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A Psychological Study of Eminent Biologists

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INTRODUCTION

THIS REPORT¹ COVERS the major part of the first year's work on a four-year study. It is an attempt to make a specifically clinical approach to the problem of the relationship of personality to vocational choice and success. It is not the first study in this general field, but it is the first of its kind. Primarily vocational studies, in which personality has been considered, have usually been in terms of conventional aptitude tests or of interest tests. There are other studies, notably those of Terman and his associates (23) which bear on this problem but do not attack it directly, and there is pertinent material in some studies of interests and their development. No attempt will be made here to survey these generally. They will be considered later as points to which they are specifically relevant come up for discussion.

As is true in all clinical and social research, the complexity of the situation makes a direct attack upon any one aspect of it impossible as a beginning. No one study or series of studies can even begin to approach a full solution of the problems involved, and this is particularly true in a pioneer study. All that one can hope for in such work is to get some idea of the nature of the relationships, the points at which a direct attack can be made, and the sort of tools to use. In the beginning, the major approach has to be observational, and even this must be diffuse. Since one does not know what factors may prove to be

effective, one must try to observe as many as possible. Hence it has seemed more important at this stage to find out a lot about a few men than to find out a little about a lot of men, although I have tried to do the latter, too. This type of approach automatically limits the number of subjects who can be used, simply because of the time required for careful clinical work.

This necessary limitation on the number of subjects also cuts down the number of comparison groups which can be examined. In work of this sort, a "control group" in the experimental sense is unobtainable. The factors which it may be important to control are not known, nor will they readily be controllable when they are suspected. The best that one can do is to study as many different groups as available resources permit, selected for comparability in one aspect or another.

The present report contains full data on only one group—eminent research biologists. It cannot be fully evaluated or utilized until other groups have also been studied. Future publications from this grant will present similar data on physical scientists, and on social scientists (psychologists and anthropologists). But this study as presented is complete in itself as a study of eminent research biologists. Direct comparison is limited to results of a Group Rorschach study of university faculties in biology. Other comparisons can be made, at least by inference, to the adult male population of the country. Publication now makes possible the utilization of these data by others. It will also, I hope, stimulate

¹ This investigation was supported by a research grant from the National Institute of Mental Health, of the National Institutes of Health, Public Health Service, Federal Security Agency.

discussion and other researches among different sorts of subjects.

There are several reasons for beginning such a study with scientists as subjects. The position of scientists in our society is rapidly changing. Since the war, particularly, public consciousness of the possibility of careers in science has greatly increased, and the current demands of government and industry for more scientists need no elaboration. At the same time there is practically no collated information on why or how people in our culture become scientists.

The aim of the whole study is to determine whether there are any patterns in personality or life history which differentiate between the different groups of scientists to be studied or which differentiate them from the population at large. It seemed at least probable that if such patterns exist, they would be most perceptible among men who have had the greatest success in these fields. Success is here defined as "eminence in research" as judged by a man's peers, in terms of the significance of his research contributions to the field. It is true that of two men of the same ability the rise of one and not of the other to eminence may be entirely fortuitous—a result perhaps of the immediacy or the breadth of the bearing of the work of the one on developments in his own or other fields. This, however, is not too important in this connection. What is important is that the men selected be among the best, not that there should not be any others as good. (It is, of course, true that the evaluation of the work of a man by his contemporaries is not necessarily the same as the evaluation which the future will make of it. This, too, is not really pertinent here.)

In accordance with the need for a

broad attack, three major approaches were planned. The first was to secure a life history of the subject, as little structured, and recorded as nearly verbatim as possible. The second was to make a serious study of his work, and to discuss with the subject the sequence in which it developed and the factors contributing to it. The third approach was to make use of certain clinical instruments, namely, the Rorschach, the Thematic Apperception Test (TAT), and a Verbal-Spatial-Mathematical test.

Utilization of verbatim life histories as clinical data has been discussed at length by Allport (1) and their value sufficiently demonstrated by him that the technique does not need justification here. Some comment should be made, however, on the possible presence in these data of the usual pitfalls. The subjectivity of these reports is not disadvantageous. Their validity may be considered in terms of the three non-quantitative indices mentioned by Allport—the honesty of the subjects in the situation, the plausibility of the accounts, and the internal consistency of the accounts. Not only the personal standing of the men who acted as subjects in this study, but their willingness to participate and their behavior in the situation are adequate guarantees of the first; the plausibility and consistency of the accounts can be judged by the reader. Although intentional deception can be ruled out, there still remain the problems of unintentional self-deception, of excessive rationalization or blindness as to motives, and of errors of memory. All of these conditions are not only possible but probably enter to some extent in each instance. There are in the documents themselves, however, good cues to the presence of any of these to a suffi-

cient extent to invalidate the report, and further check in this study is available in the results of the projective tests used. These two types of data supplement each other elegantly, each illuminating the other. That the conceptualization in using personal documents is arbitrary on the part of writer or commenter is a situation hard to avoid. How well it has been avoided here is best checked by inclusion of a considerable part of the documents themselves. Advance conceptualization on the part of the experimenter of the areas to be covered may be a limiting factor; this is considerably mitigated by the interview technique. The subject was asked to cover certain broad areas; beyond that, he was left to himself to include whatever occurred to him as of importance. Questions were minimal. They were interjected if some areas were inadequately covered, or if some point were not clearly stated.

The rationale for discussion of the subject's work is obvious. Its value is limited by limitations of the interviewer's technical comprehension of the various fields; but the procedure can be very illuminating with regard to methods of work and the creative process generally. Such discussion was always preceded by careful study of the subject's work by the experimenter.

Choice of tests was dictated in part by personal preference and skills and in part by general practice in the field. The Rorschach is the most widely used of the projective tests at the present time, and perhaps the TAT the next most widely used. Also I had found the Rorschach

not only easy to use but very fruitful in studying artists and their work, and the TAT, although extremely cumbersome to handle as a research instrument, to supplement the Rorschach very effectively (15). A test which would include several intellectual factors was also desirable. There seemed none generally available which would be suitable, largely because of the problem of getting enough ceiling, particularly in a verbal test. The Educational Testing Service was consulted, and they provided the test which is described in detail later.

Because there were available no data on superior groups for these tests, it seemed desirable also to acquire these data if possible. The Verbal-Spatial-Mathematical test could be easily administered as a group test, but not only does it not give the sort of information on which the study is primarily focused, but also it seemed unlikely that I could persuade any large number of biologists or other scientists to take it; an "intelligence" test would be too threatening a situation. On the other hand the Group Rorschach had been used successfully with paleontologists (14) and with pharmacists and accountants (18) among others. It is, apparently, a much more palatable task. Although its comparability to the individual Rorschach is inadequately established (this point is discussed later) it seemed the most probably fruitful adjunctive approach and this was therefore undertaken. The full report has appeared elsewhere (18) but some of the data are used here for comparison.

CHAPTER II

SELECTION OF THE SAMPLE

SELECTION of a group of biologists, on the basis of their eminence in research, and so distributed as to cover major branches of the field, was a difficult problem. It seemed sensible to take advantage of such selective procedures as had already been employed for other purposes. Membership in the National Academy of Sciences and/or the American Philosophical Society is considered one of the highest honors that can be achieved by any scientist in the United States. (It is no doubt true that there are equally good scientists who have not been elected, whether for personal reasons or because of limitations on the number of members, nor has every election met with unqualified approval, but on the whole these are fairly objective criteria.) A list of members in the biological sciences of these two societies was therefore made. Difficulties in categorization of scientists are pointed up by the fact that a man, for example, may be a member in biology in one society and in chemistry or geology in the other. Care was taken to go over all groups that might include biologists. This list was then pruned of men over age 68 and of those who were foreign-born, in order to avoid as many psychological complications as possible. Also omitted were those whose present administrative duties left them no time for research, the one woman, and close colleagues of my

husband. This list was then submitted independently to the following men who kindly acted as advisors: Detlev Bronk, Hans Clarke, L. C. Dunn, J. R. Schramm, G. G. Simpson, and W. J. Robbins. They were requested to mark each man whose work they knew as "first rate," "excellent but not first rate," and "not suitable," on the basis of his research, and to add to the list any others they felt should be included. Because my advisors were chosen to cover all the subdivisions of biology, not every man on the list was known to all of them, and they did not rate those whose work they did not know. In spite of this, one man received top marking from all six raters, one from five, and a number were rated at the top by four of them. From these ratings, another list of 30 men was made. This was somewhat unbalanced in the subdivisions and included several older men. Changing the age limit to 60 left 23 men who were suitable, and they were distributed among the different fields in numbers roughly proportional to the total number in each field.

I wrote to twenty of these men, and spoke personally to the other three. In a few instances, when an answer was not received to the first letter, a second was sent. Twenty of the men agreed to serve as subjects for the study and are reported here.

CHAPTER III

DESCRIPTION OF THE GROUP

TABLE 1 gives the number of subjects in each field of specialization, and the code letters referring to that field. Each subject in addition to the code letter has been arbitrarily assigned a number for simple reference (e.g., A1; PG₃, etc.).

Age range for the group is 38 to 58, with a mean of 51.2 ± 1.44 . It is note-

TABLE 1
SUBJECTS AND FIELD OF SPECIALIZATION

Code letter	Number	Field
A	3	Anatomy and Physiology
P	5	Botany (including plant physiology and cytology)
PG	4	Genetics: plant materials
ZG	4	Genetics: animal materials
B	4	Biochemistry and Bacteriology

worthy that among both botanists and zoologists, research interests are most often genetical.

Inclusion of the biochemists was debated at some length, my advisors not being altogether in agreement in the matter. It was finally decided that so much of modern biology is interwoven with or somehow stems from biochemical investigations that it should be included. From the point of view of the biochemist, however, it is almost incidental that the subject of his research happens to be living matter. Nevertheless, the biochemists included have made major contributions to understanding basic life processes. This is well illustrated by the fact that the work of one of them was known to five of my advisors and of the others to four of them.

It is not surprising that most of the

men were in their fifties, in view of the criteria for selection. Three of the men were not members of either the National Academy of Sciences or the American Philosophical Society, but were suggested independently by at least two raters, and given such high ratings that they were included without hesitation. There is no doubt but that they belong in this group, and I consider it probable that they will become members of one or both societies in due course. The numerous honorary degrees, prizes, medals, and other honorary society memberships for these men have not been tabulated since some of the men could be readily identified from such a tabulation.

FAMILY BACKGROUNDS

Some data about the families of these men were gathered but no attempt was made to go into family history in any detail.

Birthplace, by states, may be of some interest. The data are as follows: New York, 5; Illinois, 4; Nebraska, 3; Maryland, 2; Massachusetts, 2; Colorado, 1; Indiana, 1; Iowa, 1; Missouri, 1. For the most part, their early years were spent in or near their birthplaces, but this was not always the case. Seven were born in cities, the rest in small towns or on farms.

About one-third of the fathers of these men had been to college, but a number of them had had less than a high-school education. Three of the mothers had been to college. In view of the general educational level of that generation, it is clear that the parents of these eminent men had a better average education than that of the population at large.

TABLE 2
OCCUPATIONS OF THE FATHERS OF SUBJECTS

Occupation	No. of Fathers in Occupation
College teachers	4
Public school superintendent	1
Clergyman	2
Newspaper editor	2
Business	6
Salesman	2
Farmer	2
Carpenter	1

Occupations of the fathers are given in Table 2. When one man had had several occupations, the one he followed during the larger part of the childhood of the subject is the one recorded. Clearly this distribution, with 45 per cent of the fathers in the professional class, is very unlike that for the U. S. population at large. Among the business men, four were well-to-do and apparently owned their own concerns. In many of the other families, however, finances were rather strained.

Most of the mothers were occupied in looking after their homes and children. One of them, however, was a college teacher, and one worked for a while as an editor, in association with her husband. Several others worked at non-professional jobs.

A rather high percentage of these men were deprived of one parent at a relatively early age. The mothers of three men died when the subjects were 4, 5, and 10 years old respectively; the fathers of two died, one before the birth of his son, the other when the son was 9. This means that 25 per cent of the group lost one parent by death before the age of 10. The only contemporary comparative figures I have been able to find were supplied me by Dr. Robert Straus. In a group of 624 college students he found that 6.3 per cent had suffered the death

of father or mother before the age of 10. In a group of 183 homeless men whom he studied, 25.2 per cent had lost one parent by death before the age of 10. In this respect, then, the scientists are like the homeless men. I will anticipate some of the Rorschach material to note that this seems to be a point of considerable importance. Early affectional deprivation, especially of so traumatizing a sort, may be a factor which can work one or another way, depending presumably on whether or not it stimulates a search for other satisfactions. Another comparison can be made from Bell's book, *Men of Mathematics* (3). Of 32 mathematicians, whose lives are there recorded in some detail, it is definitely stated that eight lost father or mother by death before the age of 10; ten before the age of 14. (Of about half of the rest no mention is made of such an event and there are no data suggesting with certainty that both parents did live past the subject's childhood; in the rest of the cases it is clear that they did.) This, too, gives the figure of 25 per cent losing one parent by death before the age of 10. In other mathematicians there were other serious difficulties—illness, in some cases near starvation, social discrimination, as was also true of this group of biologists.

In addition, in the group of biologists, the parents of two were divorced when the subjects were 9 and 16 years old. One of the widowed and one of the divorced fathers married again, but in neither case was a satisfactory home provided for the child. The mother of still another subject was ill throughout his childhood and able to give her children very little attention. Hence, at least 40 per cent of these men suffered from obvious early affectional deprivation.

Number of children in the parental

TABLE 3
NUMBER OF CHILDREN IN FAMILY AND BIRTH ORDER OF SUBJECTS

No. of children, including subject	Number of subjects	Position in family	Number of subjects
1	4	1	12
2	4	2	5
3	7	3	1
4	2	4	0
5	1	5	1
6	1	6	1
7	1		

family and position in the family (birth order) of these subjects are of some interest. The data are given in Table 3. Average number of children in parental family is 3.3.

Six of the men have siblings who also entered a profession. The others' siblings have various occupations, but, as with the fathers, there are no unskilled and few skilled workmen among them, so far as my records go.

MARITAL STATUS

All these men are or have been married. Average age at marriage is rather late, as shown in Table 4. Three of the subjects have been divorced; two of

TABLE 4
AGE AT MARRIAGE AND NUMBER OF CHILDREN

Age at marriage	No. of subjects	No. of children	No. of subjects
35	1	4	2
34			
33		3	7
32	2		
31	2	2	6
30	1		
29	1	1	3
28	1		
27	4		
26	2	0	2
25	5		
24	1		
Average age at marriage.... 27.9		Total..... 44	Average..... 2.2
		Sons..... 30	Daughters... 14

them have remarried; one other remarried after the death of his first wife.

Table 4 also shows the number of children each man has. With the possible exception of the youngest man in the group, it is unlikely that there will be more children born to these subjects.

The disproportionate number of sons born to these men is rather interesting, but a chi-square test of significance has a *p* between 1.0 and .05.

As Terman (22, Vol. IV) has pointed out there are no accurate figures on divorce in the general population. The rate in this group is 15 per cent; for Terman's gifted men who are college graduates it was 8 per cent, but this group had at the time the calculation was made a mean age of only 30. Mean age at first marriage for all Terman's gifted males was 25. He also found a high sex ratio (111 to 100) for the offspring of his gifted subjects (men and women), although lower than that reported here.

GRADUATE SCHOOL HISTORIES

Ages at which these men completed various stages in their training are given in Table 5.

Time elapsed between bachelor's and

TABLE 5
AGE AT RECEIVING COLLEGE DEGREES

Age at Receiving Degrees	BA or BS	MA or MS	ScD, PhD, or MD
30			1
29		1	2
28			1
27	1		4
26			2
25		1	6
24		2	2
23	4	6	2
22	5	1	
21	6	1	
20	4		
Average Age	21.8	23.5	26.0

doctor's degrees ranged from 2 to 7 years, with an average of 4.25. All of these men have earned doctorates.

Eight of the men remained at their undergraduate universities for their graduate work; the others transferred. Fifteen of them received their doctor's degrees

TABLE 6
UNIVERSITIES FROM WHICH DOCTORATES
WERE RECEIVED

Columbia	5
Harvard	4
Johns Hopkins	3
Cornell	3
Others	5

from four universities as shown in Table 6. The others all attended different universities.

ASSISTANCE IN COLLEGE

Only a very few of these men came from families which were sufficiently well-to-do that no financial help was needed in going through college and graduate school. Almost all of those who needed financial assistance had scholar-

ships, fellowships, or teaching assistantships through graduate school and many of them also for their undergraduate work, although these were generally meagre. In addition, seven of them have had National Research Council fellowships for postdoctoral work, three have had Guggenheim fellowships, and one had another traveling fellowship for a year. Certainly these fellowships have brought a rich return.

MILITARY SERVICE

Nine of the men saw service in the first World War in various units. Most of these were drafted as privates and wound up with commissions. Many of the others were too young, and some were doing work which exempted them. During the last war, the majority of them were engaged in war work of various sorts. Much of this work was consultative, some of it specific research projects in their own fields, but some of it was quite different from their usual occupations.

EARLY HISTORY RELEVANT TO OCCUPATIONAL CHOICE

THE INFLUENCES that led these men into their professions and affected their final choice are varied. With some, it was an enthusiastic teacher or other person that seems to have been the decisive factor. With others, it seems to have been a more or less chance meeting with the subject matter which caught them. With only half of them did an interest in the subject matter of biology or in some other scientific pursuit appear very early in life. Sometimes this early interest was quite without any apparent source, and the professional choice was merely a continuation.

A few of the subjects grew up in homes in which their going to college was simply taken for granted. This was true of all of those whose fathers were professional men or well-to-do business men. Some of the others would not have thought of college for themselves, but were given the idea by teachers or others. Once in college, some of them shifted fields of interest, and this seems most often to have been in response to a teacher, and particularly to a teacher who challenged their interest and left it up to them to work out problems.

The records which follow are arranged roughly in order of appearance of interest in science. The first ten records are of the men who did not show any interest in the vocation they have pursued so successfully before high school years. Interest, here, is defined in terms of their spontaneous activities, how they spent their time outside of school, etc. The rest of the men all had some interest in natural history or some of the physical sciences before they got to high school. In

five instances this was rather vague. Nevertheless, when, in school, they met with the more formal aspects of the subjects, it was in part the fitting in with early interests that led them into their professional activities. With the others these early interests were sufficiently strong that they carried them right along. In the case of Subject 11 it is a little difficult to say how much early spontaneous interest he had, since the family atmosphere was such that he had little contact with activities other than science (and music).

Except for a little editing, the story of each man is given in his own words, as he told it to me. They would have written them differently but the gain in vividness seemed to more than overbalance any loss in literary quality. Any occasional question or remark made by me is enclosed in brackets.

1

I lived in a small town in the country with a high school that wasn't accredited by the state university. My father became a member of the school board and set to work to get it accredited and did. As a kid I didn't know what was going on. All I can tell you is that I didn't know what a college was, only two or three people in that town had been to college and I didn't know them well. I think mother might have been influenced by a family that lived across the street, there were two girls older than I, who did go to college. About my senior year mother said you must go to college. I still had no thought of it or knowledge about it, but about the time I graduated from high school mother saw to it that we moved to the town where the state university is so I could go there.

During my last year in high school one of the three teachers in the high school (there were seven students in my class, forty in the school altogether) had talked a good deal about chemistry. I suppose he had a course or two in college. It wasn't taught in the high school. I think that

fellow probably excited a curiosity about chemistry. I don't remember why I happened to register for the courses I took at college except I was interested enough in chemistry to register for it. I registered in the Liberal Arts college for the first semester. During my freshman year I went to Sunday School at the Methodist church on the campus and the teacher was the organic chemist. He rather stimulated me or irritated me or both, and because I was a premedic by then and because of his conversation about not taking the easy courses and being a man, I took the major course in chemistry in my sophomore year. That fellow who had provoked me was an enthusiast, kind of wild, we'd hear him start lecturing when he was leaving his office. There is no doubt that he stimulated my interest in chemistry and was a good teacher. He had some peculiar ideas but he made the students enjoy it, at least he did me. He was a good organic chemist, he had the knowledge and a contagious enthusiasm.

Then I went to biochemistry in my junior year. The biochemist was another peculiar individual, much more so than the other. We had no lectures. He talked with us occasionally, I think I was the only student who liked to hear him and liked his way of handling a class. The thing he tried to emphasize was, e.g., take carbohydrates. He would say, "What would be interesting about them, what would give you useful information about it, see if you can figure out how to do it, keep trying and don't use the book until you have spent hours thinking about the subject." They are the two people who by their behavior directed me into biochemistry. This same man in my senior year gave me a problem—I elected to work with him for my undergraduate thesis. He gave me a problem that was much too difficult for me and with which I really struggled and I expect did fairly well. Anyway he published two papers on the data I got. I probably spent three or four times the normal amount of time on it.

He had assumed that the way to continue studying science was to go into medical school but when he was offered a fellowship in biochemistry he made up his mind "in about 5 minutes." Since then it has apparently never occurred to him to do anything else.

2

Another started college because of his interest in athletics, and "if I had any

ideas it probably involved a coaching position."

I had no interest in any scientific things as a kid. I did like high-school chemistry and I liked chemistry in college, and majored in it and math because I enjoyed doing them and did them well and easily. Latin was very difficult, and modern languages difficult. I could get them if I studied but it involved proportionately much more work. My chief interest was in athletics and football, so much so that summer work was of a nature which would develop me physically.

The transfer came in my senior year at college when I was taken over to the state university, principally because the chemistry professor was interested in locating a teaching assistantship for another student. I had my eyes opened then and saw students doing research work. Just an afternoon visit. It was the research that interested me, the idea of using chemistry to find out new things. So I applied while I was there for a teaching assistantship which I didn't get, so I went to summer school thinking I'd like to get going and find out what it was all about. [That visit must have made a very great impression on you.] Yes, I must have been very excited. I went over and started course work. By that fall, I had worked hard I suppose, I was given one of the half-time teaching assistantships. My family was not wealthy and that meant a lot, that \$30 a month. Of course what I wanted was the \$60 teaching assistantship, which I got in about six weeks. As soon as I could I got started in research activities. Some were started the first year and during that year I worked off many of the required courses so about half my time the second year and all the third I could spend in research. After the first year I had fellowships that carried no teaching requirements.

He was interested in medical research from the start, but does not know where this interest came from. He has never lost it, but a medical school education was out of the question financially, and would probably not have given him any more satisfactory a background.

3

One got started in science because of his feeling for his father's brother, whom he still admires unreservedly.

It's very, very simple but it wasn't very early. When I was in high school, I decided to study

forestry because of an uncle in the service who I thought the nicest man I'd ever known. When I got through high school I wanted to go to college but had no money so my uncle got me a job as field assistant in the Forest Service and I worked for a year and three months and then went to college. The first two years you take basic courses in science and then forestry. I took a lot of botany as background and liked that better than forestry so I got a position as a junior assistant in botany and so I took more courses in botany and got deeper and deeper still. I didn't know what I was going to do in botany. When I was a senior, A. was there working on *Drosophila* but not in the department of botany. An unusual person but we liked each other and he got me interested in genetics. So I went back for my MA as a teaching assistant.

