. Time limit was 15 minutes.

The spatial section comprised 24 items, each item consisting of 4 views of solid figures. The task is to select the two views which are of the same figure. This particular test was suggested by the Board, because they believe it to be the purest space test they have. Time limit was 20 minutes.

For the mathematical section, 39 items from a 60-item test were selected so as to omit some of the items at easier levels of difficulty. The original test was given with a 60-minute time

TABLE X
NUMBER TRIED, RAW SCORE, AND SIGMA SCORE OF BIOLOGISTS ON A
VERBAL SPATIAL MATHEMATICAL TEST

Subj.	Tried			Raw Score			Sigma Scores		
	V	S	M	V	Right S	M	V	S	M
1	71	24	22	50	6	11	-.54 σ	-.77 σ	-.95
2	79	22	18	73	10	12	+1.35	+.14	-.78
3	79	14	28	70	10	18	+1.10	+.14	+.24
4	79	19	25	68	15	22	+.94	+1.27	+.91
5	68	23	12	58	3	11	+.11	-1.45	-.95
6	60	24	22	51	7	8	-.46	-.54	-1.45
7	79	21	15	59	5	6	+.20	-1.00	-1.79
8	77	18	24	68	9	10	+.94	-.09	-1.11
9	79	11	22	61	9	21	+.36	-.09	+.74
10	79	24	27	71	20	18	+1.18	+2.41	+.24
11	—	—	—	—	—	—	—	—	—
12	70	24	25	50	15	22	-.54	+1.27	+.91
13	63	22	28	57	8	24	+.03	-.32	+1.25
14	79	22	25	65	18	19	+.69	+1.95	+.41
15	52	8	23	44	8	22	-1.03	-.32	+.91
16	77	10	30	69	7	27	+1.02	-.54	+1.76
17	55	10	20	43	8	14	-1.12	-.32	-.44
18	50	15	15	28	7	13	-2.34	-.54	-.61
19	69	12	21	52	9	19	-.38	-.09	+.41
20	60	24	21	38	4	18	-1.52	-1.22	+.24
Mean	69.8 \pm 2.3	18.2 \pm 1.3	22.3 \pm 1.1	56.6 \pm 2.8	9.4 \pm 1.0	16.6 \pm 1.4			
SD	9.89 \pm 1.6	5.63 \pm 0.9	4.63 \pm 0.8	12.15 \pm 1.9	4.42 \pm 0.7	5.94 \pm 1.0			

limit, but only 30 minutes was allowed for this administration and no subject attempted more than 30 items.

There are no norms for these tests, nor any comparative data. On the other hand, there are no standard tests which have enough ceiling for this group, nor any with norms which would be applicable to this group even if there were enough ceiling. The data were secured for information on individual differences within the group and for comparison with other groups of scientists.

The test results are given in Table X which lists for each of the 19 subjects who took this test, the number tried, the number right and the sigma score for each subtest. Sigma scores are necessarily computed on these distributions.

There are some extremely interesting differences in pattern of scores on this test. Those whose sigma scores are

highest on the verbal test include all but one of the botanists, the two anatomists and the physiologist. Those with highest scores on the spatial test include the other botanist, two of the plant geneticists and one animal geneticist. The group highest on the mathematical section includes all of the rest of the geneticists of either variety, and two of the biochemists. The other biochemist and the bacteriologist have spatial and mathematical tests practically equal, with the verbal test lower. Although the groups are small the pattern is a consistent one. It is not surprising that those most adept in nonverbal functions go into genetics and biochemistry, branches in which these skills are put to good use, while these are avoided by the dominantly verbal group. It is interesting, however, that all but two of these men (one botanist #8 and one geneticist #15) say

that they do the majority of their thinking in terms of visual imagery; only two have dominantly auditory verbal imagery.

TABLE XI

INTERCORRELATIONS OF BIOLOGISTS' SCORES ON THE VERBAL-SPATIAL-MATHEMATICAL TEST

	Number Right		Tried/Right	
	S	M	S	M
V	+ .445*	+ .129	+ .273	-.014
S		+ .369		+ .385

*For this sample, P is .05 for a correlation of .44.

Intercorrelations on the test are given in Table XI. These were run for number tried in each instance to see whether there seemed to be any factor of speed of work, and for the ratio of right to tried as a crude measure of cautiousness. Only one correlation in the table is significant at the 5 per cent level, that between number right on the verbal and spatial tests.

COMPARISONS OF THE THREE TESTS

Although the group is small, this seemed a unique opportunity to make some comparisons of responses on these three tests. An attempt has been made to compare any elements which seem to have meaningfulness. In part, of course, this has been conditioned by the aspects which could be put in quantifiable form, or in terms of frequencies.