I wasn't thinking very far ahead. I just liked botany and math. When I was a freshman I took Math 1 and 2 and had a young chap as instructor and he sold math to me. I did well and I wanted to go on, it was all logical and the answers were right. But I lost interest in calculus. Then I got into genetics.

I like any kind of science, I would have gone into physics or chemistry. I think it's a matter of teachers and who gets hold of you first.

[Do you prefer laboratory or field work?] I just like science because it's something logical and you get an answer. [Why genetics?] Well, you see I did like math and genetics is mathematical; in its approach it's analytical. You can predict what will happen and if you are right it happens; so I like genetics the best of all biology because you can do things with a certain precision.

I never did collect birds and flowers as a boy. As a kid I was interested in everything, athletics included. I was just one of the boys. But I got into it because of my uncle. It was because I thought my uncle was such a hell of a fine man. So I went into forestry. I suppose I thought it would be one way to be like him. He was just a nice fellow who had a nice personality, he liked everybody.

4

It was apparently a chemistry teacher in high school who started another subject thinking of going to college. He had no biology in high school.

I grew up on a farm and thought I'd be a farmer. In high school I was interested in physics and chemistry and I suppose the biggest influence in high school was a particular teacher who taught physics and chemistry and who was, well

I guess she didn't know too much, but she was a very good teacher, allowing people to go ahead and express an interest. She used to let us work after hours in the lab and fool around and it's a wonder we didn't blow things up. It was a small town high school, about 200 students in a town of 2000. She thought I should go to college. I wasn't hard to convince although my father was hard to convince. I had to browbeat him. I finally just told him I was going so then he thought it was all right.

He later said he thought his father had consented in part because his older brother had wanted to go to college, and had been permitted to go only to a small local place, and then he had died at 18. "I think that's why he didn't argue with me as much." In any case he had largely put himself through, partly by working, partly with the help of some money left him by his mother who died long before.

So I went to an agricultural college because I thought I was going to come back and be a farmer. I liked English a lot. As a sophomore I got a job reading papers in agronomy. Shortly after this the top man in that group came back from getting his degree in genetics. He was all steamed up about it but gave a course I took and I could do the problems better than he could so I got interested in genetics by taking his course and also working for him at 30¢ an hour classifying grain. As soon as I learned about genetics in college I was very interested and I used to read about it during my lunch hours. I was an agriculture major from the beginning. I suppose my major subject was agronomy but another dominant interest was insects and I would have been an entomologist except that the professor in it was a very scholarly fellow who sat in an office all day and used to come around and admire my drawings. I spent lots of time making drawings of insects. I took all the courses offered and he suggested I should do a special problem on ants and this depressed me so I quit being an entomologist. I don't retain this interest now.

I probably went into genetics because of the personality of E. He was a man who had a very charming personality. I had a minor with him from the beginning. I liked it because he didn't want to be bothered and he was the kind of a fellow who was very generous scientifically. Instead of saying "here is my problem, do so and so on it," of course sometimes he had to, but in general he'd say, "here is a problem, work on this," and then it would be your problem

not his. A very generous attitude. This has had a big influence and this is the tradition in genetics.

5

It took another man a long time to find out what he wanted to do, and it is just recently that he feels he has found the particular sort of research that satisfies him.

In high school I was enthralled by the classics. In that high school there was a certain curriculum for college, so I studied Latin and Greek but no modern languages, which has been a serious handicap. While a senior two things happened that probably had some effect on my future, first I went into a chemistry class by requirement. The teacher and I happened to hit it off and so I got to be sort of an unofficial lab assistant and I got interested in chemistry. Now that I think of it I remember that after that course was completed I took home with me that summer some books beyond my depth and some apparatus and of course it all came to naught but I did do quite a lot of reading.

The second thing was this, and this is what always leads me to regret. In some way or other I got hold of E. B. Wilson's *The Cell* and I read and reread that and at the same time the *Origin of Species* and at the same time I found an old microtome and some stains (at the school) and a copy of Lee's *Vade Mecum* and I remember making some sections of a leaf and staining them and then it happened that the teacher of botany (here is the chance) was the sort that all of the boys sedulously avoided. A strong individualist and a woman of some considerable resources and charm. I had gotten acquainted with her because I was deeply fascinated by Wilson's book. If I had fallen into her hands I might have gotten started on biology.

Now I recall another factor. The teacher of zoology was an elderly man and one time he had one of his classes get a human head and boil it up and make a skull of it. Scarcely appropriate for high-school students and it revolted me and ever since then I've had a dislike of any laboratory contact with animal material. Perhaps that's why I never studied beginning zoology formally. . . . The long and the short of it was that the chemistry won out. For some reason I don't recall now, probably financial, after I graduated from high school it wasn't until three years later that I went back to school.

After two years in college he was drafted. At first, when the war was over,

he thought he would stay in the army but decided against this and found work as a laborer on a ranch. There he had met two entomologists.

We were sitting in the room and it being summer and lights on there were insects about. One reached up and got one. The other said, "Is it so and so?" and the one said "No." That made a deep impression on me and it might be the beginning of my taxonomic interest.

He went back to college, and for reasons now obscure to him but probably connected with the curriculum or a faculty advisor, went into plant pathology.

Well, I graduated in botany. I was still fishing around in a way and yet as I recall it I was indifferent to what I was going to do with this. It seemed to be pure chance.

Through acquaintanceship with some professor, he was offered an instructorship which he took. "It never occurred to me to go on to graduate work." This was suggested by a colleague who helped him make arrangements. Indeed, throughout, he was greatly helped by various colleagues who came to his rescue with helpful suggestions when he was floundering.

6

There were several subjects who entered college as a matter of course and because of their family's attitudes toward education. Once there, they found what they wanted. This was the case with one who had always been interested in art and for a while considered a career as an artist. He was offered a four-year scholarship at a good academy of fine arts but did not take it because it would have meant not going to college, and college was in the family tradition.

I didn't specialize in science as an undergraduate. I majored in classics and minored in history. I took some science because I had to, not that I objected to it. I later looked forward to it. I think possibly I had a little leaning

towards biology because of my summer experiences. We lived in the center of a large city where you had to look hard to find a tree. But we spent our summers in the mountains where it was nice and there were wild deer and wildcats and so on. It was just a little cottage that my father had built largely with his own hands and it was nice, and I got interested in the birds and the bees and the flowers and so on, but mainly I was interested in having fun.

I had a good teacher of biology in high school. I took botany in college with considerable interest and I enjoyed it very much so I took a second course but those were the only two courses I had in biology as an undergraduate and no zoology at all and only a small amount of physics, chemistry, and math.

[Why classics?] Father was a clergyman, there was a sort of a classics background and Greek, Latin, and Hebrew books around and a humanist atmosphere prevailed over the scientific. Then at the end of my senior year one of the botanists suggested I might go on in botany. I hadn't much idea of what I wanted to do so I thought I'd try it. I had to take courses to make up what I hadn't had as an undergraduate. Father made no objection, he never tried to urge me to do anything vocationally.

So I stayed on at college, they gave me an assistantship. They offered me a scholarship and I had hardly started when they gave me an assistantship. Later I had fellowships.

He had an interlude in the army, and when he returned, quickly found a university job. He has been teaching and doing research ever since.

7

The history of another is not dissimilar.

This is a terrible confession that I'm going to have to make. I can't put it in a few words. I didn't know what I was going to be when I entered college and took an AB course in a small four-year college, largely an engineering school. I aimed towards the more solid subjects. Having been a considerable reader of literature I didn't feel that courses in literature were what I needed for my education. So I took Latin and Greek through my undergraduate years and all the math and physics the engineers took. Not chemistry. No biology, except for one course in biology in my senior year, and I had elementary chemistry in the summer school. I was an obedient and faithful and conscientious student, I was brought up that way. So when I graduated I was offered an instructorship in math at college

and an assistantship in physics and the professor of biology didn't have any assistant, he couldn't find one and although I'd had very little he offered me an assistantship. It was the lowest paid of all of them and I took it.

I think there were two things that inclined me in that direction. One that as a boy I spent every summer on my grandfather's farm. The other was that this first course in biology and the microscope, the opportunity to see and learn something about living organisms which my farm experience inclined me towards aroused my great interest. I just liked it. So I took the assistantship.

I took some graduate work including teaching myself in plant physiology and then I went to another college. I didn't have enough money to take graduate work. I was looking for an assistantship. Plant pathology turned me down. Field crops discouraged me. Plant physiology said if you come here one year and make good on your own there may be an assistantship. So I failed to become a scientific farmer and I became a botanist.

One reason was natural inclination, I couldn't see myself confined to a mathematical career of teaching, there didn't seem to be enough there to arouse my imagination. My experience on the farm, and forbearing and patient and wise parents who didn't try to force me into something I didn't want to do but let me follow my bent if it is one. I think I could have done very well in other things, if my interest had been aroused. The last thing is that I did teach myself. I've observed a good many examples in which the specialty pursued was the result of the individuals' teaching themselves. I had good instruction in physics and yet in spite of the fact that I went through all those courses, it never really caught my imagination.

8

This man was never interested in his mother's field of botany, but entered college thinking of taking work in mining engineering. He soon dropped this idea, in fact left college and tried farming, at which he was not a success.

So then I came back to college and took an MA in chemistry and some zoology. At the end of that year I began to get more interested in chemistry and less in zoology. The people there in zoology discouraged me, they thought I'd never be successful. I was more interested in chemistry so I practically gave zoology up and took a PhD in organic chemistry. That took me two years more, and then when I began to do research I really got interested, before that I'd

not been wrapped up in it by any manner of means, and at the end of that time I'd just about decided to stay in the field and to keep on in research.

He had a traveling fellowship for a year and when he returned found a job in which his biology was extremely helpful. I think with him, as with some others, it was the doing of research that mattered. This subject is unusual in that he feels he would have been just as contented if he could have been a farmer (he failed at it a second time), although he is sure he would not have liked business. It is characteristic of the others that there is nothing else they would rather have been—some feel they would have been equally successful and happy in a somewhat different scientific field, but none of the rest would think of doing anything but research.

9

One was the son of a minister and had to make his own way. He had thought that about the only possibility of doing this would be teaching high school. He had had some rather early interest in science, however, although this seems not to have been expressed in any particular activities, partly perhaps because he had had to spend considerable time at chores. He had never been interested in natural history. His story is:

Maybe it was mere chance except that it's clear to me that I've always been interested in scientific things or perhaps it's fairer to call it just fooling around in a laboratory, rather than elevating it with a nice name like science. In 7th or 8th grade, some fellow came along with a frog fixed up to show the capillary circulation. I thought that was hot stuff. I wanted to become the high school boy who went around with the frog. [Was it the attention he got?] No, it just seemed like an interest in the experience, the microscope.

A year or two later I started to high school and took biology and was very much interested, and became a sort of student assistant to the

fellow who taught the course, and as I remember it I spent a good deal of time on it in both my first and second years and in the third year took chemistry and that really sold itself. I thought it much more interesting than biology had been. Either I didn't take physics or it didn't take. I think I must have taken it.

Then when I started college I had decided I wanted to take all the chemistry there was and really settled down to doing it. I found I had learned so much in high school I got out of first year college chemistry and could go ahead with analytical immediately to the disgust of the professors because I spent all my time in the chem lab. and didn't study anything else. [Good teacher?] No. It was a terrible college. The professor turned the whole thing over to some student assistants with the result that my theoretical chemistry has always been extra weak, but I can juggle test tubes pretty well. He died and there was no one to carry on so I changed over to the biology department and spent all my spare time there in my second and third years. I graduated in three years, and was a student assistant the third year there. There was an interesting old bird who taught those courses but I don't know how much I can blame my interest on him because it was already there.

Then he vaguely thought of going into medicine.

I didn't know there was such a thing as a career in research. Medicine was a method of making a living and as near as I could come to science.

He took a teaching job to get money for further schooling. After a summer course in pathology he was offered a teaching fellowship which he took.

After a year I decided it would be possible to get a PhD on fellowship money and summer work and so I gave up the MD entirely. By that time I found I continued to like to do things in the lab (in bacteriology) and for some strange reason people would pay you barely enough money to live on, but—so I could do that. I wasn't tempted into side paths. There was nothing else I felt either interested in doing or was fitted to do.

10

This subject had several other strong interests before he finally became a scientist.

At first I was most interested in religion. That was when I was 11 or 12. By the time I was 15

I was on the other side of the fence. The difficulty lasted for several years, I was in a very unhappy frame of mind. Then I was interested in philosophy and literature.

My interest in literature persisted until well into college. I read everything I could get my hands on. I planned to major in English but I knew then I wanted to try out everything there was. I took no more than one course in anything unless I had to. I got interested in physics, math, and biology. The latter was a great thrill to me. The teacher left the students alone, challenged their curiosity and gave them the materials and turned them loose. That was the first time I'd come in contact with that sort of thing and I was thrilled from the word "go." I didn't like the lab in physics but I was enormously pleased with the beauty of the subject matter. I knew I was going into graduate work but didn't know what sort it would be.

I finally didn't go into philosophy. When I talked it over with the philosophy professor he discouraged me. He felt there was little possibility of satisfaction in the field. Although he offered me an assistantship he advised me not to take it. By that time I think I felt I wanted to be in a laboratory science. I was probably undecided between the beauty of the construction of physics and the challenge of the unknown in biology.

Once in graduate school he quickly found a professor who attracted him.

So I decided I wanted to work with him and everything followed naturally from that. His idea of directing research was to give you an organism to work on. He had very little contact with his students. His idea of teaching was to let you work in the same room with him. He gave me an organism, said to study it for a while and see what to investigate. So I did and he said to go ahead. I loved it. I was happy.

11

With another it is a little difficult to know whether he had spontaneous early interests in science or not. His story is:

In my earliest recollections my father was teaching at a college when I was 4 and I remember his going to the lab every day and I remember going there and I guess I just grew up with the idea that that was what every one does. It's peculiar, looking back on it now, that as a child I took it for granted that every one went off to work in a lab. When I was 8 I started to school with my younger brother and we used to have lunch with my father and he started teaching us things. My first job was to

learn to wash test tubes. We were all brought up with the idea, for example, we always called salt, "sodium chloride," etc. So it was a natural thing to me and my brothers and sister.

So, when he entered college he started studying chemistry, with numerous courses in music on the side. In his junior year, however, he took an elementary biology course and was so interested that he continued. The influence of one of the geneticists in the department rather led him away from chemistry, and that summer he worked with a professor. . . .

And we went on a great number of trips. I got the impression if you were a biologist you got to go on all sorts of trips.

When he entered graduate school he decided to become a biologist, because he wanted to work with living things. Genetics as it was then being done did not attract him, however, so he went into plant physiology instead, since he thought his training in chemistry would be of value there.

12

Another was brought up on a farm and became interested in animals. He had several brothers, one of whom was crazy about horses, and when the subject was 10 or 12 showed him how to record pedigrees. This fascinated him. He went from the farm to an urban college, where an older brother was teaching.

I knew exactly what I wanted to study when I went there, chemistry. I had had some chemistry in high school, not very good but enough to get me interested. I liked math in high school, too. Because of the family tradition, I worked hard enough to get good grades. The reason I went into biology was that when I was a sophomore I took a course in biology and it happened to be the one year in all the time he was there that that professor taught the beginning biology. I was also taking chemistry and didn't like it due to bad instruction, largely. The biology course was mostly zoology. It wasn't altogether the teacher, it was also a book,

Punnett's *Mendelism*, and that excited me very much because I thought that that fitted in with a lot of stuff I had noticed in my own experience. My getting the book was due to my brother who knew I was always interested in drawing up pedigrees, and he suggested that I read about it. So I got a book from the library, the first one wasn't any good, but then I got the second and that was fine. It wasn't because the teacher was interested in genetics, that was just an accident. [Had you done any breeding on the farm?] Yes, chickens. We went into the business of raising fancy chickens, my brother and I. It wasn't any good as a business.

Technically I majored in math, but really in biology. By the end of my sophomore year I was definitely interested in genetics and knew that was what I wanted to do.

He also became interested in systematics.

For some reason, I don't know how it happened, I got interested in collecting plants. Perhaps it had to do with an old family friend who was interested in plants. I hardly knew her but she gave me a book. A catalogue of plants. You couldn't use it to identify but my aunt had an ancient botany—Woods, I think, around 1840—and I more or less put the two together. It was probably in part, I didn't realize it at the time, in part another brother who was then on the farm because I realize now that he knew the plants and animals very well. He didn't know their names but he knew about them. I was very close with him and I suppose I must have learned from him. Aesthetically I have gotten a lot of pleasure out of the systematic stuff.

13

This one was brought up in a large city.

My paternal grandfather was a business man interested in natural history, with a cabinet of curios and I think that since from before I could speak I was being shown minerals and fish skeletons, etc. My other grandfather was an inventor still making gadgets of various things. So from as early as I can remember I had an interest in natural things and in designing of apparatus. Father was a business man with no interest in science.

When I went to college, I was quite uncertain of what I wanted to do. In prep school I had had good teachers in Latin and math. I thought in my freshman year I was going in for the classics. My father gave me a good camera and I got to wandering around in the woods and took pictures. I stumbled on a couple of books

on photographing birds and I'd been given some books on natural history which I remember now I rather liked but I had no idea of being a biologist until the end of my first year at college. I got interested in bird life photography, photographed a few nests and knew a few species. But I knew it was natural history after that summer and went to my advisor at the beginning of my second year and I told him I wanted to put biology down in my curriculum and the only course that could be displaced was Latin (this was the Latin professor) so he said okay and I began to study biology and I have the most vivid memory that the first day in class I knew this was what I wanted. It was like a religious conversion.

In the same summer that I was doing the bird nest photography I was visiting a relative, a veterinarian, so I had seen a good deal of veterinary practice without the thought of being one. I don't think I got any conscious stimulus to go into biology from that but I know I got some from reading Department of Agriculture reports on his shelf on cattle tick fever. That added to the interest from the birds. It was a feeling that here was an awfully interesting story involving animals and the microscope. In the first year it was more the techniques of the lab, the use of the microscope and the methods of study that attracted me.

Before that when I was still in prep school, oh, I must tell you that beginning in grammar school I took a great interest in tools. Father gave me a kit and I had a work shop in the basement. So I built some simple electrical devices, got books from the library and I ran into a little odd thing which I've never seen referred to again, something that happened when I hooked up some electrical gear and I wrote to the editor of a scientific monthly. It didn't send me into physics. The editor wrote back that no one had noticed it and I must go into it some day. I had physics my freshman year in college. I did very badly in it, just barely got through.

Failure to do well in math and physics got me away from my interest in electricity. And then biology interested me. [When did you learn about research?] I must have been aware before I left college that people like myself could go into investigation. I did so well in biology in college, never less than 95, that a junior teacher suggested to me that he thought I might get a fellowship in biology. This had never been given at that level before I asked. The professor said it couldn't be done but he fixed it up for me to go to a biological laboratory that summer, where I worked by myself. I had a problem in mind, the teacher had suggested one, but I felt the problem was impossible. So I said I'll just

see every kind of animal I can find. So I went to work and made a note book in which I drew. One of these protozoans developed an interesting phenomenon so that I did what amounted to beginning research in my first summer out of college. I thought then I was going to return to biology. I had a cousin, now deceased, a surgeon who sent for me. Mother may have put him up to it, I never asked her. They knew very little about the career of a university teacher and one of the few teachers mother knew was a baffled man. Mother had wanted me to be a minister. He (the cousin) told me it would take brains to make a career in science and any fool could make a living in medicine.

So he went to medical school, and "fell into the department of anatomy," and was very shortly doing research. The professor "was a great man and very exacting. The kind who gave no help until the paper was written and then said it's no good, do it over again." He became interested in a particular branch of medicine.

I think I know why. It was then and is still one of the most morphological of the clinical branches, more concrete. The concepts are simple, the range of possibilities narrow, and one isn't tantalized by a lot of loose ends. I was still timid, I remember thinking that to be a general surgeon you have to know too many different kinds of things. This seemed to me within my grasp.

His internship was postponed until he had a year of anatomical research. His comment on why he didn't go into practice shows a good deal of insight.

At the end of that year I had weakened about going into practice. I could have been resident after that but I would have had to deal with patients and their relatives and I thought then I couldn't carry the responsibility of life and death comfortably. I thought I wasn't good in emergencies and I was right. I was a little afraid of the burden and not in the least afraid of the burden of intellectual responsibility that goes with science.

14

For the next two subjects illness and accident played a part. For the first it was measles sometime when he was between 7 and 9 years old.

I was confined for the conventional period and during the convalescence there was a good deal of hustle and bustle and then father told me he was building a chicken coop. When I got out of bed and went out the first time I found a shed about half the size of this little room, a little wood burning stove, benches, a carpet or two. I think that was about all in there initially. He had of course built it to keep me off the streets of that rather rough town. I took to it like a fish to water. I could build a fire in the stove and so on. I collected minerals and a magpie and put up shelves for the collection, etc. I was always alone. I was considerably younger than my youngest sister, if I was 9 she must have been 19 or 20. There was no one really close to me. Then the accent shifted and I got very interested in electricity. Some place I picked up what is commonly called a static machine, which makes static electricity. Then a doctor, perhaps the family physician, gave me a discarded X-ray tube. I hitched it onto the machine and could see the bones of the hand. Why I didn't burn myself I don't know. One of my older sisters was going with a young physician who took a casual interest in me and he suggested that we dissect a cat. So we did. I found out how to do it. I had a few adventures on my own and a traumatic experience with the family over a meat platter I had dissected a cat on. I had some chemicals. [Did you have a set?] No. I bought my own. There were lots of books for children which tell you about these things and how to put them together and one I remember in particular. Then on Christmas I got a book about Edison. There was a picture of him in the front and I still remember the stains on his apron. Then I got interested in wireless, and built myself a set at an early age. Until I left I spent all my spare hours in the shed, with apparatus and gadgets and dissected cats and reading literature intended for youngsters. I had no personal guidance but still that satisfied my interest in some field of science. I think there's a big difference between art and science. In science it's chiefly opportunity. I believe I could be a paleontologist, for example. I think I could be an authentic instance of an early incident which bent the twig.

He worked his way in college, taking his major training in chemistry. Then the war came along and he went to the chemical warfare service, where he shortly wangled a transfer to a research division in which he did some pharmacological research. After finishing his undergraduate work, he shifted to phys-

iology for his graduate work. This change may have been stimulated by his research and perhaps more by his colleagues in this research during the war, but it also had to do with another early interest, that is, in evolution, stimulated in part by finding fossils as a child.

15

The second subject was taken to New York for special treatment after an accident, and while there went to the American Museum of Natural History.

The fossil hall hit me. Then we moved there and I spent lots of time at the museum. I copied labels, the labels didn't always agree. That was in the 8th grade, then we left New York again. Every time I got back in New York I went to the museum and looked the place over.

Then I went to college and thought I'd go into history but I had to have some science course and the boys said, "Take evolution that's an easy course," so I took evolution and there were my old friends and I was sunk. The other stuff was interesting but only mildly. All along outside of history and the railroads I'd read some nature study. In history it's the beginning of things that you don't have much data on that fascinates me. The gaps. Wondering, what the devil, you haven't much to go on but can you piece it together somehow. I majored in German and history, I didn't take any biology. Then I spent a couple of years in France in the war. When I came back a university gave me an assistantship in biology. Now of course I couldn't have gotten into graduate school in biology. I never had a course in anything I was interested in. What I'm interested in is structure.

16

Another also had early but not too crystallized interests.

I suppose it's hard to say. We collected birds' eggs and insects and lists of birds, my brother and I. A friend organized a class of children, when I was 10, and I think that stimulated my naturalist interests. My brother and I had a magic lantern and I remember preparing a series of slides of prehistoric animals to illustrate evolution, so that I had an interest that goes back as far as I can remember.

He still has an old notebook containing lists of birds and the dates on which

he had seen them, made when he was about 12. The family took "bird walks" not because of special parental interests in birds, but rather because they liked to get out into the country.

I spent most of my spare time out in the country. Collecting eggs, of course only one from each nest and all that. I remember how I sat watching birds all morning to find the nest.

One of my great triumphs was seeing a particular rail. There was one little patch of marsh where you could just sit quietly and all sorts of things came around. Finding an unusual bird or a nest I hadn't been able to find before was very satisfying. I had field books. Not much, though. I didn't know about scientific names of birds. I knew some of the butterflies' names, they stick to me now and now they are all wrong. Of course I did know the major classes in mammals, in birds I knew in a rough way the major orders and some of the families. I suppose I would have a fair knowledge of the families but never learned the scientific names. I was much interested in the relations between the orders of mammals and making trees for it. I was never systematic enough to make a really good collection of things. So far as the natural side is concerned, I really had read a good deal in an unprofessional way. Just what you pick up in popular books.

Between his junior and senior year in college he spent some time with a surveying party, which he enjoyed very much. He had had quite a little chemistry, but no course in biology until his senior year in college. It was a small college and the teacher, Mrs. K., was about the first one on the faculty with a PhD.

It was about my first contact with the idea that not everything was known. My first contact with research. Mrs. K was very enthusiastic and she brought this idea of research.

In that course I think my final decision was really taken. I had to review work on Mendelian heredity of which I had never heard before. That was about 1912 and I think I went to the *Encyclopedia Britannica* and looked up other things and gave a report. But I should say that my interest in evolution antedated that, I'd read Darwin. I suppose at home there was some talk about evolution, I knew the general theory, and got interested in it and I can't recall what started it. It was mainly that I wanted to do something

in the way of research though I didn't know just what, but working out something new.

He got a scholarship for graduate work and went into biology.

I wasn't prepared at all. I'd had only one semester of botany and one of zoology but it seemed to be the field that aroused the most interest. Especially in Mendelian heredity which seemed to be wide open for development. That article of Punnett's in the *Encyclopedia Britannica* stimulated me.

He had a course in introduction to research, with a professor who gave him the material and told him to find out what he could. He dug in and did a fine job and clearly enjoyed it. He has been at it ever since. His early interest in engineering gave him an unusually good mathematical background of which he has made good use.

The other men in this group have always had an interest in some aspect of science. In most of them the focus of interest has shifted, but they were never seriously interested in any other fields.

17

One subject was brought up in New York and like another his early interest in evolution stemmed from his father's discussion of the horse exhibits at the American Museum of Natural History. He thinks the Unitarian church also influenced him.

They made us socially conscious and gave us a certain amount of evolution, at least by taking it for granted. And that thrilled me most and for a while I became deeply religious in the Unitarian way. I felt religious towards evolution which I later gave up. I became mechanistic but still kept evolution as a thing to be striven for, as a great tendency in things even though it no longer had mystical connotation.

An important element in deciding me in what I was going to do is that I'm interested in animals. I always have been, I don't know, either tradition or heredity or both in my father's family because so many of us independently had gone into something biological.

My mother took botany in what was then

Hunter normal school, more like a high school, and liked it very much. She went on these Torrey botanical club expeditions, and we use to go with her. . . . I can remember when I was three-and-a-half and broke my leg I used to arrange the blanket fringe into animals. And one summer at the seashore I tried to collect all the animals I could, I was interested in how they behaved. And I liked to draw animals. And then I read Seton Thompson's books. I didn't like books that animals talked in but I liked his. I even wrote him a letter when I was eight asking if I could go on some expeditions with him and I remember he wrote a very nice letter to me. Most summers we went out in the country. Father was there only weekends; he died when I was 9 and a half but he too . . . dogs and cats used to follow him home and my mother didn't like that.

Father, although a business man, was interested in his father's collection of butterflies and induced me to collect. We had several cases he had exchanged with others the way the German collectors did.

In high school he had belonged to a science group, but they had excluded biology as not a science. He became interested in the structure of matter and in general things about the universe, and very interested in astronomy. For a while he thought he would like to be an engineer but he was too young to get into college. His first year in college he had a course in general biology, and "got converted in biology." On his own he read Locke's *Recent Progress in the Study of Variation, Heredity and Evolution*. "It was like a revelation. I still think it's a wonderful book." From then on his course was clear.

18

One spent all his early years collecting and studying birds, but he is now a botanist. He lived in the Middle West.

There were meadow larks and bobolinks and violets and shooting stars and grass nearly as tall as I was and glacial boulders which my elders told me were meteors, they meant meteorites of course, so I wandered around and saw all those things, and I liked them. And in all fairness I must add that there were strawberries.

In other words, I was raised in the country. I had chickens and rabbits and a goat I attended to.

My grandfather and uncles and all the family were tree planters in the 1800's in Illinois, but in that stage of my life I wasn't planting anything, I was just looking and liking. No one I knew, knew anything, anything at all. My mother was deeply interested but knew nothing. No one could tell me anything. We knew the names of a few birds and flowers. Birds are my main interest even now, I've done work on birds all over the world but things came too fast.

When I was 10, my oldest sister was in high school taking a course in zoology. Her teacher was the first I ever knew of with anything approaching scientific knowledge. I saw a bird which I now know to be a towhee, scratching around in the leaves, and I had never seen such a bird so I described it to my sister who was taking a course in high school and she came back with the news that it was a towhee. The fact that I remember it shows that it was a definite connection between the observation and a reward. I think it was a major experience. To know that it had a name and that I could find out the name by giving the facts to someone who knew.

My mother got me books about birds. We didn't have much money, but she got them for me for Christmas and birthdays and so on, and I had half a dozen books. At high-school age I had a bicycle and I went walking with neighbors, older men who were egg collectors and they helped me find nests. I had my first talk about girls and not nice girls. These boys were 18 or so and they bragged about their conquests. And I learned a lot about it. . . . So we saw lots of birds and nests and I got quite a lot of information and misinformation because they weren't scientists just egg collectors.

After they moved into town, he went to high school and met the bird man on the staff of the local museum, and "It was he who really told me what every bird chaser should know, about migrations and all the rest." When he entered the university he intended to be an ornithologist. He met a geneticist, working on birds, who bought specimens from him, and talked to him about it.

Nothing like it had ever happened to me before. So naturally I went to study zoology and he encouraged me, but the teacher was a shy man and retiring and it was a terrible course for a freshman, all lab courses and no natural history which I was interested in. So my sopho-

more year I went on with zoology, and I took botany, given by the head of the department. Marvellous. And I got all fired up with botany but again it was lab, all on slides and under a microscope. Fortunately in my junior year (I was getting A's in this and C's in everything else) I had a course in field botany with C., one of the great men in my life, so I found out botany was something besides microscope slides. He was the only naturalist, the rest were all lab men. Fundamental science but not what I wanted as an undergraduate. So I took geology and it was a wonderful department in those days.

Eventually he graduated in geology, with heavy biological background, but the dominance of laboratory work, removed from things he had seen and known, disgusted him and after some graduate work, he quit and went to teaching. Then one of his fellow students found some unusual plants and sent for him.

Here was what I wanted. I liked botany and geology better than anything else and this was the combination. By then I was 26 years old. I really liked plants and I liked ecology, the habitat relation. I got interested in the climate, topography, life relation. I realize I always have been, and it's still my major interest.

19

In the early life of another there were many incidents connected with natural history which were clearly very ego-inflating. They spent their summers in Maine for many years. He and his siblings always had a race to find the first lady slipper and give it to their mother.

It was a great thing to do, she always praised us. Soon after we could read we learned there was another kind of lady's slipper, the showy lady's slipper. It was very mystical and it would be a wonderful thing to find.

When he was 5 or 6 they had a nature club, but he had no formal education in science or natural history in grade school. His father fostered their interest in sea life; they went hunting in tidal pools, and fed the sea anemones and

gathered fishes. They also went butterfly collecting. When he was 9 they moved west, and a year later in an English class he had to give a talk.

I took a topic in science. I gave this dissertation about the butterfly wing and I remember putting a diagram on the board. It made a great hit.

That spring he went east and spent the summer in a small town.

It was paradise for a small boy, so much freedom. My family had been there since 1810, every one knew every one. There were no rocks, a few swamps, but not bad ones, I was just let loose, I could wander anywhere I pleased so then what I settled on in the line of natural history was birds. I identified about 45 species of birds, by myself, from the field guide. I made a list with no help; that was more natural history.

A little later, with a group at the school he found plant fossils, as a result of a temper tantrum.

I was poking around there one afternoon and someone needled me rather badly about something and I got real mad and chased this person with rocks. I threw some at him but didn't hit him and sat down in remorse and started picking at a rock and found a leaf in it so then we had a week-long hunt. We had a contest to see what we could find. I was the one who started it and I think that inflated me greatly. I'm not sure of the details but that it started from a tantrum is right.

I knew the common kinds of flowers but never spent any time identifying flowers. I did with butterflies, we had large collections, we were intensely interested, we had a lot. It was rocks and mountains and butterflies at that time. With that interest in fossils if someone had shown me what one could see in the geological structure I might have become a paleontologist.

I had the first formal course in science in high school. It was a conglomerate business, some physics and chemistry, then astronomy and meteorology then botany, systematics of plants. I never got poor grades but was always a little behind my brother, we went to the same school the same year, I was a year behind him. There was always a competition for grades, I caught up when he was sick. The first year there he broke all the records. All down the line I was always in the high B's and he was in the A's. Then I had science and got the highest grade in the class. [His brother didn't take it.] That started my

interest in systematic botany and from then on it grew.

The following summer he was back in Maine. He had a flora of locality.

I went systematically through the book and tried to find everything. I had an awareness of scientific names. [The book is marked with dates and the places where he found each thing he did find, a very high percentage.] From then on I just expanded in systematic botany, but hadn't given any thought to it as a career. When I went to college I thought I'd go into government, law, or politics, something like that. I'd been impressed by the course in government. However my interest in botany grew.

Several years later I made a fern collection and with a roommate we took a two weeks pack trip through the White Mountains and on that trip I made my first botanical exploration in collecting the plants of that region. During the following year it got to the point that I couldn't keep my mind on government and I went to father and said what do you think of my going into natural history. Father said you won't make any money but he went to my professors and then said if that's what you want you can try it out. I think that settled it. Once I got started there was nothing else.

20

This subject was always interested in the same thing.

I'm a born botanist. I've been fascinated by plants ever since I was a small child.

When I was a child a brook ran in back of our house and a sandy beach, and I had a sand-pile down there and when I was about 6, I was fascinated by the way people made geranium cuttings. So I snipped off some of my mother's geranium shoots when she wasn't looking and carried them to my place by the creek and rooted them. Then we were about to leave. I couldn't bear to leave them, though I expected to be punished for doing it. I can still remember how astonished I was that I wasn't punished but mother was proud I had pulled off something like that. They were given to the lady who scrubbed for us. When we visited later I saw them.

When I was 4 I was given some beans to play with, weevils got in them. I lived in an enormous Dutch house and in the spring when the frost was going out of the ground the man who came to deliver the wood left wheel tracks all over. So I planted the beans in the wheel tracks and then it rained. . . . I may have patted down the

dirt, anyway I went away on a visit, and while I was gone the beans came up. At first no one could imagine what had happened in the front yard, then mother remembered giving me the beans. They were all gone by the time I came home.

I remember my first scientific experiment. I think it was quite good. I had already found out that other people than father and mother were apt to smile at me if I asked wondering questions. One of the things I noticed was that the clouds followed me around. I didn't think they really did but that they just seemed to. So I took my baby brother, he must have been pretty young, I remember he had on long dresses, they wore them in those days, and told him to watch a cloud and I walked down to the end of the garden and then asked him if the cloud followed me and he said it didn't.

The next experiment I remember I was 8. I was always thrilled every spring with the things planted in the garden and always helped. Father had a vegetable and a flower garden. Every year he had planted morning glories and nasturtiums. I had heard about hybridizing plants, and I decided I would hybridize nasturtiums and morning glories. I started out with typical and superb self-confidence. I took the morning glory seeds and pushed them into the seeds of the nasturtiums. I had no doubt they would grow. I planted them in the edge of my wild flower garden—it was quite customary for people in that town to have wild flower gardens from transplantings, not grown from seed. The morning glories didn't come up but some of the nasturtiums did but even they looked a little sick. I tried very hard to see if they were different. I expected either they would be morning glory flowers on nasturtium vines or nasturtium flowers on morning glory vines, but I wasn't sure which they would be and that was one reason why I was so fascinated.

If I'd grown up on a country farm or where there was no knowledge of botany as a profession I don't know what I would have been but when I went to college I already knew I wanted to be a botanist. I'm one in spite of my undergraduate work. It was sound stuff but not very attractively taught. I majored in horticulture, of course, it was an agricultural college.

The other thing that fascinated me most as a child was math and it occurred to me (about age 10) that you could have a number system with another base so I invented ones with 11, 12, and 13 bases. I never found out that the 12 base would work better. I worked with the 11 base quite a little and found I could do some problems with it. My teacher caught me and tore it up. But I took it as a matter of course.

In an old *St. Nicholas* I found out that if you

took a piece of paper and pinned it together and cut it you got a result you didn't expect. I played with that for weeks. I was figuring out the system as far as I could.

There was never any question of what he wanted to study, and he went on to graduate school with no hesitation. He has managed to combine his interest in mathematics with his interest in plants in a most fruitful way. He has a great feeling for precision of form and he thinks this, too, is a factor in the development of his professional interests.

It is clear that a childhood interest in natural history undoubtedly fosters development into a biologist, but it is also clear that it is not a prerequisite. Those who did not have such an interest often became interested in science (but rather from the laboratory point of view) because of required science courses in high school or college, and often, too, because the teachers of these courses were stimulating people.

A number of studies of the development and persistence of interests (as shown in interest tests, not in actual spontaneous activities) tend to confirm that the interest patterns shown by high-school students remain fairly stable and most of the change that takes place does so by the age of 18. On the other hand, interests, as inventoried, would apply to as general a field as science, and shifts within that field would not be very evident. It should be remarked that the selection by these men of science as a vocational choice was not due to any general social prestige value of the occupation. A study in 1931 (11) gives the social status of occupations as seen by elementary and high-school students to be, in descending order, physicians, bankers, and ministers. Science may enter into the first category, but only periph-

erally. The situation was different immediately after the last war when there was some glamourization of chemistry, which seems to have affected this group only slightly. It would probably be very different now. Furthermore, the experiences of the first two years of college training in a professional field have been shown, perhaps because of the importance of the first real contact with a field, to have some effect on inventoried interests (21).

There are a number of very interesting points that come out here. These men came to be biologists following several different routes. Only eleven of them had any childhood interest in some form of *natural history*, sufficient to spend considerable time at it one way or another. The fields in which they were then able to work, however, are not necessarily the ones in which they later specialized. A few of these had very few courses in biology in their undergraduate days; with several of them it was an opportunity to do graduate work in biology that started them on their way, but the pre-existing interest in natural history undoubtedly was a factor in their choice. The rest seem to have come to biology through an original interest, not in natural history, but in laboratory techniques or methods. Many of these were first interested in chemistry, and only

gradually went on to biochemistry or botany, or genetics. It is very possible that the more general availability of courses in chemistry than in biology in high schools of the time was a factor here.

Sometimes, too, some personal influence was of considerable importance. This was occasionally very direct, as when a teacher suggested going into a field the student had not previously considered, or as in the case of one subject who wanted to be like his uncle. More often, however, it was the influence of a teacher who challenged curiosity and then stimulated the student to work out the answer for himself, and made it possible. The discovery that not everything was known, and that one could find out things for oneself seems to have been an overwhelmingly important revelation. The theme of the pleasure they found in the experience of working on their own is a constantly recurring one.

To some extent in the excerpts from their stories given here, and to a greater extent as they described their continuance in their profession, the amount of time and energy devoted to professional activities is striking. Once well started, once they had the feel of research, this became the most important thing in the lives of all of them. The *intensity of their concentration* then, and now, is notable. Notable, also, is their satisfaction in it.

PROFESSIONAL HISTORY

A FEW of these men held jobs for a brief time in industry and a few have worked with federal agencies, but most of them have spent all of their professional lives in universities or research institutions. This has been supplemented in a few cases by traveling fellowships. Some interest attaches to the number of changes they have made in institutional affiliations, and this is shown in Table 7 which gives the num-

TABLE 7
NUMBER OF INSTITUTIONS WITH WHICH SUBJECTS HAVE BEEN CONNECTED SINCE RECEIVING DOCTORATE

Institutions	Subjects
1	4
2	7
3	4
4	1
5	2
6	1
7	1

ber of institutions at which they have held positions since receiving their doctor's degrees. An institution is listed twice if the men left it for another and later returned, but the number of institutions does not include fellowship work or visiting professorships if these lasted only one quarter.

Those who have made few if any changes in institutions have progressed in rank with considerable regularity. These figures cover an average span of 25 years, and add confirmation to what has been said previously about the general social stability of the group. It should be said, also, that the five who have been connected with more than three institutions during their profes-

sional careers are not personally less well adjusted than the others.

Almost all of the men have done and are still doing some teaching. In a number of instances they now carry rather small teaching loads. With some, the amount of teaching is voluntary, that is, the institution recognizes the importance of their research and gives them a great deal of leeway in the amount of time they devote to other duties. It should be said that a number have administrative duties, however, and that very few shirk all teaching.

Of perhaps greater interest is to what extent they have continued with their first research problems. The content of the doctoral thesis was in nine instances unconnected with their later work. To some extent this was because of limitations in thesis material due to limitations of the university or staff, although in some measure it was a result of uncertainty on the part of the subject; in other instances, the shift was due to the job immediately available after the doctorate. Others continued more or less on the lines of the thesis, for a time at least, and a few have recently returned to their original interests which had had to be laid aside for a time.

The general picture is one of a start, sometimes entirely on a fortuitous basis, sometimes as a result of personal contacts, on a line of research that was interesting and that got results, with succeeding work a logical development of the problem. Thirteen of these men have spent their professional lives on one major problem, or one major specific field, developing it with varying degrees of

breadth and inclusiveness. This can reach the point at which the relationship with their early work is far from obvious. Three of them have pursued several major lines more or less simultaneously, and the remainder have, in the course of their work, shifted from one major field to another. In one instance this was due largely to personal acquaintance with an

inspiring colleague, in another to the fact that the chemical background was inadequate to permit further pursuit of the line then being followed, in the others to specific job requirements. In both of the latter, the men are now freed of these restrictions and back at work on the problems that first interested them.

PSYCHOSOCIAL DEVELOPMENT

THE social and sexual development of this group seems to have been generally retarded and sometimes is still incomplete as is clear in the Rorschach and TAT protocols. I do not have very full data on early family relations but there is a strong impression of a general dearth of close ties, even for those who lived in an unbroken household.

As has been stated, there were seven whose homes were disrupted fairly early. Their stories are given briefly below.

We had a whole series of housekeepers, that is all I can remember about growing up. Mother died when I was about 4. I just remember a little, a few things. I think the main effect this had, well, I don't know whether it had this effect or it was just coincidence but as a youngster I had, I suppose, a rather unusual social life. Not so much lack of opportunity but I didn't take much advantage of it. I had a lot of friends in the neighborhood and spent time in the Boy Scouts but not in mixed activities. I got crushes on girls but they never knew it. I got over it in college in undergraduate days. A brother, 8 or 9 years older, died at 18. My sister was three years younger. I think we fought more than usual.

Mother died when I was 5 so I was brought up by my father and sisters. [He was asked if he saw his sisters often now.] The ties aren't close. Three are dead. When I lectured in a distant place recently I saw one sister for the first time in years. I have no address for the other, we don't correspond much, they send a note or card.

I had a brother a year older and my mother died when I was 10 and father married again when I was 13 and then there was a half brother and a pair of assorted twins. There was quite a lot of domestic strain. That's why I left home at the last year of college, said I'd never go back again and didn't. I don't know whose fault that used to be because I was quite enthusiastic about the arrangement at first. My brother left home before I did. We were as unlike as any two people could be. I've only seen him a couple of times in 20 years.

One was born, the only child, after the death of his father. He was brought up by his mother, with the assistance of an aunt or two, and subjected to very little discipline of any sort, so far

as I could make out. He commented that his mother had not approved of his interest in hunting and fishing but this seems not to have deterred him. He is the one man in the group who seems never to have been in the least shy with girls, and to have considerable experience with them. Nevertheless, he is a rather unsocial man in general, never goes to meetings, avoids casual social contacts, is still almost as much interested in outdoor sports as he is in his work, and is quite satisfied to go off by himself.

The father of another died when the subject was 10. He and his father had done many things together, and one gathers that his early years were happy ones, and that the family ties were reasonably close. However, he apparently was not close to his mother and she did not at first approve of his professional choice, which was a matter of first importance to him. There is much evidence in that TAT pointing to difficulties in this relationship, perhaps of a rather subtle sort. He still carries a heavy load of guilt with regard to women and considerable resentment of them.

The parents of another, an only child, were divorced when he was 9. He remained with his father. He says he had never felt very close to his mother. He did not dislike her but they did not seem to have very much in common, and he had seen very little of her. He seems to have been closer to his father, but this relationship was disturbed by his father's remarriage, and after a little while he went to live with his grandmother. She was a very solid sort of person and a great bulwark for him, but I do not have any impression of great warmth from her.

Another, the only child of his father's second marriage, had apparently no contact with his stepsiblings. His parents separated when he was a junior in high school, and he remained with his mother, who was working. She did not put any pressure on him in the matter of grades or vocation, nor had his father so far as he could remember, but she was always interested in what he did and found something to praise. He says that she was rather possessive, and he feels that he was fairly successful in coping with this. He had moved to the dormitory his last two years in college although she lived in the college town, and had seen her with decreasing frequency after he went on. She objected strenuously to his marriage although there was no open break, and apparently her resentment over it is now dominantly directed against his wife.