It was thought that there might be an underlying factor of productiveness, or general energy output which could be manifested in the amount of work done on each test. For the VSM this could be taken as number tried; for the Rorschach the number of responses, for the TAT the average number of typed lines per story. (This last is fairly crude, and is predicated upon my having gotten down the whole story verbatim. This was almost always the case. In the very

few instances in which I could not keep up, the average length will be a little short, but in these terms the differences from actuality are very slight and I think insufficient to distort the results.) These correlations are given in Table XII. None is significant.

TABLE XII

INTERCORRELATIONS OF MEASURES OF PRODUCTIVENESS ON RORSCHACH, TAT, AND VERBAL-SPATIAL-MATHEMATICAL TESTS OF BIOLOGISTS

	Rorschach	TAT	V Tried	S Tried	M Tried
	N	Average			
	Responses	Length			
Rorschach		+ .149	+ .364	-.016	+ .276
TAT			-.012	+ .198	+ .313
V Tried				+ .210	+ .304
S Tried					-.039

TABLE XIII

INTERCORRELATIONS BETWEEN SCORES OF VERBAL-SPATIAL-MATHEMATICAL TEST AND $W\%$, $F\%$, AND $F+\%$, ON THE RORSCHACH FOR BIOLOGISTS

	V Right	S Right	M Right
$W\%$	-.460*	+ .001	-.145
$F\%$	+ .001	-.105	+ .025
$F+\%$	+ .085	+ .487*	+ .140

* P is between .05 and .02.

It seemed of some interest to correlate number right on the VSM tests with some of the Rorschach factors, and for this purpose $W\%$, $F\%$, and $F+\%$ were chosen. The results are given in Table XIII. There is, then, a low significant negative correlation between number right on the verbal test and $W\%$; and a low positive correlation between $F+\%$ and number right on the spatial test.

"Originality" on Rorschach and TAT as measured by $O\%$ on the Rorschach and a measure of $O\%$ on the TAT secured from the number of unusual stories or additions that are unusual, correlates +.031.

An attempt was made to compare at-

tention to details on the two tests. Subjects whose use of detail on the TAT was particularly noted in the interpretations were compared with the rest as to $D\%$, Dd and $W\%$. The two groups were practically the same on Dd ; the more detailed group on TAT was somewhat lower on $D\%$ and higher on $W\%$. The measure on TAT is a very crude one. Nevertheless, it would seem that the perceptual attitude in this respect varies considerably with the material involved.

Munroe's [3] studies of verbal and nonverbal ability as measured by the ACE and Rorschach pattern showed in the students with higher nonverbal ability a significantly greater tendency to use of F responses, better form quality and less use of M responses. In this group this is not confirmed on $F\%$, averages for the subgroups having highest verbal, spatial and mathematical performances being respectively 47.0, 39.5 and 46.1. For $F+\%$, however, as might have been expected from the correlations, these averages are 80.3, 94.7 and 76.1 respectively. There is no apparent association with the use of M in the subgroups. Numbers of M for the higher verbal group are 1, 1, 1, 1, 3, 3, 9; for the higher spatial, 1, 2, 2, 3, 3, 4; for the higher mathematical, 0, 1, 2, 3, 5, 6. Munroe found subtler differences in the elaboration of responses, and the use of color but these are not quantifiable. Protocols of this group are so different throughout from those given by Sarah Lawrence students that the subtler criteria which made it possible to differentiate the higher verbal and nonverbal groups from their Rorschach protocols cannot be applied to this group. Whether the difference in the protocols are at least in part reflections of the age differences, which is considerable, or of sex differences, cannot be judged.

SUMMARY

Data from three tests, the Rorschach, the Thematic Apperception and a Verbal-spatial-mathematical test given to 20 eminent research biologists have been presented. Wide individual differences appear on all of the tests.

On the Rorschach there is some tendency to increased W and also to increased Dr . There is some restriction in use of human movement, but no general restriction in that area; there is more general restriction in the color area. Although $F\%$ is not particularly high generally, there are extremely few compound responses in which F is not the primary determinant. Shading shock is generally prevalent from mild to severe in degree. The group is a generally very unaggressive one, and with very little interest in interpersonal relations.

On the TAT there is further confirmation of the generally slow and somewhat restricted psychosexual development, and indications that most of them tend to avoid emotional and interpersonal situations. They are usually unwilling to go beyond the data presented and have a general distaste for the imaginary and a strong preference for concrete realities. Most of them are rather conventional, and have a fairly strong sense of responsibility.

On the VSM, they show all possible patterns of superiority of score on one or the other subtest, but there is a clear separation between those with highest verbal ability and the rest. The first group include all but one of the botanists, and two anatomists and the physiologist. The geneticists and biochemists are without exception better at either the spatial or mathematical test than they are at the verbal.

Except for a correlation of .445 between the verbal and spatial tests, no

significant relationships were demonstrated between the VSM tests. But there was a low, but significant, negative correlation between $W\%$ on the Rorschach and number right on the verbal test, and a low but significant positive correlation between $F+\%$ on the Rorschach and number right on the spatial test.

Received January 7, 1949.

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