There are two who went through a period of fairly open rebellion, partly at least, directed

against their mothers. One was very over-protected, but remembers several traumatic experiences. One was his first experience of severe pain associated with bleeding. The other was learning of sex, when, as was the custom, the leader of a club he belonged to discussed it. He was so upset he fainted, and for a long time thought it all very horrible. He is not sure how he got over it, but perhaps he was helped by conversation about it with a girl who was very sophisticated and worldly wise. He was further helped to reorient himself by a woman associate when he was a graduate student. He also went through a period of serious upheaval over religion which he used quite aggressively against his mother. His father was a business man but interested in science, and he thinks it was the great value his father placed on learning that made him take it for granted. He feels he is in a way the fulfillment of his father's ambitions.

The other says he has been an agnostic and a rebel almost since adolescence, and it is clear that much of this is directed against his mother's self-righteousness. She used to whip him severely, being very quick of temper. His father seems to have been a mild, decent man very dominated by his mother, and to have had little influence. Of his sexual development he says, "Maybe I was inculcated with the Victorian idea of women, something one put on a pedestal and knelt down to and all that sort of silliness, and I lived rather in fear of them and I probably was taught that any sex satisfactions were wrong. I was always girl-shy, and in fact never went out until I started to court my wife. I must have been close to 30."

There is another whose mother was ill throughout his childhood so that he was brought up by a succession of nurses. His father was obviously interested in the children and kind to them, but his time with them was limited. He says, "I never had a girl until I was a senior in college. Then I had a casual and platonic affection for a lady scientist. Then I developed a passion for a girl whom I hardly dared to speak to when I was a graduate student. I have never understood women."

There are two who were brought up in fairly close-knit families, one religiously an orthodox and the other a liberal household. The parents in the first instance seem to have been strict but not stern, in the latter the father at least was quite stern. Both were very shy, and this shyness was increased by the presence of a younger brother of totally different temperament. One was much dominated by his brother; the other was not so much dominated as made more and more conscious of social ineptness because of the great social popularity of his brother, as well as the rest of his family.

Another says of his parents only, "I recall distinctly when I was a kid that they were talking and I heard my mother say she didn't care what her boys did so long as they were honest men. I'm sure she takes pride in her sons. Father didn't care that I didn't go into his business. When I went away to college I lost touch with them. I didn't go home much. Sometimes not for several years. I was never homesick." This does not sound as though there had been any close relationship with his parents. Asked about girls he said, "I was never shy about girls, the only thing that really I suppose was unusual was that when I was a youngster I had a speech defect. I had a tough time of it at school. I had it for a long long time. I didn't get over it for a long time. I guess as you mature you get more stable. I remember how bitterly I used to cry when they laughed at me. It is one of the worst things that can happen. It didn't interfere with my social life. I've always been a friendly person, had a lot of friends, people have always liked me and I've always gotten along with people. There were times when it was awkward."

There are two who come from rather strict households, but who apparently had no serious difficulties in relations with their parents, and both of whom clearly have great respect for their parents. The impression is that the feeling of respect is stronger than that of affection.

There are two others of whose early life I know very little, but they are now in reasonably close touch with their siblings, and seem to have always kept in touch. I would infer that they had closer family ties than most of the group. One of them, however, had had social difficulties. He says, "I was late going out with girls. Not until my junior year. I got through grade school young and was very slow developing physically, very small. This made for difficulties. I went to a small college and was a complete misfit my first two years. The third year I got into a fraternity; I didn't fit very well there but I had to go to dances and so on. When I came back for my last year, it was a more social life, and I fitted in much better."

There are two who seem to have been fairly close to their mothers, at least to have been definitely aided by them, so far as was possible. One mother was determined that her son should go to college, although he would not have thought of it himself. When he was as young as 10, she had him buy a cow and sell milk, so that by the time he was ready to go to college he had ample savings. She does not appear in his story after this, and nothing was said of his father. He and his wife are very close but he has so few social contacts that his wife has sometimes been thought a widow.

The other was supplied by his mother with books on the things he was interested in, so far as their very limited means permitted, and when he went to college, planning then to be an ornithologist, he had her hearty approval. "My father probably thought we were nuts but he was a very good Joe and anyway he didn't object. I'm sure he wondered if there was any way of making a living at it. I've often thought I'd like to have a day with my old man (he died many years ago), just to sit around and get a lot of liquor and talk to him. I'd like him to know how things turned out and that it was a good business. I'd like to get acquainted with him."

The other man was one of many children who had many recreational and other interests in common, and all of whom seem to have been fairly close. I am at a loss to account for some relatively minor present difficulties.

To many of the men who did not volunteer the information, I described the general retarded development of the others, and found that they tended to agree that their own had been similar. It is the classic picture of the boy who is shy, over-intellectualized (sometimes clearly as a defense), not as a rule a member of any neighborhood "gang," even in the innocuous sense, although often with one or two close male friends like him. Dating girls was no part of the picture, but there may have been a period of unexpressed adolescent crushes. In most instances, their first personal contacts with girls were during their late undergraduate or graduate school years. Very often the first break came through a platonic friendship with another graduate student, which seemed to serve as a bridge over which a more direct and sexual approach could be made to some other girl. This picture is one frequently found in males in our culture with intellectual interests, but it is apparently not the picture found in other groups (9).

Rorschach and TAT data are confirmatory of this. There is one story on the TAT (see p. 35) which is in so many

respects expressive of the situation that it is quoted below. I do not know that it is autobiographical, although I suspect that at least in part it is. It was given in response to a picture showing a girl with her breasts exposed lying on a cot and a man standing, turned away from her with one arm over his eyes.

I don't like this one very much. I don't see much future for it either. It certainly looks to me like the morning after anyway. I won't . . . , I don't think he has murdered her I think he has just waked up [laughs heartily]. He's evidently a studious fellow, we will make this a little different. Well, he has been studying for years living a scholarly life struggling along probably going to the university either a graduate student or a young instructor, and having practically nothing to do with women but feeling a strong urge, all the more so for that reason perhaps, and in a moment of relaxation he picks up this girl who is apparently a prostitute in a beer hall or some place like that and brings her to his room, probably had quite a lot of beer, too, and the next morning he wakes up before she does and feels very much ashamed about it that now he has departed from this strict life that he has set for himself. There are his books unopened. We might say he took her for a prostitute of the commonplace variety and she really liked him but she was an easy sort of girl although they hadn't known each other long. But he thinks he's ruined [laughs]. Now a little later after the scene in the picture she wakes up. She begins to ask him questions, what are these books here for and she acts very nice and they part as quite good friends. And he goes back to his work and doesn't know how he stands. He has mixed feelings, he has feelings of hope and energy but he has a great struggle with himself but he sees her again and again after all, and in the meantime he does studying in between. Well, he finds that it hasn't hurt his work so much and they like each other very much but even though he has been so starved they don't fall in love deeply and she finally meets another man and falls in love and goes off with him but tries to be nice about it. And he feels more normal than he ever did before and he can take this all right because he didn't love her and he goes out more with both men and women and after a while he comes to feel very grateful to her for having wakened him to a side of his nature that was being so suppressed as to cause a warping of his whole personality. He too finds a girl more suited to him and they have an affair but they finally become married and quite happy.

CHAPTER VII

RELIGION

MOST of these men had a moderately orthodox Christian upbringing. Very few of them now have either church affiliations or any remnant of orthodox faith.

There are only two who are active in religious organizations now. One was brought up in a liberal community church of which his father had been a founder. When he was in college he became a Quaker and is now very active in that group. He says that his religion is very important to him, that he knows he has experienced God. He is a Quaker because his own attitude is acceptable among them; the ordinary church would endanger it and he must keep it. He speaks of a longing to integrate himself with the universe as best he can, and it is clear that this is a strong need with him.

Another is an elder in the Presbyterian church and he and his wife attend regularly. He says that he never had any serious conflicts but of course when he got into science he had to do a lot of "rethinking." His father, though conservative, was not fundamentalist in an emotional way and did not object when he believed in evolution, although the father himself did not. His children have always been taken to church and seem not to have any difficulties over it.

One other contributes to a church but does not attend. He says he does not now believe in much of the dogma of church sects, but supposes he is religious in a way. They had sent their children for a while, but the children did not seem to take to it and they did not force them.

There were a few who went through a period of serious conflict over religious beliefs. One had early been extremely interested in religion and took some training on his own initiative. He says, "By the time I was 15 I was on the other side of the fence. The difficulty lasted for several years, I was in a very unhappy frame of mind." He often thought of suicide during this period but made no attempts at it. "I was interested in philosophy then, and literature. I remember the book that really crystallized my own revolution was a book by Mencken on Nietzsche." He spoke of his mother as the embodiment of faith, and added that he did not discover his father was an atheist until after he had become one himself. During this period of conflict he

wrote frequent letters to his mother suggesting behavior he had not indulged in and beliefs he did not hold. He never treated his father that way. When it was suggested to him that part of his religious upheaval was rebellion against his mother, he accepted it although it had not occurred to him before. He thinks, too, that some of it was just a desire to astonish her.

Another had a period of severe conflict. He was brought up in a very orthodox Methodist household. There was no dancing, no theatergoing, and so on. But his father's success in business meant that in private schools he was with quite a different group. "When I was 16, what to do about dancing caused me agonies." He solved the problem of his class dance by taking the daughter of the minister to it. They didn't dance, just walked around and talked. But when he was 17 he began to waver in his religious beliefs. "Father lived until I was 48 and mother until almost then. I was anxious not to give offense to them, so I postponed admitting I was an agnostic, but I've had no conviction since I was 18. About 20 I realized I couldn't honestly say the Apostles' Creed."

One had a somewhat less severe period of conflict. When he was in college he visited all of the churches in town. "I can remember one thing when I was shifting from one church to another. The Congregational minister wanted me to join and this caused me a great deal of distress and I felt very guilty. Why was I different because I couldn't believe it? After I discovered most scientists didn't believe it, it was all right. I kept going to church when I was in college because I went with a couple of girls. I think this made me unhappy because I felt deeply over it for several years. I used to talk to my high-school teacher about it but she was very religious."

Another seems not to have had any very severe conflict over it, but did revolt, and most of this was a revolt against his mother. He says that with her "all was black or white. I was brought up in a small midwestern town with highly conventional mores. She wasn't really devout, all I think a gloss, she has literally no faith despite her protestations. I've been an agnostic and a rebel almost since adolescence. Chiefly against regulations. I suppose what bothers me most is that human beings are so illogical in the mass."

Still another says he went to Sunday School in childhood but it bored him and he soon quit. He had no conflicts over it and so far as I could

ascertain his parents weren't disturbed although his mother was an active church worker. His own children have had no religious training. He wouldn't object if they wanted to go to Sunday School but apparently the issue has never risen.

One says that his family were nominally Methodist, "to which I was subjected, not too seriously, but I suspect that at a tender age I had some perspicacity and occasionally things may have made some dent at that time." His reaction to the pretensions of the minister was iconoclastic, but like his family's.

Two others said that they had now no religious beliefs and hadn't been to church in years, although both had had some early training.

I do not have a record of the present status of the others. None of them, however, mentioned church activities when discussing their avocational pursuits, and I am quite sure that none of them is an orthodox believer. That aspect of life just does not exist for most of them.

CHAPTER VIII

RECREATION

MANY of these men still work very long hours, although most do not work as long now as they did when they were younger. Practically all of them, however, are accustomed to working Sundays and holidays, frequently evenings, and many of them do not take any regular vacations. As one of them put it, "My real recreation is doing what I want to do, my work." Another said, "There is nothing I'd rather do [i.e., than work]. In fact my boy says I am paid for playing. He's right. In other words if I had an income I'd do just what I'm doing now. I'm one of the people that has found what he wanted to do. At night when you can't sleep you think about your problems. You work at it on holidays and Sundays. It's fun. Research is fun. By and large it's a very pleasant existence."

Most of them spend such time as they are not working with their families. A number of them are interested in gardening; a few spend a good deal of time at it.

Very few of them play any card games, or have "social" evenings except at the instigation of their wives, or as duties connected with their professional lives. None of them goes to the movies except for very special shows, the universal opinion being that most are worthless and boring.

Most of them have been interested in music but this interest is not so strong as it was, and it was repeatedly remarked that they less often listened to music over the radio or played from their collections of records than they had when younger. A few play some instrument,

but only two have spent a good deal of time at it.

The amount and kind of reading they do is very varied. A few do scarcely any outside of professional reading. Others read a great deal. Their tastes vary from adventure stories to Proust.

Five of them remarked that their wives were very active in the League of Women Voters. As a result they are sometimes more or less dragged into civic activities. On the other hand, there are two who took a personal hand in local politics with very great effect, one of them now being, he says, the local political boss. Their political views range from rather rightist to very leftist, with the bulk of them liberal.

A few have more specialized interests. One, for example, has spent a good deal of time delving into the early history of the small town in which he owns a house. Another has spent a great deal of time in historical research which he expects to continue after he retires.

There are seven who have particular sports interests. Three of these are great hunters and fishermen. One of them spends a great deal of time at it, and says it has as much interest for him as his work. A fourth is an enthusiastic and active mountain climber. A fifth is fondest of skiing as recreation, and also likes square dancing. Two of them have played tennis a good deal. A few others have been interested in various spectator sports, or do a bit of climbing and hiking, sometimes also collecting, or have in the past done a certain amount of it, but do not really do a great deal now.

For most of them, their work and

families really provide sufficient satisfactions and recreations are incidental. But for two, this has not been enough.

One of these has written several books (one a very successful novel) and now spends a good deal of time composing piano music. He says:

I got a great kick out of many papers I had written. Then it became more hackwork and less a sense of personal achievement, and longer drawn out—a diluted emotional response. Where achievement is abrupt and quick in time, and personal, it carries with it a great emotional satisfaction, I should say excitement, roughly comparable to that of writing and music. The difficulty in science, I suppose, is that the longer the job the more the emotional excitement is diluted and the more intellectual factors must carry you on. In music and writing it is different. You get a tremendous kick out of writing, all the kick of a very strong drink. But, there is personal aggrandizement, elation, gratification in science and you do get carried out of yourself. It may have the external appearance of heightened ego, but as far as relative appreciation of ego compared to job done it seems fair to say that the ego becomes subordinated. I'm sure it's true of artists performing music, or actors playing a role. A few achievements lead to the type of ecstasy that keeps you awake nights floating, though that may seem odd over technical work. . . .

No, definitely, I wouldn't have applied myself night after night [writing] for years if I had had other satisfactions. It's sort of like knitting. Now I have difficulty in forcing myself to do scientific work which now gives me less satisfaction. There are many reasons. The temptation that I have is to go off and leave it. It's partly fatigue from the war. I may just be stale.

For him, as for another, satisfactions in work have not been sufficient. His personal life was a very unhappy one, and his work did not make up for it. Resort to creative activity of a different sort was his answer.

Another has two outlets, one being writing poetry. "I sometimes write verse just as an outlet. I couldn't just sit down and try to write a sonnet but let me be under the strain of emotion and the words flow." His other outlet is fine carpentry and cabinet work. This he does at the level of fine art. He says, "It's an almost sensuous satisfaction. The sense of having overcome some resistance, for example, I used to tool leather and carve. To make things just as you wanted it, to see the whole thing in your mind beforehand and then to achieve, that was very satisfying."

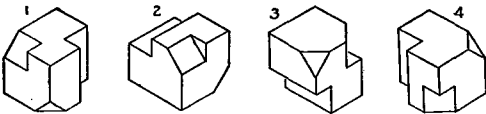
I have felt for some time that there is no such thing as an entity, "creative ability," but that "creative" activity provides satisfaction for certain needs, not otherwise obtainable by some. The work of most of these men has given them scope for some creative activity but for these two it was not enough, and they have found some of the satisfaction they were seeking in artistic creation. But it is still not enough for one of them.

THE VERBAL-SPATIAL-MATHEMATICAL TEST (VSM)

THIS test was compiled by Dr. William Turnbull of the Educational Testing Service from several of the most difficult of their tests. The verbal section consists of two parts, the first comprising 50 items, the second 29. The second part was added when it became 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. Two examples are given, one from each part:

1. Mark the two words in each group which are most nearly opposite:
 Ex. (1) predictable (2) precarious (3) stable (4) laborious.
2. Select the numbered word which is most nearly *opposite* in meaning to the word in capital letters.
 Ex. CASTIGATE: (1) distortion (2) embolism (3) divergence (4) erudition (5) reward.

The spatial section comprises 24 items, each item consisting of four views of solid figures. The task is to select the two views which are of the same figure. This particular test was suggested by Dr. Turnbull because he believed it to be their purest space test. Time limit was 20 minutes. A practice example is reproduced below:



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. Time limit was 30 minutes; no subject completed it. An example is:

The breaking strength of hemp is $M^2 \times 900$ pounds, where M = circumference, in inches. What radius, in inches, will give a breaking strength of 10,000 pounds?

- (A) $\frac{5}{3\pi}$ (B) $\frac{10}{3\pi}$ (C) $\frac{10}{3} \sqrt{\frac{1}{2\pi}}$
 (D) $\frac{10}{3}$ (E) $\frac{10,000}{81}$

Clearly there are no norms for this test, nor any comparative data. On the other hand, there is no standard test which has 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. It would be of considerable interest to learn whether the physicists have a different pattern of scores from the biologists, for example.

Unfortunately it was impossible to secure a test from one subject, so that test results for only 19 are represented here. It is notable that in a group as highly selected as this one is, the range should be so wide. One of the points of greatest interest is the relative position of each man with regard to the three tests. The scores, therefore, have all been converted into sigma scores¹ on the basis of these distributions. These are given in Table 8. It can be seen that A₁, A₂, A₃, P₂, P₃, P₄, and P₅ all do distinctly better with the verbal material than with the rest. P₁ is a little higher on the spatial test,

¹The distance above or below the mean of each test in terms of the standard deviation of the distribution. The formula is $\frac{X - M}{\sigma}$.

TABLE 8
 VERBAL-SPATIAL-MATHEMATICAL TEST RESULTS

Subjects	Raw Score (No. Right)			Sigma Score		
	V	S	M	V	S	M
Al	50	6	11	-.54	-.77	-.95
A ₂	73	10	12	+1.35	+.14	-.78
A ₃	70	10	18	+1.10	+.14	+.24
P ₁	68	15	22	+.94	+1.27	+.91
P ₂	58	3	15	+.11	-1.45	-.95
P ₃	51	7	8	-.46	-.54	-1.45
P ₄	59	5	6	+.20	-1.00	-1.79
P ₅	68	9	10	+.94	-.09	-1.11
PG ₁	61	9	21	+.36	-.09	+.74
PG ₂	71	20	18	+1.18	+2.41	+.24
PG ₃	—	—	—	—	—	—
PG ₄	50	15	22	-.54	+1.27	+.91
ZG ₁	57	8	24	+.03	-.32	+1.25
ZG ₂	65	18	19	+.69	+1.95	+.41
ZG ₃	44	8	22	-1.03	-.32	+.91
ZG ₄	69	7	27	+1.02	-.54	+1.76
B ₁	43	8	14	-1.12	-.32	-.44
B ₂	28	7	13	-2.34	-.54	-.61
B ₃	52	9	19	-.38	-.09	+.41
B ₄	58	4	18	-1.52	-1.22	+.24
Mean	56.6±2.8	9.4±1.0	16.8±1.4			

but the differences are small. PG₂, PG₄, and ZG₂ are definitely best at the spatial test, PG₁, ZG₁, ZG₃, ZG₄, B₃, and B₄ at the mathematical. B₁ and B₂ do equally well on spatial and mathematical and better on both of these than they do on the verbal. Whether the geneticists and biochemists do better on the mathematical than the others because they have more occasion to use mathematics or went into fields requiring more mathematics because they were relatively easy for them is perhaps debatable. The issue is clearer in the case of the spatial test; the task was completely foreign to all of them. The general dominance of spatial imagery in the group has been discussed

elsewhere. Of the four whose dominant imagery is apparently verbal, two do best on the verbal test, one on the spatial and one on the mathematical.

Intercorrelations of the three tests are: Verbal-Spatial +.445 (significant at the 5 per cent level), Verbal-Mathematical +.129, and Spatial-Mathematical +.369.

An attempt was made to get a group of male college students for comparison. Only ten subjects were secured. The results were: Verbal mean 56.1, S.D. 12.2; Spatial mean 10.0, S.D. 4.9, and Mathematical mean 16.2, S.D. 6.5. Not only the means but the standard deviations are very close to those for this group.

THE THEMATIC APPERCEPTION TEST

ONE method for personality analysis utilized in this study was the Thematic Apperception Test (TAT). This test, developed by Murray and his associates (12) at Harvard, consists of a set of pictures. The task of the subject is to construct a story telling what happened before the moment pictured, what is going on at the time, and what will happen in the future. In the usual set there are 20 of these cards, but not more than 9 were used for any subject in this group. The TAT was always given after the Rorschach, and with the first subject cards were selected which, it seemed possible, might help elucidate any problems shown up in the Rorschach or in the interview. This was not satisfactory as a research procedure, so that thereafter the same 8 cards were used each time. After eight subjects had been seen, Card 4 was added in an attempt to get further data on psychosexual adjustment. The cards finally used, all from the male series (of 1943), were 1, 2, 4, 6, 7, 10, 13, 15, and 11, in that order. Subjects P₁, P₂, P₃, P₄, PG₁, PG₂, PG₃, PG₄, ZG₂, ZG₄, B₁, and B₄ were given the full series; subject A₁, A₂, P₅, ZG₃, B₂, and B₃ all but Card 4. A₃ was given Cards 2, 6, 7, 10, 13, and 18. There were 168 cards given to all. Number of responses is 176, some alternates having been given.

Card 1 shows a boy, seated, looking at a violin on a table in front of him.

Card 2 is a farm scene, with a man plowing in the background, a woman leaning against a tree, and a young girl carrying books in the foreground.

Card 4 shows a young man and woman, the woman facing the man, with her hands on his arms and the man looking away from her. There is a picture behind them, showing a partially dressed woman.

Card 6 shows an elderly woman looking out of a window, a young man, hat in hand, looking away from her.

Card 7 is a close-up of an older and younger man, the boy looking away.

Card 10 is a close-up of two heads, incomplete, the forehead of one against the chin of the other, and one hand as though on the other's chest. They are usually interpreted as a man and woman.

Card 11 is a vaguely delineated scene, apparently in a deep canyon, with some indefinite figures at the edge of a bridge, and a webfooted long-necked creature apparently emerging from a hole in the canyon wall. None of the details is very clear.

Card 13 shows a girl lying on a narrow cot, on her back, her breasts exposed, a man standing turned away from her with his arm over his face.

Card 15 is a stylized picture of a man standing in a graveyard with his hands together pointing down in front of him.

Interpretation of the TAT protocols (the responses to the cards) has not been codified. It is particularly of value in giving hints as to the genesis of any difficulties that may be present, which the Rorschach does not do. It is also useful for getting at attitudes toward family, etc., which may be of significance. The stories were scored formally, following Wyatt (24), with some emendations, and these data are given in Table 9.

The first section in Table 9 refers to the relative amounts of *Story* (S) and *Description* (D) in the productions of these subjects. The task is set as giving a story. Some subjects, however, give a great deal of description, either with a narrative, or without it. The latter, if general throughout, is usually a form of noncompliance, often on a subconscious basis. Subjects who have difficulty thinking of a story to a particular card will also often resort to description as a way out instead of refusing the card. As can be seen, responses limited to description alone (D) or dominantly description (DS) with some story, are comparatively few, except in the protocols of P₃ and B₄. P₃ said frankly he thought the whole thing was "the bunk" but courteously went through the motions of doing

TABLE 9
TAT SUMMARY

Subject	Story				Perception	
	S	SD	DS	D	Omit	Distort
A1	6	7,13	2,10	15,11		2 church
A2	6	1,2,4,10,15,11	7			10 sexes
A3	2,6,7,10,13					
P1	4,7,10,13,15,11	1,2,6				
P2	1,4,6,7,15	2,10,13,11				
P3	4,6,7	2	13	1,10,15,11		
P4	1,2,6,7,10	4,13,11		15	2	
P5	2,6,7,10,13,15,11	1			2	10, sex
PG1	10,13,15	6,7,11	1,2,4		1	
PG2	1,4,6,7,10,13,15,11		2			
PG3	1,6,10	2,4,7,13		15,11	1	
PG4	1,2,4,6,7,10,13,15		11		1,4	
ZG1	1,2,6,7,10,13,15	11				
ZG2	4,6,7,10,13,15	1,2	11		1,2,4	
ZG3	2,7,10,13,15,11	1,6			1,13	
ZG4	1,2,4,6,7,10,13,15		11		1	
B1	1,4,6,7,15	13	2,10,11		1	10 sex
B2	1,2,6,13,15,11,10	7			1	
B3	6,7,13,11		1,2,10	15		
B4	4,6		2,7,10,13	1,15,11		

Subject	Level					
	Concrete factual	Endopsychic	Symbolic	Mythical	Make-believe	Conditional
A1	6	2,7,10,13	15		11	
A2	1	2,6,7,10,15(1)	11			4(1)
A3	2,6,7,10,13	(10)				
P1	1,2,4,7,10,13,11(6)	6(1)(13)	(7),(11)	15		
P2	2,4,6,7,10,13	1,15(13)			11	(1),(4),(7)
P3	1,2,4,6		15			7,10,13,11
P4	6,7(13)	1,4,10,13	2,15?	11		(1)
P5	7,13	1,2,6,10,15(13)	(15)	11		(1)
PG1	1,2,6,7,10,13,11(4)	4,15				6,13
PG2	1,2,4,6,7,10,13	15(1),(4),(10)	11			(1)
PG3	1,2,4,6,7,10,13	(1)(10)	15			(6),(7)
PG4	2(1),(4)	1,4,6,7,10,13,15		11		
ZG1	1,2,6,7,10,13,15	(1),(2),(3),(10),(13)			11	(2),(6)
ZG2	1,2,4,6,7,10,13,15	(1)			11	(6)
ZG3	1,2,6,7,10,13,15	(1),(10)			D11	(6)
ZG4	2,4,6,7,10,13,15,11	1(2),(6),(7),(15)				
B1	1,2,4,6,7,10	13,15(2),(7),(10)				11
B2	6,7,10,15a,(1)	1,15b	2,11?		11?	(13),(15)
B3	2,10,13,11	1,6,7,15				(1),(10),(13)
B4	2	1,4,6,7,10,13(2)				(7)

TABLE 9
TAT SUMMARY (Cont.)

Perception		Time Trend			
Description Detail	Deviation	Past, Present, Future	Past and Present	Present and Future	Present only
(1) accident	13(11)				2,6,7,10,13,15
(1)(2)	1,10,11			1,2,6,7,10,15	4,11
	(7)(10)13			6,7,10,13	2
2,4	(2)(4)(6).7.(13)		7	1,4,6,10,13	2,11,15
	(1) 4,10	13	4b,6,15	1,2,10,11	7
(1) 7,13	4 (7)				All
(1)(7)	(1)(7)	1,6		2,4,11	7,10,13
	(2) 10	2,10	13	1,7,15,11	6
1,2,4	(1)(4)(10)(13)(15) (11)6	2,13	1,15	4,6,7,10,11	
	(6)(13)(15)(11)	6,7,10	15	1,2,4	13,11
	(2) 6a (10)(15)		6a	1,2,6b,7	4,10,13,15
11	(13)	4	2,13	1,6,15,10	7,11
	(1)(2)(6)(7)(10)13, 15,11	1,6,7,10,13,15,11		2	
	(6a)(13)			1,2,4,6,7,10,15,11	13
6,10,13,15	(2)(6a, b)(7)(10)15	1,10,5		2,7	6,13,11
	(4)(7)(15)			4,6,15	1,2,7,10,13,11
13	2(4)7,10(13)	1		4,6,7,11	2,10,13,15
	(7)(15)(11)			1,6,10,13,15,11	2,7
	2(6)10			2,6,7,11	1,10,13,15
		2		4	6,7,10,13

Tone

Indifferent, Detached or Contemplative	Cheerful	Serene	Melo-dramatic	Unhappy	Tense	Anxious	Morbid	Aggressive	Sardonic
2,6,15?			13,11		7,10				(7)(15)
	2			10,15	4,7,11	1,6			
			7,13	6,10		2?			(13)
		2	15	6,10,13	1	4,7		11	
1a			10,11	6,13,15	2,4a,7	1b		4b	
	11		2,4,6,7,10, 13,15		1				(15)
2		1	11	6,13	10,7	4			
		7,10	11	13,15	1,2	6			
				10,15	2,6,7	4,11	1? 13?		
		2	11	4,10	6,7,13,15	1			
2? 15?			4	1,6,7,10,13					
		(10)	15,11	4,6,7,10,13	1,2				(15)
	1,2,13,15		11		7,10	6			(15)
1			11	3,10,13,15	2	6		7?	
				1,2,6b,10,13, 15,11		6a		7?	
				1,10,13,4,6,7	2,15,11		15?		
11			4,6	7,10,13	1,2				15(4)
		2,7,10		13,15	1,6(7)	11	13a		
1			11		2,7,10,15	6,13			
1,11	2			4,10,13	6,15	7			

TABLE 9
TAT SUMMARY (Cont.)

Subject	Quality								
	Simple→ Literate	Simple	Literate	Cliché	Col	Cr	Ev.	Formal	Emotional
A1			2,6,7,10, 13,15		(7)	(6)(7)		2,6,7	13
A2	I	6	2,4,7,10, 15,11					1,2,6	7,10,11
A3	2	10(7)			6,7,13			6,10	2,7,13
P1	All	2						1,2,4,6,10, 15	7,13,11
P2			All			(10)		6,13,15	2,4,7,10,11
P3	11				1,2,4,6,7,10, 13,15	(1),(7),(10), (13)		2,6,7	2,4,10,15
P4	10	4,6,7	1,2,15,11			13(4)		6,7	4,10,13
P5			All					1,2,6,7,10, 13	
PG1			All			(2)		2,10,15	2,4,6,7,13
PG2			All					1,2,4,6,7, 10	13,15
PG3	7,10,15	1,2,6,13			(6)	(2),(4),(6), (7)		1,2,6b,10, 13	4,6a,7
PG4	1,2,4,13,15, 11	6,7,10						1,2,6,7	4,10,13,11
ZG1			All					2,6,7,10,11	1,13,15
ZG2	1,2,15,11	4,6,7,10, 13				(7)		2,6b,7,10, 13,15	4,6a
ZG3	1,2	7	6,10,13, 15,11	(7)		(7)		1,2,6a,10, 13,15	2,6b,7
ZG4	1,2,4,15	6,7,10,13, 11						6,7,13	2,4
B1	15	1,2,4,10, 13,11		6,7(4)				1,6	2,4,7,10,15
B2	All							2,6,7,10	13
B3	6	1,10,13,11	2	(7)		(2)	(15)	6	2,7,10,13
B4	All							2,6,10,13	4

the task. B₄ was rather disturbed, and depressed throughout. In both of these instances there was a general, not deliberate, noncompliance. For the others, when this situation occurs, it is usually linked to specific difficulties. The card most often provoking it is Card 11, which is probably the most difficult for this group who have a strong preference for the nonamorphous, and dislike to guess.

The section on *Perception* notes cards on which any subject omitted a detail usually taken into account, gave an unusual interpretation of any detail or went into considerable description of any one detail, without doing the same for the rest of the card. The detail most often omitted from consideration is the sheet of music on the table in Card 1. The only perceptual

distortions were interpretation of the barn in Card 2 as a church by A₁; and change in the usual interpretation of sex in Card 10. A₂ gave the figures as a woman and a boy, instead of the usual man and woman; P₅ gave them as a mother and daughter, and B₁ as a monk and a boy. Unusual concentration on individual details has meaning only in the general context for each subject, and no summary statement is possible.

The column headed *Deviation* refers to unusual stories or unusual twists to a part of a story. It should be noted that usual or unusual here refers only to my own experience with the TAT which is pretty well limited to superior, normal adults. Since these records were scored Stein has published some material on common stories (20). There is no serious incongruity

TABLE 9
TAT SUMMARY (Cont.)

Not Stated	Personal Relations			Presses		
	None	Friendly	Unfriendly	Impersonal	Internal	?
10	15	7		10,13	2,15	6
4	15	2,6,7	10,11		15	1,4
			7,13	2,6,10		
		1	11	6,10,13,15	4	2,7
	1	4a,7b	2,3b,7a	13,15,11	1	6,10
13	1,11	4	2	7,13	1,10,15	11
2	1,15,11	4,6,7	11	13	1,10,15	2
15	11	1,2,6,10	7	13,15,11		
	1,11	7	6	1,10,11	2,4,13,15	
	11	1,4,6,7	15	2,10	13	11
	15,11	1,4,7		6a,10,13,15	2	11
	11	1,6,7	11		2,4,10,13,15	
		1,2,7,13,15	6,11	10		
	1,11		6a,7	2,10,13,15,11	1,4	
	11	1	7	2,6b,10,13,15		11
10	1,15,11		2	6,7,10,13,11	1,15	
13	11	1,10	2,4	6,7,13	15	11
	1,15,11	6,7,10	13	15,11	1,2	
1,15	11	1	2,7,10	6,11	13,15	
7	1,15,11	4 ² ,6,7		2,10,13		1,15,11

with my own experience. The figures in parentheses are numbers of cards to which the story had only an unusual twist. Numbers without parentheses are those of cards to which an original story was given. There are not a great many of these, only 22 of the 176 stories told altogether. This is some indication that in this respect scientists are in large measure as other men are. At least one unusual story was given to each card but there are more to Card 10 than to any of the others. This is in keeping with this group's somewhat lesser development of or dependence on close heterosexual relations. (The term heterosexual is not intended to emphasize the physical element, which is not the important one. What is meant is a close interpersonal relation between two people of opposite sex. I

must state, also, that describing this group as of lesser dependence on such relations implies that such dependence is general in the population at large. I do not really know that this is the case. It would probably be more accurate to put it that not all of this group have developed this possible aspect of life as fully as may be.) The variants tend to get away from consideration of the heterosexual relation (mother-daughter; monk-boy) or to give some derogatory modification of it (woman leading boy into evil; man old enough to know better proposing to a woman with a comfortable nest egg; and a couple caught in amorous dalliance by the headlights of a car, or a low-minded gentleman with a flashlight.) Unusual stories to Card 4, and modifications of usual ones show the same

TABLE 9
TAT SUMMARY (Cont.)

Subject	Outcome					
	None possible	Success	Defeat	Unsolved Tension	By rule	None or? given
A1	15,11					2,6,7,10,13
A2		1,2,6,7	10,15?			4,11
A3		13	7,10			2,6
P1		4,10,11	1	6	13	2,7,15
P2		10,13?,4b	11	2		1,4a,6,7,15
P3	1,6,7,10,13,15,11					2
P4	7	1,2,4 man 11	4 girl 6, 11 others			10,13,15
P5		2,7,10 or 1	11	15		6
PG1		2,11	13	6,7	10	15,1
PG2		1,2,10,11	4,7,13	6		13,11,15
PG3	6a,13,15	7,2	1,6b			10,11,4
PG4		6,15		1,4	10	2,7,13,15,11
ZG1		1,2,7,10,13,11		6(?),(10)		15
ZG2	13	1,6,7,10	4,11	2,15		(13)
ZG3	6b,13	1		2,10,15	7	6a,11
ZG4	13	4	6	15		1,2,7,10
B1	13,15	4,6,7,11		1,10		2
B2	2,7	1,6,10,11	15	13	11	
B3			7,11	2	6(2)	1,10,15,13
B4	1,13,15	2,4				6,7,10,11

thing.

The *Time Trend* of the responses is greatly curtailed. In all, only 23 stories had a past and future other than immediate, as well as present, and 7 of these were given by one man. The past is much more often disregarded than the future. In part this reflects an unwillingness to go beyond the immediate data, which is rather characteristic of this group, but this does not explain greater freedom with the future than with the past. The future is not usually given in particularly rosy terms. Approximately the same situation occurred with the artists I studied, and I think this may be in part an age factor, and in part it may reflect the fact that for most of these men the present and the probable future are very satisfying, more so than the remote past. Slight pressure sometimes produced a past so immediate that it is not scored as such; it was somewhat more effective in eliciting a future. Certainly the tendency of this group is to give some interpretation of the immediate situation and let it go at that.

Outcome of the stories which have a future is

more often success in some terms for the central figure than defeat or unsolved tension. Often the latter, however, is implicit in the stated situation, although not made explicit as a statement regarding the future. The outcome is most often stated as probable, but sometimes is given with some degree of certainty. Greatest certainty seems to be in connection with Card 6, the (usual) mother and son; the certainty usually involves the success of the son after he leaves home, or at least the mother acceding to whatever he has made up his mind to do.

Under *Level* the stories are recorded as concrete-factual, endopsychic (i.e. chiefly having to do with feeling or thoughts), symbolic, past and mythical, make-believe, and conditional. An entry preceded by a plus sign indicates that that aspect was secondary to some other, but nevertheless included. As can be seen the level is overwhelmingly concrete-factual; but there are a few subjects who gave more stories which are dominantly endopsychic than factual. With two exceptions these men are presently much concerned with particular emotional problems; this

TABLE 9
TAT SUMMARY (Cont.)

Certainty of Outcome					
Certain	Probable	Possible	Personal Reference	Refused	Personal Opinion
				1(11)	
1,2,6,7,10,15			1,2,6,7		
13	7,10		10?		6,7
10,11	1,4,6,13		1		4,7
	4b,10,13,11	2			(4)7
			All but 15		
2,6	4,11	1	7		4,13
10	2,7,11,15				
	2,4,6,7	1,10,11,13			2,6,7
6	1,4,7,10	2			
1,2	7,6b		1,7,10,15	(11)	2,4,6
1,6,15	4,10				
1,6,10,13,15,11		2	7		
1,2,6	4,5,11	7,10	1		7
15,2	10	1,7			
6	4	15			
6	4,7,11				
13,11	1,6,10	15			
6	2,7,13,11				2,7,10,13,11
4	2				

is less true of the others. Entries under *Conditional (Co)* are mostly additional; this means only that the conditional aspect refers only to part of the story. Other levels are extremely rare, except for Card 11, which evokes symbolic, mythical, or *make-believe* interpretations with some regularity. It is interesting that when the situation forces them into some sort of guessing, their responses are clearly specified as non-realistic. There is no confusion between fact and *fancy* in this group, and there is a strong preference for fact. This is emphasized by the many comments and complaints expressed in connection with Card 11, and to a lesser extent with Card 15, which is sufficiently stylized to be rather unrealistic.

Feeling tone of the stories is recorded as indifferent, detached, contemplative, cheerful, serene, melodramatic, unhappy, tense, anxious, morbid, aggressive, and sardonic (additional). As can be seen, melodramatic, unhappy, and tense feeling tones predominate. This is partly a function of the cards—it is easier to make up such stories than cheerful ones to most of them. Card 2 seems to be an exception. The frequent appearance of Cards 11 and 15 under

melodramatic points up the general tendency to treat these as unrealistic.

Quality of the stories is recorded as simple, literate, in between these two, cliché, colorful, critical, or evasive. Other categories listed by Wyatt were never used by this group. Literate or near literate diction is most usual, with some additional colorful or critical touches.

Personal relations are somewhat more often stated as formal, institutionalized ones. This does not necessarily mean that no emotional element is present; e.g., in Card 6 the usual interpretation is a mother and son (formal relation) who are in conflict. Presses refers to any form of pressure, to do something, or not to do it, to feel something, etc. Impersonal ones seem to be most numerous, in this group. I have added the category *Internal* to take care of a number of situations which do not seem to me to be covered by Wyatt's classification. For example, Card 15, the man in the graveyard, may be given as a man mourning the death of someone he loved, and the press is then recorded as impersonal, but if it is given as an elderly man, contemplating his own life and feeling baffled, the press is recorded as internal.

Three of the men gave a number of direct personal references in connection with the stories, four others gave them in connection with particular stories. Eight of them expressed some personal opinion of the characters or their behavior. The greatest incidence of any single card in these two groups is Card 7, the older and younger man.

These are the formal characteristics of these stories, so far as they can conveniently be scored. They do not, however, give much indication of the richness or value of the material. To reproduce all of the protocols here is impractical. Instead, the responses to Card 7 are all given below, with a summary of the interpretation of all of the responses of each subject. This card was chosen partly because of the number of direct personal references in the stories given to it.

A1

That's the old argument between father and son, his hair is gray and he thinks he knows all the answers and the son isn't so damn sure and he doesn't want to do it. Possibly the father is moved to play Father with a capital F. Or possibly his face expresses deep love and deep concern. The son is a bit of a lady killer, square head, ears, square lips, Roman nose, black eye brows, that curly hair, he would have liked to have been a gangster but he was brought up in a nice home. Father is conventional, I'm sure he has a plush collar on his overcoat.

This is more of a story than A1 usually gives. The protocol is subtly noncompliant, and there is a pervasive defensiveness which takes the form of sardonic comment. His method for handling difficult emotions is to cast them into a vulgar form in which he can deride them, thus he gives a story which he says is like those in a popular weekly magazine. (Several others do this also.) There are many indications in the other stories, too, that A1 is greatly annoyed at any form of stereotype and severe disturbance at the suggestion that he might do anything commonplace. It then becomes evident that he has a basic problem, concerned with the loss of love, which he cannot handle in any direct way. He is one of the subjects whose mothers died when he was a child.

A2

Well, here's a serious young man who has laid a plan before the older man. The way the older man is slanting his eyes and curling his lips suggests that he's being worldly wise and is offering advice or more likely poohpooing the plan and raising doubts. The young man is trying to be thoughtful. The older man is a good man, not counseling anything he thinks isn't right but offering a worldly wise course. Not as ideal. The older man is probably right. I've been in this position a lot lately. The older man looks a bit like my father, the young man is not like me at all. The young man has a strong jaw, he's pretty sure he's right. (?) If he's like me he'll take as much as he thinks he has to and do his own way as much as he can. Not so great a thing as to cause too much, just shrewdness, he'll chance his own way. If the old man looked much more grieved he might take it more seriously.

This is a very revealing story, and the implications are fairly obvious. It is interesting to get this shift of identification from a young man intent on as much of his own way as he can get without open dissension to an older man who has come around to a not unrighteous but worldly-wise point of view. His moral categories are clearly defined in his own mind, and he is a man with a very strong sense of duty. But he is not a romantic idealist; he is willing to concede as much as necessary to reality, but no more. He has a paucity of self-protective barriers, and shows a general willingness to expose himself that is based on an honest humility which is not self-deprecating. His parents' pride in him, particularly his mother's, has seemingly been of very great importance to him, so much so that in a direct expression of it he mitigates the emotion by refuge in the banal which he never otherwise descends to. He has a strong sense of the necessity for self-reliance but at the same time there is a strongly dysphoric trend which is a feeling of futility. Evil is a substantive concept for him. He does not easily express or feel strong personal emotions, and he prefers the rational and controlled, but they must be solidly based; he rejects anything artificial.

A3

I would say that these aren't related people. This is a youngster here whose past history I don't know much about. He is in a small business with the old man and he is somewhat of a weak vessel. I can't think he is particularly bad, at least at the moment,

but the situation in the business is such that in order for its best interest a bit of shady work has to be done and the old man has explained it. Part of it is beyond the bounds of morality and the jail may be in the distance. The old timer has him about convinced, he doesn't like it but will go through with it. The older man has got him and he knows it. As to the future I think the boy will go a little farther and farther and I don't know just where he will wind up but it won't be to his good. That's very vague but I can't see—

This subject gave several stories of antisocial behavior. In all of them, the outcome was in accordance with the nature of the person (as it is here where the boy is a weak vessel) not a result of social pressure or punishment. There is a strong feeling throughout the protocol of the continuity of living to which he clings but practically the whole expression is at the behavioral level. There is not much affect throughout, but there is some aggressiveness which is rare in these protocols. He has a habit of keeping distance between himself and the outside world. The only story with strong affect was of a couple long married, and even here, with emotional abundance, the outcome is danger and death, capped by the phrase "I have no future." This man is haunted by death and finds no compensation for it in personal possession or work or affectional relations. Rebelliousness has been present in the past, but there is little now. His present defense is a determinedly casual acceptance of any form of behavior in others without condemnation.

P1

We could make all sorts of stories out of this, this is obviously an old man giving advice to the young man and I think the older man is a professor, probably a big shot, even a member of the National Academy of Sciences, and probably sits on committees that give out lots of money and the young man for our purposes we assume since the older man is a professor, possibly no longer a scientist although he probably claims to be, that the young man is an applicant for a fellowship or possibly an assistant professor who has applied for a grant to support the work he is interested in. Probably a lively and successful man so far. He has applied for a traveling fellowship or research grant to Washington and this old rascal is a member of or possibly chairman of the committee. The elder man has just told the young man that he isn't going to get the grant and is giving him fatherly words of

advice about why he ought to change the nature of his application so that he will be more successful next time. I imagine he is using the same sort of platitudes people on committees, big shots, generally use, in telling young people how to improve things. Probably saying the project is too ambitious and the young fellow would not be able in any case to solve the problems he proposed to attack and he had probably better cut a smaller problem and this is probably true because that's a mistake that young people often make. I'd better stop, I could go on and on. . . . I don't mean to criticize either, both are right in their way. The fact remains that the young man is making and will make contributions to science and probably the older man is, if anything, a stumbling block because he has arrived at a situation where he has a lot of power but is no longer able to keep abreast of the new work. This is a paradox in scientific administration today which no one has resolved.

The generalization of this situation is interesting and characteristic of this subject. Also characteristic is his ability to see both sides of the question, his inability to come to a solution, and his maintenance of objectivity in personal relations. He is helplessly acceptant about life. He does not know how to handle many major problems, perhaps especially death, and reacts emotionally and sympathetically but deliberately passively. This leaves his problems unresolved, but it is not accompanied by anxiety and is countered by a sort of essential optimism which seems a reflection of the observation that somehow people do muddle along. Much of the material in the protocol is concerned with an immediate personal situation with which he is much preoccupied. He has a strong tendency just to leave a difficult situation which he cannot cope with, but he will always come back, or allow himself to be brought back without resentment. He dislikes intensely to have disturbances and feels that if a problem is left to incubate, it will solve itself.

P2

Here is an older man and young man in conversation. They aren't related and the older man is a rather sinister character. I judge that from the half closed eyes, the fact that they are rather dark around them and the rather nasty look to his mouth, and he is advising this young man to do something that he ought not to do. The younger man is undecided but he is listening. I'm very much afraid that he is likely to yield because although he has a good nose I don't

like his hair, it looks too barberish which would suggest an element of weakness rather than strength and manliness, and I don't like those sharp lines that come from his mouth to his nose, it looks as if he has been harried and he may be in a position that is difficult. I may be mistaken about my character reading, it may be the young man is in trouble and the older man who might be the agent of his father is giving him some good advice and the young man is trying to make up his mind. If I could talk to them a little while I could do better on that.

This story is very like that given by the next subject; but he reconsiders and expresses some willingness to give both characters the benefit of the doubt. It is interesting that he translates an immediate reaction of personal dislike into an imputation of antisocial behavior. Again, the story is dependent upon the characters of the individuals concerned. Outstanding qualities of this protocol are moderate intensities, with due regard for feelings. That the future is often uncertain is due to inadequate information; where he is clear about the situation he is willing to predict. Even so he will not go beyond the facts before him, although he often notes the precise areas where other facts are needed. He has a dominantly rational but not an unsympathetic approach. He feels strongly that a determining factor is the strength of character of the individual, and he has great admiration for calmness (which he tends to consider a feminine attribute) and self-control. He does not have too sanguine an opinion of the motives of mankind, but is realistic rather than cynical. Most people are able to accept what they must, and religion is not particularly sustaining. His insistence on the necessity for self-control does not result in an obsessive character because he has accepted aggressiveness as a fact of life and is not disturbed by it. There is little implication of close personal relationships or great interpersonal warmth, or of any feeling of lack of them. He has probably the best personal integration of any in the group, and he has an original and interesting mind.

P3

Gee whiz! That could be the professor and student, it could be the old guy telling him the facts of life. The young man seems rather thoughtful. The old guy isn't putting out very much, his mouth isn't even open. All those that ever talked to me kept their mouths open. They don't seem to be getting anywhere. Maybe mama just died and they are feeling rather badly about it.

It doesn't mean much to me. If one was talking it would mean more, both are kind of quiet.

There are several suggestions but no very definite story here, although the subject seems finally to decide that it is a father and son, after the death of the wife and mother. This last is an unusual suggestion, and its significance is not clear. The general tone, and the personal references are quite characteristic of this subject. Although he went through the motions of cooperating he thought "it was the bunk" and he spent much more time on description and personal comment than on stories. These, when given were prevailingly melodramatic and slangy. The most striking thing is the constant personal reference, which is developed not only in terms of personal experiences of which the pictures remind him but also in terms of how he would behave in such a situation and what he thinks of the characters, which is generally not much. At first glance he seems a completely self-centered person, who is very determined and energetic; unaware of any interests other than his own rather than ruthlessly aggressive. He is superficially forthright and direct, and definitely prefers to avoid strong emotional situations, handling them, when he must, by over-conventionalizing them or putting them on a sordid level. He is interested in objective realities only, strongly rejects anything imaginative, and not only will not go beyond his data in any way, but limits strictly what he admits as data. His scorn of conventionality takes a very conventional form. Nevertheless he is basically a very reactive person; it is probable that the apparent self-centeredness is at least in part a protection against this.

P4

That's Artur Schnabel, I recently heard him play so he's fresh in my mind, and that's his son. They are looking over a score and the old man is telling the son how the thing really goes and what happens thereafter I don't really know. I don't see how you can read much of a past or future into that, it's very static isn't it?

It is striking in this response that there is no indication of the son's attitude. This subject has generally a very sensitively sympathetic attitude towards the young but I think it is undoubtedly true that he is much less sure of his son's thoughts and feelings than of those of many of his students. This subject does a good job of integrating details into a story without fussing over them. He is more given to broad abstractions than are most of the group. He blocks

noticeably on situations that are strongly emotional, is unable to develop them and turns to critical comments about the drawing rather than taking recourse in the banal or melodramatic which is more usual with these men. He is clearly an agnostic, and has achieved some acceptance of uncertainty without real resignation. There is a recurrent feeling of having been blocked, of there being no way out (but it is not clear whether there is any structural dilemma). This is anxiety producing to a considerable degree.

P5

Well, I'm trying to decide whether the younger man is of the criminal type or not. I'll assume he is although I'm not sure that he is. He has been accused of embezzlement and he has employed a lawyer who is counseling with him. uh . . . and the lawyer is instructing him as to his rights and what course he should follow in the proceedings. The lawyer looks . . . uh . . . my first impression was that he looked distinguished enough to be a judge and I think he does actually, I'll assume that he is a future judge. He is a very able looking lawyer and I think that the man looks as though he may really not have been actually guilty of embezzlement but simply accused and the chances are that the lawyer will be able to prove his innocence.

It is interesting that although this subject starts out as did two others he reconsiders and winds up fairly sure of the young man's innocence. The interesting point is that this assurance seems to stem from his interpretation of the character of the older man, as though he would prefer the boy to be innocent since it seems clear that the older man is so able. The difference between this reaction to this character and that of some of the others is quite striking. This subject is dominantly concerned with feelings, rather than events. He uses details interpretively or disregards them. All personal relations except in the story cited are formal and all are familial. It is clear that parent-child relations are an immediate present concern, and his feeling of responsibility is a very strong one. His comment to Card 13, "You can make all kinds of more lurid tales out of it but I think I prefer that one" is a clear expression of a firm tendency to rejection of the irregular and unconventional. He is a very conscientious and upright man in all his dealings and probably rather an uncompromising person. He seems to be seriously concerned with death and although he holds to the idea that it is futile to believe that death is the end, he does so with considerable effort.

PG1

Well in this case some, uh, the older man is wearing some kind of an old fashioned collar so he is rather conservative and not too smart. The younger man is foreign born. That suggests he is a college dean, fairly sympathetic as college deans go and the young man has gotten into trouble and the old gentleman in a fairly kind way has told him what the official decision is. I haven't the slightest idea whether marks or conduct or extracurricular activity and the young man, rather resentful, is thinking it over. And I think that the young man has got to take the decision whether he likes it or not and I think he is going to continue to be resentful about it.

The not infrequent reference in the stories to this card, to a college or counseling situation is to be expected. Not all of them mention any resentment, as this one does, and here it is not overtly expressed, but is continuing. This subject pays much more attention to details than do most, and when he is disturbed by the situation elaborates them considerably, but is always able to work out a picture that satisfies him. His intellectual ingenuity is remarkable. The stories are strongly negatively toned, and such future as he gives is usually not an improvement, except that he sometimes admits that time will lighten distress. There seems, however, no chafing against this rather dour outlook. There is derivable from the protocol a very full interpretation of some of his difficulties as a parent, and it is also made clear how sustaining his marriage has been, in spite of serious difficulties in his personal adjustment. There is a strong feeling of the futility of aggression and some indication of a relationship in his mind between aggression and death, although the idea of death does not appear to be particularly disturbing to him.

PG2

Here is an example of a man who's, I imagine it's a father and son. This time the son has come back and he's not done very well for himself but he has a very set expression, he probably isn't going to stay with the family. He's trying to rationalize. The father in a kindly manner, is trying to explain his errors and says if he will just admit he's been wrong and take the advice he will be all right. But the young man looks as though he wouldn't do that, he's set in his ways so I imagine he'll go along in his own ways and probably wind up in jail or as a dipsomaniac or something like that.

Here we have a further development of the same situation. The young man remains rebellious, refuses to admit his error. The result is unfortunate for him. For two subjects, the boy gives in outwardly, at least. Here he does not. To some extent, this result is implicit in the stories of the other two, at least it is probable that it was to avoid disaster that the boy gives in. The psychological structure is the same. This subject includes a much more extensive time spread than do most of this group. He pays very little attention to details, but gets an idea from the total picture and develops the idea, not altogether independently of the picture, but less anchored to it than most. The picture in family relations (with which he is much concerned) is an interesting one. Parents may offer guidance and this is needed, but the children may take it or not and rather incline to pursuing their own interests regardless, with variable results. Weakness plus penitence results in a life of luxury, but bachelorhood; weakness plus impenitence results in jail or dipsomania. The choice is not too broad. On the other hand, intelligence and determination may bring results. He refuses to dwell on certain problems, and is presently suffering under a considerable load of guilt.

PG3

Well, I'd say this was a conference between the dean of men in a university and an errant student who is on the carpet and the dean is trying to give the young man some good sound advice, father-to-son affair. The young man is on a hot spot so he isn't very happy about it, the older man has a fairly nice face. The student obviously is in trouble. Of course it could be any sort of scene where an older man is giving advice to a kid in difficulty. The older man isn't a lawyer exactly because the lawyers I've seen don't have such a pleasant face, more likely some kind of advisor, possibly a minister but not a lawyer, not a judge either. (?) He looks very penitent, I suppose he probably will [i.e., take the advice] he's very unhappy, though.

Again, the student takes the advice, but remains unhappy about it. (Apparently these subjects have not all had similar experiences with the legal profession.) Outstanding in the protocol is a marked preference for the superficial, a dislike amounting to a refusal to contemplate the specific content of the most serious situations, and a rejection of strong emotion, which may be associated with his rather marked sensitivity. There is little feeling of sharing things in any very deep sense, rather a feeling that it

does not happen and no feeling of its being needed. The dominance of unpleasant situations is striking, and so is the lack of any positive solution of them. If the situation develops or changes at all it is either for the worse or without change in unpleasant feeling tone. He has strongly acceptant attitudes regarding social customs and the usual mores and a great distaste for any breaches of them. Personal conflicts do not occur, even in situations which are a setup for them. There is no feeling of the development of a situation through either inner dynamics or outer events, but a sort of waiting, passive attitude. One has the feeling that his superficial adjustment is extremely good, and that he is satisfied in most respects—that he has achieved this by almost deliberate refusal to live below the surface. His attitude about death (Card 15) typifies this: "You know a good many poets have been concerned with death a lot, all their poems. This fits in with that very much, someone who is brilliant and slightly crazy, some conception of death. It's a funny thing so many poets have written of death. To me it's depressing to pick up some of these anthologies, you find them so concerned with things." There is nevertheless a lingering undercurrent of indeterminacy and lack which he cannot quite conceal.

PG4

This is a father and a son and the father has been giving the son a fatherly but friendly talking to, that is, the type of a talking to that the son knows is inevitable but doesn't relish in the least. I don't know what this is about. The son has been straying from the beaten path in some respect or other, involving a woman possibly; possibly he is a college student and hasn't been doing the work. He knows he has to do something about it and he doesn't enjoy the prospect. The father hasn't enjoyed telling him and he is trying to make the blow as soft as possible and he feels very sympathetic with his son's difficulties. [This is not exactly verbatim, he talked so fast I couldn't keep up, but there is only a sentence or so missing and most of it was repeated later and so got in.]

This seems to be a repetition of the same story. This time, however, there is evidence that the son himself knows something must be done, so that the rebellious element is considerably less. As usual, the father's attitude is sympathetic. Unlike most of this group, there are no unusual stories in this protocol and few unusual touches, other than disregard of some details commonly noted. Most of the stories contain an

"I don't know" referring usually to the content of the emotion. On the general principle that people get over things he will go beyond his immediate data, otherwise not. He seems to be an acquiescent, passive but somewhat skeptical person whose chief preoccupation at the moment is a family situation. A good deal of what looks like guilt in this protocol is because he thinks he should feel so; actually he is not at all as unhappy as he makes out. This is partly because of a completely bland affect. He hasn't very strong emotions or much need of affectional relations. He has very great tolerance of irregularity because he just doesn't care.

ZG1

This is work, you know. This, I'm not so sympathetic towards this picture. However, one might be able to make something out of it that is more along the lines of my knowledge or familiarity. I should fancy, I mean I would like to fancy that this man is a successful business man perhaps a banker, some people might have taken him for a scientist but I don't think I would and that this is his son and that the boy has developed scientific inclinations. He's going to college, he decides he wants to be a scientist of some kind, the kind isn't important, let's say something with very little practical application, not a chemist, might be a, let's see, might be an astronomer even or a botanist, let's say a botanist that seems even less practical, although some, well we'll say one like Dr. X who is interested in cells and what they do. . . . And this disappoints his father very much because his father had been expecting him to go into business and take up his own line of work and make a great success with the aid he could give him materially and through influence and training and all that. He has had an argument and now there I could draw a little from my own experience because my mother got a lawyer who was a friend to talk to me when I wanted to be a scientist, and he said, "You want to go into a study," (he called it) "all of your life and not get out and do things in the world?" Then the boy sees all his world crashing down before him if he does that. Well, it doesn't look as if the man has threatened to cut him off and all that but there is a possibility of that and he has told him how silly he thinks all that. He says, "It's all right for school teachers and young kids and children, leave that for people who can't do any better." Here he's worked himself up and now the son wants to throw that all over. But it's the son's life and he feels he has a bigger

stake in it than the father and resolves to go ahead and tells him. The father makes a deal with him. If he wants to get along he must see how he can get along on his own resources for a few years. He must remember the world has depressions and his future isn't so secure. He may leave his fortune in trust but the boy must see how it is to live as scientists live. For the following five years at least, he will have just a little of his father's money. I don't know just how they figure that out but it will be so little it will just prevent his starvation especially as he can't live at home, there is no suitable university. The boy decides to accept that challenge. He does find things much harder than he expected them. Now we pass beyond the picture into the future. He finds it hard because he doesn't have many things he took for granted but he is fortunate enough to get with a group of young fellows who have the same attitude he has and some good teachers and so he sticks it out and gets a PhD and has an offer of a meagre job and just then a crash has come and wipes out his father's fortune and I think that is a good time for the father to die also, I suppose the mother has been dead for some time before this picture, too, otherwise she might have been present there. Aside from his father's death which he does take seriously because they had loved each other, the boy does find himself happy in his job except that he feels he can't marry for a long time. But he finally in the lab meets a girl with a similar point of view and they do get married. Really it's harder for the girl than for him because she finds out that in the little university town there is nothing open to her in her work and because she has to keep the house, they can't afford a servant. So her life is broken in half but she tries to make a substitute and make his life everything to her which saves her psychologically. He feels her sacrifice very much but doesn't manage to do anything about it except to sympathize with her and talk over his problems; they have no children. He concentrates on his work but it doesn't make difficulties as it does in some cases and he never regrets the step he took at that time.

The striking differences between the protocol of this subject and those of all of the others are well exemplified in this long story. The narrative flows easily and rapidly. The direct personal reference is not disguised; his stories to Cards 6 and 13 are variants on the same theme, and refer to the same period in his life. It is clear that conflicts aroused then have not yet

been worked out, although his present life would seem otherwise a very satisfactory one. In this, as in several stories of his, there is an acceptance of sacrifice (not always on the part of the wife) to forward a career. This is never without conflict, but the career always wins out. In none of the others is this particular situation made manifest. There is a great affective energy throughout, the emotional tone is very vivid, and he can be quite carried away by it to the extent that usual scientific attitudes are completely in abeyance. There is a general feeling of the conventional being cheap, but at the same time it is not completely discarded. There is a very strong feeling that great determination and courage, as well as much effort will be rewarded, and this is quite openly translated into occupational terms. There is a terrific indictment of conventional sexuality and religion, but without bitterness, as though he had accepted the fact that those who have taught or pursued it had had to do so. In interpersonal relations, the outcome is usually the reflection of the nature of the woman involved. Actions are governed by inner dynamics. He is haunted by guilt feelings with regard to one specific area. He is capable of rich adolescent fantasy.

ZG2

That one is hard. The first item is I don't like either of them. My guess is that first it's father and son and second that they are cooking up some kind of a dirty deal which they will try to put through. (?) I don't know, the father is a slick one and maybe they will get away with it.

Note that the others who have decided that something criminal may be going on carefully specified that the two men were not related. This subject, however, does not hesitate to make them father and son. Here, too, the reaction of dislike for them is translated immediately and bluntly into imputation of antisocial behavior. The stories are generally bald, without detail, and very concrete. Like many of the others he shies away from strong or even moderately emotional situations, preferring to handle them, when they arise, matter-of-factly and without dwelling on the feeling involved. He seems to have somewhat ambivalent attitudes towards children although he is not particularly preoccupied with problems concerning them. He apparently has a very stable and supporting marriage.

ZG3

I don't like either of these gentlemen, I can tell you that right away. Well, this would fit in with the popular notions of a crooked business man who is trying to get

one of his young agents to help him out on a plot. How it would succeed isn't at all indicated by the picture unless you want to say crime doesn't pay [with a laugh].

This differs from the preceding story only in the different relationship of the characters. His stories are largely based on general impressions with very little reference to usual details, but an occasional use of unusual ones, which may be used to give a unique twist to a common response. There is some suggestion of character as a casual factor in behavior. More definite is an uncertainty over how to proceed in the face of difficulties and a markedly passive attitude. Paternal pressures of any sort are noticeably lacking. There is some suggestion that he would like to get away from overly intense relationships, and some slight feeling of being shackled, whether by such relationships or by something else is not clear. In any case there is no serious frustration apparent.

ZG4

That's somewhat the same you could interpret in the same way. Father and son. He doesn't look too, except that, well, not quite the same, I'm not quite clear in my mind just what that picture means. I had a good deal the same impression though, (referring to Card 6 which he interpreted as a mother learning of behavior of her son which will disgrace the family). The father there is looking at his son affectionately but also disappointedly. The son looks as though he doesn't know what to say, he's done something or failed in something. I don't know what the next step is. I think that I don't know just why he's failed to make the grade in something he's tried to do and doesn't know what the next step will be. The father is also disappointed.

This protocol contains many implications of a feeling of helplessness in the face of difficulties, and also of a general feeling of not understanding human situations. He is a very sensitive man and somewhat inclined to get stuck in a situation. He was notably hesitant in regard to interpersonal situations, particularly sexual ones, but not to an extent extreme for this group. His confidence in himself is easily shaken. There is a strong depressive tendency, and a suggestion of conflict over aggressiveness but this is not clear.

B1

Well, I don't know whether this is a father and son or the kind family doctor telling the bad news to the boy but he's undoubtedly telling him bad news and the

young man is taking it hard but I think he will meet the situation and fight it through. [Can you describe the situation?] No, I suppose he's been telling the boy that his mother or father or someone is in pretty poor shape and probably isn't going to pull through.

This is reminiscent of the response of another, but more specific and detailed. That the boy fights the situation through by himself, as is implied, is especially interesting in view of several other stories from this subject, indicating the inefficiency of attempts to offer comfort. This is one of the subjects who lost his mother when he was very young. There is other evidence that this had been a close relation, never replaced. Although the stories are usually factual, he also usually specifies appropriate feelings, but usually does not deal directly with an emotional situation. He has recourse to clichés and sardonic references to a popular weekly.

B2

Well, this . . . an interpretation I should think could be, a father and son interested either in conversation or in some event which they seem to be sharing, either the event or the conversation. I have the feeling of a close relationship which is agreeable. If it's conversation I suppose the father is imparting to the son a few words of wisdom which conceivably are desired, I don't know. The young man doesn't look too pleasant, he has sort of a sneering appearance. The father looks quite determined, though.

This is quite like the story given by P4. In both the father is giving advice to the son, whose reaction is not clear, although this subject indicates that it is not very agreeable in spite of the close relationship. The father's determination is an interesting touch and in line with his acceptance of the paternal role as a protective and firmly advisory one. He is a man who has very thoroughly introjected the standard mores. If one works hard and is sufficiently determined he will get ahead, and if he does what is right he will come out in the end, even if very distressed meantime. Close relationships are important, protective, and rewarding; never to have loved is the cause of unhappiness and love is a protection in some way against the unhappiness of death itself. To do what one is ashamed of is as bad as murder and is sure to have a bad outcome. Any anxiety or disturbance can be tolerated if you are sure you are right. But the picture is a little too perfect. There is a shadow. Maybe man is not so safe after all,

for the only ultimate reassurance is that he has survived to now.

B3

The gentleman on the left is telling the one on the right that he's got to do something or other or else. The gentleman on the right doesn't want to do it but is trying to make up his mind whether he can get away with it or not. Of course all these could be elaborated endlessly. We might suppose the gentleman on the left has asked a question and the gentleman on the right is trying to make up his mind whether to answer it or not, yes or no, trying to decide whether he has to say yes or no or whether. . . . (?) I think on the whole the gentleman on the left is too much for him, no match for what he says, I think he is going to get into trouble sooner or later.

It is characteristic of this protocol that the relative ages of the characters are never mentioned, nor apparently taken into account in any way. The "gentleman on the left" is clearly the older and here the more dominant, although this subject seems to feel the dominance is one of character. The protocol is unusual in several respects. One is the manner in which details are worked into the total picture. He shifts attention from one detail to another, restructuring the whole when necessary to fit. He shows some uncertainty over correctness, but this is not anxious and rather a reflection of sustained flexibility of approach and a willingness to accept uncertainty. Another unusual aspect is the number and freedom of the sexual references. There is always some danger connected with sexual activity but this is in no way a deterrent.

B4

I don't think that is very clearly suggestive of anything: The older man is looking at the younger man. The young man apparently doesn't look the older man in the eye. It could be in an office. The young man is an employee who has made a mistake and is a little abashed by the reprimand. Could be a father and his son who has had some kind of difficulty. I think the expressions aren't very suggestive. Obviously they are city folks.

This subject doesn't get very far with interpreting the picture. His other responses were of a similar sort, although a few of them included enumeration and description of details to a greater extent. There is a feeling of emptiness and loss, including loss of interest. I am inclined to interpret his statement on Card 1— "He isn't particularly interested and yet not re-

sentful"—as a pretty good description of his frame of mind during the interview. His only show of interest is on Card 2 with a description of a long account of farming under hardships and with some dwelling on the pride of accomplishment. There is strong indication of a very close marital relation. And there are some hints of a deep depression.

SUMMARY

In general, the sort of picture derived from the TAT is of a group of intelligent men, somewhat self-absorbed but not aggressive, and not particularly interested in other people. For the most part they are clearly men who have come to satisfactory terms with life. There is surprisingly little indication in these stories of the strength of the drive that has carried them along, but this is perhaps because they have now arrived and know that they have arrived.

The general course of psychosexual development, already discussed in the light of their personal histories is further clarified and the earlier impression confirmed. Some contributing causes are clear in some of the protocols. Their general disinterest or unease in close or warm personal relationships (except as parents) is also indicated, but it is to be noted that there are several exceptions. It should be added that few of them give any indication of wanting or needing closer relations, or even particularly noticing the lack of them. For the most part they avoid emotional situations, and when they must deal with them their techniques vary from matter-of-fact dealing with the obvious realities, to recourse to the banal, or to over-dramatization.

Their general handling of the TAT material is also varied. A few rely only on general impressions, and the others pay varying amounts of attention to details, and make little or much use of them. They are almost all of them very unwilling to go beyond their data, and

they show a general distaste for the imaginary and a strong preference for concrete realities. It is clear, too, that most of them are rather conventional, although a few are definitely not, and that most of them have strongly held convictions of personal responsibility, particularly with reference to parental duties. Their relations with their children seem often to be their most satisfying or at least most absorbing personal ones. They seem to have a very clear conception of the paternal role as sympathetic and strongly supporting. This is in contrast to their general lack of sharpness of conception of other relationship roles.

What is equally striking are the very great differences between them in many ways. They are by no means all cut to the same pattern. A few of them have perhaps rather difficult personalities and may have had some troubles in getting along in their early days. Nevertheless, this has not interfered with their professional development, which speaks well, both for them and for society.

In a number of the protocols there is clear evidence of disturbance over death (usually shown in responses to Cards 11 and 15, but not evident in those reproduced here). In some instances this is a conscious problem with them and it is usually but not always related to early loss. This may be a factor in these individual cases in their following a profession concerned with the study of life. There is no evidence here that it is a common factor.

How much the TAT protocols of this group differ from other academic groups is not known, since directly comparable data are not available. They will be as this study proceeds. It seems a fair comment, however, that the results do not seem surprising in an academic group.

CHAPTER XI

THE RORSCHACH METHOD OF PERSONALITY DIAGNOSIS

THE Rorschach Method for Personality Diagnosis (19) is one of the most widely used in the clinic situation today. It consists of a series of 10 standardized inkblots, which are shown to the subject one at a time, and he is asked to say what they look like to him, or make him think of. After the cards have been run through once, they are gone over

again, and an inquiry is instituted to make sure that the examiner knows where the concept was seen, and what factors in the blots stimulated this. The scoring is intricate, and interpretation depends upon the interplay of factors, and upon qualitative as well as quantitative aspects.

Scoring in the present study has been

TABLE 10
RORSCHACH DATA

Subj.	R	M	FM	m	k	K	FK	F	Fc	c	C	FC	CF	C	W	D	d	DR	S	P	O	T
A1	39	3	5	1	6			18	2			2	I		8	17	5	7	2	5	13	9
A2	33	1	8	1				15	7			1			7	17	7	2		6	6	9
A3	41	9	4					26				2			8	24	3	6		6	2	4
P1	26	3	4	1				9	2			4	2		15	8		3		4	7	2
P2	23	3	4					11	2			3			6	16		1		6	5	3
P3	17	1						10	2			3	1		7	6		1		6	5	4
P4	19	1	3		I			6	1		I	2	2		15	4				6	2	4
P5	11	1	3					4	2	I		I			5	5		I		4	4	2
PG1	16	2	1		I	I		6	3			2			9	5		2		3	5	3
PG2	26	3	3			I		8	3	I		3	3		10	14	2			3	2	1
PG3	11	1	1	I			I	4	2		I	I			8	3				3	4	1
PG4	15	1	2		I			7	1		2	I			8	7				6	2	1
ZG1	23	1	4	I				11	2			4			10	11		2		4	11	11
ZG2	17	2	2					10	1		I	I			7	8		I	I	7	2	0
ZG3	23	6	1					11	3			2			5	11		2	5	5	3	0
ZG4	20	3	7	2				10	5			3			7	15	3	4		8	5	3
B1	20	4	1				I	9	2			2	I		8	8		4		6	0	1
B2	10	2	3		I			2		I		I			7	2			I	6	2	0
B3	28	5	6	I	I			7	3		I	4			17	7		2	2	8	6	0
B4	15							10	2			2	I		8	4		2		2	9	3

TABLE 11
ADDITIONAL RORSCHACH DATA

Subj.	R	W%	D%	Dr%	F%	F+%	F+%**	A%	Last 3	Turning	T/R	Ave. RT	RT Range	d%
A1	39	20	44	18	46	83	85	36	36	no	—	7.9	5-14	13
A2	33	21	51	6	45	87	85	45	39	no	9	7.4	5-17	21
A3	41	20	58	15	63	96	98	49	36	no	25	9.6	3-25	7
P1	26	57	31	12	35	89	81	29	42	on I	30	17.5	8-27	0
P2	23	26	69	4	48	91	96	39	56	yes	—	19.1	4-64	0
P3	17	47	35	12	59	80	88	47	41	yes	57	10.5	4-40	6
P4	19	79	21	0	32	50	42	47	27	yes	45	11.1	3-29	0
P5	11	45	45	9	36	75	73	55	36	VIII & VI	65	28.3	3-100	0
PG1	16	56	31	13	38	83	75	38	31	no	30	10.5	1-30	0
PG2	26	39	54	0	31	100	81	31	35	no	28	2.5	1-4	8
PG3	11	73	27	0	36	80	63	46	36	no	44	8.7	1-19	0
PG4	15	52	48	0	47	100	80	47	47	on IV	49	33.5	8-102	0
ZG1	23	43	48	9	48	64	74	39	48	yes	31	11.0	1-45	0
ZG2	17	41	47	6	59	90	94	59	35	IV, V	39	9.6	2-22	6
ZG3	23	22	48	22	48	91	95	26	43	no	39	26.8	1-79	9
ZG4	29	24	53	14	34	80	79	55	28	yes	31*	13.9	4-45	10
B1	20	40	40	20	45	89	90	50	40	yes	36*	22.9	1-65	0
B2	10	70	20	10	20	100	70	60	20	no	78*	28.6	4-53	0
B3	28	60	29	4	25	100	96	39	39	no	38*	11.1	2-25	0
B4	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.

according to Klopfer's system (10) and the absolute values for all determinants are given in Table 10. Table 11 gives various percentages and other information; Table 12 contains the tabulation of content. I have found for research purposes that Munroe's Inspection Technique (13) is the most useful method for handling the data, and the scores on her Check List are given in Table 13.

A more technical analysis of this material and various correlations with other tests have been reported elsewhere (18). Discussion here will be largely limited to the Inspection Records, and the individual interpretations.

An over-all picture of the group is easily obtained from Table 13.

The total number of responses ranges from 10 to 41, with an average of 22.1. This is low for so intelligent a group. Total number of responses may usually be taken to indicate something about the energy available to the subject, but with this group the rather low average probably indicates more a lack of concern than a lack of energy. They have arrived, and are under much less pressure to prove themselves than a younger group or one less eminent would be, and although they were in general very cooperative, most of them did not feel constrained to put forth any very great amount of effort. It may be, too, that this low number of responses is a reflection of their strong distaste for the nonfactual, their disinclination to go beyond their data, and the distrust of imaginativeness which is characteristic of their TAT protocols. No attempt was made to push them in any way. That the three highest response totals were from the three anatomists is interesting, but a different explanation would be pertinent in each case.

The next entry refers to *time for each response*: a plus is entered for an average time of over 60 seconds, and a minus for an average of under 30 seconds. It can be seen that on the whole the group tends to respond rapidly. There are only two plus entries, but there are four minus ones and four others whose responses were almost as quick. The very intelligent are often, not always, very quick, so that this is not surprising.

The next entry refers to *refusal or inability to respond to any card(s)*. A single check (✓) indicates that a card was initially refused, but an

adequate response was forthcoming following some encouragement; a double check (✓✓) indicates spontaneous, adequate response during the inquiry, as was the case with B2. Refusals are sometimes due to an underlying uncooperativeness, but this factor was not operative here (unless possibly in the case of B4). It indicates rather, a real, but temporary inability to cope with the situation as presented.

Location. The location entries refer to the area of the blot which is used for each concept (the check list records only *W*, whole card; *Dd*, unusual detail and *S*, white space) and the regularity of the order in which they are used (*Suc*). To use the whole card for a response requires a special sort of volition, and a special way of looking at things. It means seeing the forest rather than the trees, and the more elaborate whole responses are taken to indicate ability to theorize and construct generalizations. Generalizations may be sweeping and impressionistic, or may take into account the parts involved and their relationship to each other; these distinctions can be made from the *quality* of the *W* responses. These will be discussed later. Here it is sufficient to point out that *W%* is not unusually high in this group, as a rule. It averages 45 per cent, and only four of the group have more than 60 per cent, which rates an entry on the check list. This is not the complete story, for there are several who gave at least one whole response to all or all but one of the cards, without having an excess total number of *W*, which indicates some compulsiveness in this respect and warrants the entry → 100. The *B* and *V* entries indicate an excessive number of poor and vague forms among the whole responses. These are associated with a tendency to careless or sweeping generalizations, not held in check by sufficient criticalness. When this was shown on the Rorschach, it always was admitted as a tendency in their professional work; one which they had learned to watch out for. One of them, for example, said that he knew his first generalizations were likely to be wrong and he had learned from bitter experience to think again before he committed himself.

That half of the subjects used more than the usual number of rare details (usually *Dr*) is of considerable interest. When not used to excess, with a resultant deficiency of other types of response, this indicates a more than usually elastic approach, a tendency to look at different aspects of a problem, to see things in a little different way. Such persons are usually good observers, although they sometimes get bogged down in details to the detriment of theory. In this group it is not carried to that extent. Certainly in some instances this capacity has contributed materially to the work of these men.

Only two of these men made other than necessary use of the white spaces on the cards. Persons making much use of this determinant are likely to be stubborn or eccentric, depending somewhat on the total picture.

Entries for erratic succession are not many; the entry 1 indicates loose, and 11, confused succession; that is, there is no attempt at any orderly survey of the card, beginning with a whole response, then going to usual large details, then the more obvious small details, etc., but the subject goes at it any which way. Most of those men are reasonably but not compulsively orderly and systematic in the way in which they approach new things.

Choice of locations for responses to the Rorschach cards bears some relationship to the manner in which these men go about their work, although this is rather intricate. In this situation, the relative numbers of *W*, *Dr* and the nature of the *W* responses are the most important. Even in a group of men chosen as were these, there are differences in the amount and breadth of abstract generalizing that they do, and in their tendency to make offhand generalizations without careful checking, and some are very restrained, indeed, in their generalizations.¹

¹It is not easy, particularly with material as technical and involved as the work of these men, which is not in my own field, to be very sure about comments of this nature and an attempt on my part to rate them in these respects is somewhat invidious, but it seems worth trying on theoretical grounds. On the basis of their published work, I divided the men into two groups, i.e., more and less tending to generalizations and theory. I then tabulated the *W* responses on the Rorschach, noting them as of vague form, popular level, popular or common responses but with additions raising the level, and combinatorial *W*'s. I gave each man 2 points for every combinatorial *W*, one for every other well above popular level and an additional point if he produced more than three human movement responses, and on the basis of these scores split the group into two, i.e., those tending more and less to broad generalization and theory. Only two men were placed in different groups by segregation on the two bases. There are so many chances of error at so many different points that I offer this with considerable hesitation, but it does tend to support Rorschach theory.

In discussion of this point with one of the subjects, he commented that he would think such a judgment very difficult for anyone not an expert in the field. As an example he suggested a man in his own field, saying that unless one

There are other points of interest. *B₃* has by far the greatest number of combinatorial *W*, revealing an extraordinary facility in this respect. His papers have one notable aspect. In every one he begins with a brief survey of the total field, and follows this with a lucid exposition of exactly where the present work fits in and what its significance is. He does this unvaryingly, even if it is only the report of a new development in methodology. Obviously, all the others do this some of the time, some of them do it fairly often, but none of the rest does it all of the time. Nor is it just the fact of doing it, but the extraordinary clarity with which it is done that is impressive.

The men who have made some of their major contributions by noticing a fact that others had overlooked are likely to have high *Dr* percentages as well as good *W*.

Content. That scientists are not strange beings, completely out of touch with normal, everyday life, is shown in part by the lack of minus entries (with one exception) for popular responses (*P*). These are responses which are given with great frequency. It is obviously a good thing to be able to see things as others see them, up to a point. It is also a good thing to be capable of some originality, and to have a fresh point of view on things. It is rather surprising that more of these men do not have plus entries for original responses (*O*). For the most part they keep well within bounds, although a few produce original responses which are poor in form, and not well organized. These merit a *B* (for bad) entry here, but there are no really bizarre responses in the group. When intellectual control is allowed to slip, it never slips very far with these men.

Munroe (13), in directions for the check list, notes that in considering whether anatomy and sex responses are sufficiently numerous to merit a check, "considerable latitude should be allowed for special study in the field of biology." These responses were not generally frequent, however, so that in entering checks I have followed her practice for "unsophisticated" groups. In the case of *A₂*, the excess of these responses is definitely linked to his immediate professional

knew the field thoroughly, reading of his publications would suggest that he worked on specific problems only, with very little theorizing, but that he was, in fact, advancing on so broad a front that the actual theoretical background would be obscured. I do not think he knew this man was one of the subjects. In fact, I had made precisely the error he suggested,—I had classed him from his work as not broadly theoretical, whereas on the Rorschach results he clearly belonged in the other class.

work, and I think is not otherwise particularly significant. For the others, the excess of such responses does indicate specific preoccupations not related to their work. It should be noted that very few of these are sex responses (see Table 13); in all of the protocols, only eight sex responses were given.

The only minus entry for range of content was given for too high a percentage of responses having only animal and human content. Plus entries indicate use of a very large number of categories which may indicate some diffusion of interests. The *t* entries indicate repetition of inappropriate concepts. These were all anatomical for A₁, ZG₁, and B₄; for ZG₄ it was a repetition of chick embryos, scored as science for content, but having much the same significance in this connection.

In addition to the usual scoring for content, I have added the notation *T* for technical responses (usually but not always original) which are properly described as such. The small center detail in Card X, for example, called the pollinium of the milkweed, was recorded as *T*, in addition to the usual scoring, but if called a maple seed it was not recorded as *T*. The number of such responses is listed in Table 11. They range from 0 to 11. From the distribution, over 4 seems excessive for this group and they are probably significant of some tendency to take refuge from other stresses in professional activities. This is certainly not uncommon, and can be a very helpful technique, when, as is usually the case here, it is not carried to the extent of altogether evading a problem that needs other solution.

Form. Responses that are determined entirely by the shape of the blot or some portion of it, and not at all by color, or shading, or any feeling of movement are called form (*F*) responses. A high percentage of *F* responses is common among persons who tend to take an intellectual rather than an emotional approach to things and to view reality rather objectively. It is rather surprising in this group that there are only three with plus entries, although there are five others who almost rated it. Range in per cent of responses using only form is from 20 per cent to 67 per cent with an average of 43 per cent. Actually, dominance of rational control is somewhat greater than appears from the *F*% alone. This is shown by the very rare occurrence of concepts in which form is secondary. When more than one determinant, e.g., shading and form, is used, the form element is usually dominant. It is important, I think, that this group is not overintellectualized to the point of pedantry. It is very probable that such a tendency is somewhat sterile,—undoubtedly a useful thing in a technician, but limiting at other levels.

Thinking that is directed with conscious attention and judgment produces good forms, clearly conceived, and appropriate to the area used. The entry B indicates some letup in this conscious control, to the extent that the form is not exact; V indicates vagueness, such as clouds, molten metal, etc. The only E entry, not a full entry, is for some tendency in the opposite direction, overfinickiness in this respect. These entries are for the form level of all responses, not the *F* responses alone. It not infrequently appeared in the inquiry that particular responses had been considered and discarded because the form was not accurate enough. On the other hand, it is rather characteristic to find criticisms of form in the protocols, although the response may be given and these are sometimes quite detailed. It was usually the case that the subject was satisfied once he had pointed out the inaccuracies, but a few subjects then shifted the concept to take care of the inaccuracy, and some of these alterations were extremely ingenious.

Shading. The very general prevalence of shading shock in this group is an outstanding finding. This is supposed to be quite uncommon in normal groups. The entry is given when the reaction to the more differentially shaded cards is notably different in any respect from the reaction to other cards. It is manifested chiefly in increased time before a response is given, in change in the manner of response or the content, or in decrease in form level. Three of the group showed it to a severe degree, one nearly so; ten gave clear indications of it, and four gave some indications of it. Only three of these subjects did not manifest it at all; (one of these had a generally disturbed protocol and the shaded cards did not give him any perceptibly greater difficulty than the others). The meaning of shading shock is not completely worked out. Beck (1) says, "It signalizes that anxiety which, because its roots lie deep in the very early experiences of the individual, has become a central character force diffusing his energies and paralyzing him in almost all of life's crises." It occurs in [Cards] IV and VI principally, less often in V and VII. It "... signifies a low threshold sensitivity to events bearing potency of danger... it bespeaks a chronic readiness to be upset." It is important to add that in this group, recovery is generally very good, and the disruptive effect is only temporary. Traumatizing early experiences, particularly affectional loss or deprivation are clear in the histories of a number of these men, but not for all of them, but this may have a bearing. I cannot at this point offer a general explanation which seems very satisfactory, but I think the finding of very great importance. Clearly, to have reached the position that these men now hold, a constant and sustained effort,

internally derived, and maintained over a long period, has been a major factor. They all have worked for years, and many still do, to a somewhat lesser extent, not only the length of the usual office hours, but nights, and Sundays and holidays, and generally most other things in life are subordinated to their professional pursuits. There has to be some motivation back of this, some inner need spurring them on. This can be thought of as a basic insecurity which is generally buried far below the level of consciousness, and the presence of shading shock would indicate just this. How it becomes translated into vocational activity is another matter. But given this need, sufficient intelligence, the discovery that research is satisfying (probably just because it does mean finding out things), a first-rate scientist may appear. This should probably be further qualified to note that these men show high recoverability to the shock; lacking this, the result might be different. It may be that this insecurity is no more than a supersensitiveness to the basic insecurity of man in a universe which is complex beyond his capacity to comprehend it. If this is it, it is not surprising that research may be so satisfying a way of relieving this anxiety. ZG₃ remarked: "The driving thing may be just that I wanted to find out. I began to get great satisfaction out of discovery and then I felt less need for information. There was a definite break there, there was a time when I read everything and did no research work and then the reverse." The TAT story of B₂ to Card 11 may be significant here—" . . . well, maybe this is these men are escaping from this apparition coming out of the hole in the side of the wall. They are showing considerable fear and I suppose well they might. Although you would gather that the outcome would be highly questionable we know what has been the real outcome, man did survive in the face of such monsters." The story of A₂ to the same card ended: "Puny man has climbed the canyon and put the animal to flight; they don't know what is coming next; they are still crouched in fear."

I do not think this is just a covert fear of death as such, although this, too, is clear in the histories of some of the men, and quite conscious in a few instances. The shading shock is linked at least superficially, perhaps more deeply, to some difficulty in sexual development which is the rule with this group, but I am inclined to think that the sexual difficulties are secondary. In any case they are no more than is typical for the intellectual group in our society, and not limited to scientists.

There are some entries for more than the usual attention to the grayness or blackness of the cards (*C'*), or to the vista effects (*K,k*) but

these are of only individual importance. That there are not more is some further indication that the problem denoted by shading shock is well handled. With this group *C'* responses seem to be associated with a form of passive stubbornness of a somewhat different quality than that usually found associated with a high number of space responses.

Movement. Seeing movement in the cards, particularly in the form of human movement (*M*) requires a considerable empathic projection of the subject. This has been thought of as an indicator of special "creative" ability, but there is reason to doubt that this is a precise formulation. At any rate, there are individuals whose "creative" activity is undeniable who produce few or no *M*'s in a Rorschach protocol. All of this group work in science at a level which almost certainly involves genuine creative activity, along with everything else, yet they, too, in general, do not produce the number of *M*'s that is expected at their intellectual level. Only one subject has a plus entry in this category; six others have adequate (often barely adequate) *M*, and the rest have fewer than 2 *M* each; or the *M*'s they produce are remote in content (cartoon figures, angels, etc.) or very restricted in movement (standing, looking, etc.). Remoteness in content is characteristic of persons who have not quite reached a mature conception of the human role, but who are on the way to this, whereas restriction in activity is characteristic of rather passive persons.

Counterbalancing this in some instances is an overproduction of responses involving animal movement (*FM*); in other instances these responses are also lacking. The former situation is characteristic of persons with a fairly extensive but immature fantasy life and probably egocentric. Again the nature of the movement is of importance for interpretation; it may be remarked that in this group it is generally very mild, and often restricted in the same manner as the *M* responses.

Responses denoted by *m* are movements due to inanimate forces,—explosions, wind, etc. Any excess indicates some conflict over instinctual drives; this is present in some cases but is not overly pronounced in the group as a whole.

In one way or another, only two of these subjects show a marked constriction in movement responses of all sorts. In general, in this area, then, the only finding of any consistency is that of some underproduction of *M* responses, which shows a reduction of the extent to which the subject can put himself into what he is concerned with, and is an indication of a more objective attitude.

Color. Color responses are interpreted to show the subject's reactions to the environment, his

responsiveness to it, and in particular his reactions to other persons, and the warmth of his personal relations. Color shock is analogous to shading shock, but of considerably less diagnostic significance, since it occurs in about half of the protocols taken from "normal" groups. Only the severer forms seem of particular significance in personal diagnosis, but its very general occurrence here is in accord with the rather common lack of free social activities. Responses determined dominantly by form, secondarily by color (*FC*) are interpreted as an expression of the desire to adapt socially, and if the form level is good, and they are not strained, as indication of success at this. As shown by the minus entries, this is deficient in five of these subjects. In fact, the difficulty is more extensive, for there are a number who have sufficient quantity of *FC* but whose responses are strained, so that a really easy, mature sociality is doubtful. Responses dominated by color but having some form are very infrequent; no subject has more than three, and many have none, or use this determinant only additionally. Lack of it indicates general absence of responsiveness, usually lack of warmth; too much indicates an egocentric emotional responsiveness. As always, the content is important in interpretation, as well as the relation between *FC* and *CF* responses. Rorschach says, "The greater the preponderance of *FC* over *CF* the more stable the affect and the greater the adaptability and capacity for formation of rapport. The closer *CF* comes to *FC* the greater the moodiness, instability, and egocentricity." (19) Color responses without any element of form (*C*), i.e., without any control, are lacking in this group except very occasionally as incidental to another concept.

In most of these men, there are evident difficulties in social relations—not so much that they are hard to get along with or have not developed sufficient suitable social techniques, but that they are not greatly interested in people, are often rather cold, sometimes ill at ease with others, and generally prefer their vocational, or some special avocational pursuits to social and personal contacts. In a few of them, there is evidence of well-developed, close ties to one or a few persons with general disinterest in others.

Color:Movement. The relation of the color responses to the movement responses is taken as an indication of an introversive (higher movement) or extroversive (higher color) adaptive type. Most are not dominantly either one, although the group tends somewhat more to an introversive adaptation.

INSPECTION TECHNIQUE SCORE (*ITS*):
The total number of checks for each man on the Inspection Technique Score is to

be found at the bottom of Table 13. These range from 2 to 19, with a varying number of near checks in addition. The mean *ITS* is 8.8. There are few groups with which to compare this, other than those to be reported in the next chapter. In the group of eminent painters which I studied, the mean *ITS* was 10.3 (15). In college students, Munroe thinks a score over 10 indicative of sufficient maladjustment that difficulties are probable.

It is necessary to distinguish between "clinical maladjustment," which means the presence of stresses in the personality structure, and "social maladjustment," or the expression of these stresses in behavioral terms. The *ITS* appears to measure the former not the latter, at least in my experience with such groups as this. Here, for example, a separation of the total group into those who have had or now have evidence of social maladjustment shows no relation to a separation of the total group into those scoring above or below the mean *ITS* for the group. At the same time, those who have higher *ITS* scores do have problems; what is not shown in the *ITS* (or necessarily in the Rorschach generally) is whether or not they are able to cope with them in one way or another. Such instances offer very useful data on the extent to which serious problems² can be tolerated and something on how this can be accomplished.

In general, the most effective technique, and one widely used in this group, although unconsciously so, is immersion in work. That this work is of an impersonal nature is of very great help. Not only is the work itself impersonal in a way completely different from artistic

² Philosophically this opens up a discussion of when is a problem not a problem. This reminds me of the WCTU argument that while it is true that alcohol gives one a feeling of confidence and relaxation it is a "false feeling."

creation, but the record, the manner of communication of the productions, is so fixed that it is hard to find the man behind it. That is to say that the methods of research and the usual forms of reporting it are strikingly rigid. Even within this framework, the real man does sometimes appear, or at least something of his intellectual make-up can be discerned. Concentration on such a vocation not only serves to wall off a difficulty very effectively, but the vocation itself offers many additional satisfactions. Furthermore, socially, it is ideally suited to a man who is disinterested in people, because it is accepted as a matter of course if a scientist wishes to work evenings instead of going to bridge parties.

It is even accepted, in large part, by the wives of scientists, which is another matter, because this thoroughgoing concentration on work could easily be interpreted as personal neglect, and indeed must often take on something of that aspect. The situation requires a very high order of toleration and understanding on the part of the wife and family, and usually must mean that the wife has very considerable resources of her own, or can find them. Again, in this latter aspect the academic situation offers some help during and beyond the years during which her time has been sufficiently occupied with child-rearing. There are usually a number of cultural outlets available (more than are generally available to the wives of business men), and many of the women do a good deal of highly useful civic work.

In addition, it is clear that a number of these men must derive a great deal of support from their wives in more specific ways. One man, for example, gives test evidence of very severe anxieties, which are practically completely repressed. There are no obvious indications in his

life history or in general conversation of any such thing. Careful consideration of the evidence has convinced me that there is no doubt but that the anxiety is there, highly localized and completely or almost completely beyond his own awareness. How does he manage? He quite simply leaves all the worrying up to his wife. This very complete projection of anxiety works beautifully for him, and his wife appears to be able to tolerate it, but not without considerable cost to her. In the case of another of the subjects who is hampered by neurotic difficulties, it seems probable also that his wife has been a very large factor in his being able to maintain his integration. I am not clear about the mechanism in this instance.

Quite the opposite can occur. Marriage to a woman who cannot tolerate the general or particular situation can be extremely disrupting. This may or may not affect the man's work to a noticeable extent, but it can. (There is one fascinating instance of invasion of the vocation by emotional problems.) It is more likely to result in increased immersion in the work, which probably exacerbates the problem. Or it may result in the man's having recourse to some other outlet, such as creative work in the fine arts. (There are, of course, other motivations for creative work in arts.)

SUMMARY

These men are individuals not characterized by any completely consistent pattern of personality structure. There are, however, some trends which appear with fair consistency among them, and which would not characterize a group of adults picked at random.

They have somewhat greater than average tendency to see things as a whole, and to generalize, but this is not carried

to such a degree that they are unable to attend to details. On the contrary, more than most groups, they are sensitive to aspects of a situation not usually noticed. They are not by any means generally egocentric, although many are somewhat egocentric. They have, as a group, good control of discrimination and judgment, and some tendency to be more objective than most. Social and personal relations tend to be at least superficially smooth, but often not warm. The most striking finding is the prevalence of shading shock.

The usual Rorschach interpretations would classify most of these men as personally unaggressive, but they are a very stubborn lot and cannot be pushed around. They do not seem to need to feel dominant with respect to other persons, but they definitely are not subservient. What looks like a general passivity in many of the protocols may have limited implications for behavior. In a sense they are acceptant of things as they are, in some ways profoundly so. This does not prevent an intense interest in how or why things are as they are, it may

even be an essential element, but wanting to find out how things work is quite different from wanting to change them.

They are not very "outgoing" persons in a social sense and would not rate very high in "masculinity." (It will be remembered that their personal histories usually show a delayed sexual development.) Some of them have had conflicts over this, a few still have, but others have accepted it without much evidence of strain. A similar picture in artists was emphasized by a large percentage of broken or unsuccessful marriages. There have been fewer divorces in this group, their marriages are as stable as are those of the population at large. The difference between these groups is probably due to the biologists' generally more complete rational control, and considerably less interest in sex as such, as well as to differences in the social and personal pressures in the two groups. These latter are not only obvious differences between the social climate of the two vocational groups, but are also in part due to the much larger number of children of the biologists.

COMPARISON WITH A GROUP RORSCHACH STUDY

IT WAS decided to administer the Rorschach as a group test to as many biologists as possible, in order, first, to obtain data of value for comparison with results in the group of eminent biologists, and second, to obtain data of value on their own account.

Some statement must be made on the comparability of Rorschach protocols when the test is administered individually to those obtained when it is given as a group test. In the individual test the inkblots are presented to the subject on cards, he may look at the cards in any position, he responds verbally, and he may take as much time as he likes. In the group administration the inkblots are projected on a screen and the position is fixed, responses are written and each card is exposed for a limited time—in this instance for three minutes. Furthermore, the inquiry is more effective on individual administration.

There are a few studies comparing results on the two forms for normal subjects which are pertinent. Harrower (4) reported on 110 college students and nurses tested with both; Hertz (5) reported the administration of both to 73 women college students; Hertzman (6) reported comparisons between 100 college students tested individually and an equated group tested by the group method. All these investigators note certain relatively minor differences (varying from one study to another) but all agree that important aspects of personality are revealed almost as well by the group test as by the individual. These studies are not conclusive, but they justify the use of a group study for com-

parative purposes. As this research proceeds, more groups will be similarly studied, and it will be possible to adduce further evidence on this point.

The sampling problem was not an easy one. In connection with a previous study, it had been possible to secure a good sample of paleontologists at a meeting of the Society of Vertebrate Paleontology (14), and it was originally planned to try to secure subjects for this part of the study by attending meetings of various of the professional societies, such as the Society of Mammalogists, the Botanical Society of America, and the Genetics Society of America. Vertebrate paleontologists, however, are a very small group, and practically all of them belong to one society. This is not the case with other biological groups and further study of the situation made it evident that a sample obtained in such a manner would be biased in unknown ways for which no correction would be possible.

An attempt was made to consult the National Roster data for information on the distribution of biologists, but these data are not now available to anyone. An appeal was made to the Office of Scientific Personnel, to which Dr. Trytten and Dr. Lapp responded promptly and effectively, making all their relevant data available. From their information it was learned that over 80 per cent of graduates in biology had jobs in educational or research institutions, and since all of the men selected for individual study were also connected with such institutions it was decided to get the sample for the group study from universities and a representative museum.

For comparative purposes, it was desirable to have biologists who are fairly specialized, and it seemed evident that the universities giving the largest number of degrees in biology during the last twelve years (this is the period for which the data are available) would have the most differentiated faculties. Since there was no information available on any differences that might be associated with geographical area or type of university, these also had to be considered in the sampling. The country was subdivided into four geographical areas (by combining several census areas): North Atlantic; North Central and Midwest; Pacific Coast and Mountain States; and South and Southeast. In each of these areas the public and the private university giving the largest number of PhD's in biology in the last 12 years were selected.

These were Cornell University (partially public and partly private) and Columbia University; the University of Chicago and the University of Wisconsin; Stanford University and the University of California at Berkeley; and The Johns Hopkins University and the University of Maryland. The National Museum was added to the list to include some men in government service.

The testing was done in most instances by faculty members or graduate students in psychology at the various universities, to whom a great deal of appreciation is due. It is a somewhat delicate task to get a group of faculty members to give the necessary hour's time, but in general the response was very generous. The testing was done at Cornell by Dr. Frank S. Freeman; at Chicago by Dr. Leota Janke and Dr. Alice Jonietz; at Wisconsin by Dr. Ann Margaret and Mr. Leonard Eron; at Stanford by Mr. John Schlosser; and at Johns Hopkins by Dean G. W. Shaffer. I did the others. Dr. James Miller at Chicago; Dr. Jean Macfarlane at Berkeley; Dr. Lewis Terman at Stanford; and Dr. Alexander Wetmore at the National Museum helped a great deal in initiating contacts with the departments involved. All of the tests were scored by Mr. Louis Getoff.

The number of usable records obtained ranged from 7 to 35 at the different universities, with a total of 188 records. The representation from all levels from instructor through full professor was good, and so far as could be determined there are no definite biases in the sample. There are considerable differences in coverage from university to university, but the average representation is about 50 per cent.

The total group of 188 includes representatives from a number of subdivisions of biology not included in the sample for individual study, such as invertebrate zoologists, etc. It was decided, therefore, to select for this comparison only those in the same fields as the 20 individuals reported, and only men. The total group is fully discussed in another paper (15). The data permit comparisons between individual universities, between public and private universities, between different geographical areas, between ranks, between subdivisions of biology, and between the sexes. Here it is only necessary to state briefly that none of these comparisons showed important consistent differences except those between individual institutions, between public and private universities, and between different subdivisions of biology.

In this chapter, then, are reported the Group Rorschach data for the following subjects, all male: 16 anatomists; 22 physiologists; 17 botanists; 4 plant geneticists; 9 animal geneticists; (the total sample includes a number of geneticists who could not be distinguished as to field);

12 bacteriologists; and 14 biochemists.

These men constitute a sample of biologists who may reasonably be taken as representative of successful university faculties in biology. All have positions at very good universities, and presumably they are at least adequate in these positions. This means that even in this group there is some selection for competency. In the faculties of these particular universities, there is also some selection for competence in research, as well as (sometimes in spite of the lack of) competence in teaching. Hence comparison of this group with the men who were studied individually, is a comparison within a vocation of men who are successful in it and of all degrees of eminence¹ and men who have achieved the greatest eminence in the field as a result of their research. The question is whether this difference in degree of achievement or recognition is associated with any differences in personality which are determinable from the Rorschach.

TABLE 14
COMPARISON OF MEANS OF INDIVIDUAL RORSCHACHS OF EMINENT BIOLOGISTS AND GROUP RORSCHACHS OF BIOLOGISTS

	Individual Rorschachs <i>N</i> = 20	Group Rorschachs <i>N</i> = 94
Age	51.2 ± 1.4	41.6 ± 1.1
<i>R</i>	22.0 ± 1.9	33.8 ± 1.9
<i>ITS</i>	8.8 ± 0.8	11.2 ± 0.5
<i>W</i> %	44.5 ± 3.6	38.8 ± 0.6
<i>F</i> %	42.8 ± 3.5	44.7 ± 3.5
<i>T</i> %	13.6 ± 2.6	12.8 ± 0.9

The data are given in Table 14. Differences in age, number of responses, and Inspection Technique Score are statistically significant; the other differences are not. Responses of normal adults are expected to run between 20 and 40, so that the responses of the eminent men are clearly under expectation. This was true of the paleontologists also, although it is clearly not a characteristic of biologists generally. Participation of both groups was entirely voluntary, but it seems that those taking the individual

¹ There are a few men in the group studies as eminent as those in the individual studies but who were not considered for the latter by reason of age, foreign birth, or dominance of administrative duties.

test may have felt less need to prove themselves (the specific situation being taken as an aspect of a more general one) or less inclination to make a particular effort to extend themselves, although at least reasonable effort might have been expected as a result of the individual administration. On the other hand it may be that I had somehow so structured the situation that the limited number of responses in the group of eminent biologists is a reflection of extra caution. I do not think that this is the case, but it remains a possibility. Report throughout was extremely good in all but one or two instances; the Rorschach was not given until after some hours of interview and general discussion, and the records themselves do not show extra cautiousness where there are no other indications that this is characteristic of the subject. Another possibility is that this relatively low number of responses is primarily a result of the general dislike of these men for imaginative constructions, their unwillingness to go beyond the data. It seems to me highly probable that this is the case, and that this is one reason for their eminence in science. It is easy to overstate this, and it must be added that there are a few very imaginative persons among the eminent men, and furthermore that too much constraint is certainly unproductive. Whitehead speaks of the "dangers of unimaginative empiricism." Distrust of imagination, however, does not mean distrust of new approaches or inability to see things in a new way.

The significant difference² in the total (Inspection Technique) scores, indicat-

² The significant difference might indicate that in the group sampling there was no bias in the direction of adjustment or, conversely, that the more maladjusted were more willing to be tested or at least more interested in the test.

ing that the eminent men are somewhat better adjusted, is another point of very considerable interest. One may ask whether they have been more successful because on the whole they are better adjusted, or whether they are better adjusted, or whether they are better adjusted, and are presumably more secure and more satisfied. It is probably a combination of the two. Some comparison of the different check list entries is necessary.

Significant results are tabulated below, with the p level. The last entry was checked by a 2×3 table, the 3 divisions being $C:M+$, $C:M-$, and Neither.

Entry	Chi square	p
$F\%$	5.33	.02-.05
$c+$	4.55	.02-.05
$FC-$	4.15	.02-.05
$CF+$	5.18	.02-.05
Total color—	4.98	.02-.05
$C:M$	6.59	.02-.05

In all of these, the number of entries is relatively larger for group than for individual administration. Here, then, are the entries which contribute most to the higher total scores of the group administered Rorschachs. It will be remembered that mean $F\%$ did not distinguish between the groups;³ the entries here indicate that although the central tendency of these two sets did not differ, a greater number in the group administration made excessive use of F . High $F\%$ is usually associated with reliance upon intellectualization, with decrease of spontaneity, and often with a rather pedantic approach to life.

The increased number of entries for undifferentiated shading in the groups is, by usual Rorschach interpretation, an indication of the presence of more "free

³ Hertzman (7) found $F\%$ higher in the group administration.

anxiety," and also of some impulsiveness, and less tendency to delay initial responses. The higher entries for over-use of color-form also indicate impulsiveness and lack of delay, and somewhat spasmodic control of actions. In addition, the lack of sufficient *FC* responses (form color) reinforces this and indicates also some general poverty of affective rapport with others. The general paucity of color responses is also some indication of poverty of emotional responsiveness. Were there less use of all color responses in the group protocols, there would be a strong suspicion that this was more probably attributable to the difference in administration than to differences in personality.

It must be kept in mind that these entries occur in different records in different combinations. A high *F%* and a high *c* and *CF* are not often found in the same record, but a high *F%* and a poverty of color responses may be associated. Hence, it is clear that the members of the large group differ from the eminent biologist group in several possible ways. They may have more inhibition, amounting to excessive restriction, or they may have insufficient control, and ability to delay responses, which results in a quite different picture. This is also shown in the study of the relative amounts of color and movement re-

sponses. There is a higher proportion of the large group that uses one or the other relatively excessively, but they are almost as likely to have an excess of movement as they are of color.

The larger group, then, is like the eminent group in having a relatively high incidence of use of unusual details, a very high incidence of shading and color shock, and a considerable restriction in the use of human movement. They differ from the eminent group in having either less rational control or an excess of it, and in having even less general affective reactivity than do the individuals studied. There are also some indications of greater free anxiety in the protocols of the large group, and I would suspect considerably less recoverability from shock, although this has not been carefully checked. One may suggest that this patterning of differences between these individual and group records suggests strongly that the differences are not due to the difference in administration.

A few of the men who took the Group Test requested individual analyses which I made and reviewed with them. It is encouraging that this can be done very effectively from the group test. It is worth while adding that knowledge of the usual situation among scientists has very considerable value in diagnostic and therapeutic consultation.

CHAPTER XIII

DISCUSSION

AT THIS stage in a long research project, discussion of general or theoretical aspects would be premature. But there are some specific findings relevant to biologists which may be further developed here.

It would seem that for these biologists, the pattern of relatively superior educational and occupational family background, with a higher evaluation of intellectual interests and a lesser emphasis on warm personal relations, is a fairly constant one. The continuance of this pattern in terms of somewhat delayed psychosocial development, in intellectualization of interests, and in primary concentration on vocational interests is entirely consistent. None of this is out of line with what is known or surmised regarding professional or academic groups in this country generally, but it has not previously been documented so far as I know. Nor is it yet certain that scientists in other fields do follow this pattern.

In so small a sample,¹ one must be extremely cautious in interpreting the findings. Such a finding as that of relatively high incidence of loss of a parent at an early age may, for example, be a chance

¹The sample is small in absolute number; but it is a sample drawn from a very small universe, the group of top-ranking research biologists in this country. In that sense the sample is relatively large. One may argue that it should rather be considered a sample from the upper end of the distribution of all research biologists. This is a somewhat difficult concept, if pursued. Is eminence distributed normally? I doubt it very much. It would not appear to be from the ratings of some 80 biologists from whom 23 were selected, 20 of whom were studied. From these ratings, one gets a decided impression of a group that is not just on a continuum with the total group.

fluctuation and of only individual importance. But it cannot be altogether discounted on that basis, nor should it be overlooked as a clue to a possibly more generalized situation in terms of psychological dynamics.

The one statement that can be made about all in the group of eminent biologists, without exception, is that they have worked at their jobs with persistent intensity, with single-minded devotion—and with great personal satisfaction. They have worked day and night, work-days and holidays; generally only reluctantly and usually chiefly because of outside pressure have they spent any noticeable amount of time on anything else. Most of them are happiest when they are working. Such concentration usually appears as soon as the research concept is fully understood by them.² And the concentration is on the work primarily as an end in itself, not for economic or social ends, or even for professional advancement and recognition, although they are not indifferent to these.

All of this would indicate a continuing need, of considerable force, which has been met more adequately in this way than by any other means within their experience. Although the source of such

²The importance in these histories of the discovery of the possibility of doing personal research in biology has very sharp and direct implications for pedagogy. It is much easier to tell a student what to read, what to do, and what to think, than it is to set up a situation in which he must figure out all these things for himself. This is as true of graduate courses as it is of grade-school courses. It isn't what makes research scientists. Perhaps not all students can learn to work on their own, but it seems evident that few have been stimulated or even allowed, to try.

a need or drive may not be the same for all of the men, yet it may be expected to have some features in common. Since the major element in the satisfaction seems to center around finding out things themselves, one would look for some basic insecurities which could be alleviated in this way. The common incidence of shading shock on the Rorschach supports this guess, but does not define the cause or nature of the insecurity. That an emotional problem over the acceptance of death can be assuaged by a study of life is an obvious suggestion and I think there is evidence that it has played an important role in some of these men. But there is no evidence of its being for the others in the group more of a problem than it must be for any man.

It would seem, also, that these men must have developed a high degree of tolerance of delayed closure and of frustration since it so often happens that research must be continued for many years before any major results can be obtained. It is suggested that development of such tolerance may be related to early experience of success in research. This does not mean that the success must apply to discovery of some new and important fact, previously unknown to anyone else, although that would have a greater impact certainly, but it may apply to discovery of something already known to others, if the discovery were genuinely a personal one. If this is the case, the pedagogical implications are of some importance.

It is apparent that possession of superior intelligence is not the decisive factor in the success of these men. Presumably a certain minimal level of basic intellectual capacity is required, but the results on the verbal-spatial-mathematical test,

so far as this is a test of intelligence, would indicate that this is not extraordinarily high. Indeed, this factor seems to be of less importance than others. Nor do fortuitous elements seem to play a major role, although they are not lacking.

Such comparative data as are available from the group study are from a sample of successful men in the field. A few of them are as eminent as the men studied individually, and not all of them are engaged in research. But it would appear from this that certain Rorschach factors which are emphasized among the eminent biologists are common in the large group also—the shading shock, the slightly higher than average use of whole and unusual detail responses, the paucity of human movement responses. So far as the larger group differs from the eminent individuals here studied, they do so in terms of either increased or decreased intellectual and emotional control. The eminent group show a generally better balance, but there are exceptions both ways.

It is a serious lack in the design of this whole study that it has not seemed possible to make a comparison study of men of *least* eminence in research. Such a comparison would provide a decisive check on such inferences as may be drawn from the material at hand.

These data suggest that important in the development of a first-rate research biologist are the following: a background in which intellectual activities are valued; an intense emotional need which can be satisfied by activities of a research nature; the ability to concentrate energies, probably reinforced by early experience of rewards for such concentration.

CHAPTER XIV

SUMMARY

AS THE first part of a clinical study of research scientists, this monograph reports data from the life histories and three psychological tests of 20 eminent biologists. All are American born and trained. Age range is 38 to 58, with a mean of 51.

The parental family backgrounds of these men were generally superior with respect to educational and occupational level; the fathers of 45 per cent were professional men. In all but two of the homes, it is clear that whatever the parental occupation, education and learning were specifically valued. In general the vocational choice of the son was accepted, and aided by the parents, although in a few instances there were reservations usually on economic grounds.

There is some evidence of lack of warmth in many of the parental homes, and incidence of death, divorce, or serious illness among parents of the eminent biologists is high, amounting to 40 per cent. The psychosocial developmental pattern is fairly constant in the group. Intellectualization of interests appears at various ages, sometimes as late as college, but a general picture of shyness, lateness in developing interest in or in being able to express interest in girls, and present general disinterest in most social contacts is characteristic of all but one or two of the group.

A childhood interest in natural history was present in only half of the group. Discovery of the possibility of doing research on their own was usually a specific experience and always a major factor in determining their fixing upon a career. An outstanding feature in the

history of all of these men is the persistence and intensity of their devotion to their work. It has clearly been the most important thing in their lives, judging by the time and effort expended. Only one of them had any idea that he might have preferred doing something else, although several thought other fields of science might have been equally interesting. The rest express themselves as completely satisfied.

The range of scores on the verbal-spatial-mathematical test is very wide. Some patterning is evident: the anatomists and physiologists and all but one of the botanists have higher sigma scores on the verbal test; the geneticists and biochemists are without exception better on either the spatial or mathematical test than they are on the verbal.

The Rorschach test showed in the group as a whole some tendency to increased *W* and to increased *Dr*. There was some restriction in *M*, not accompanied by any general restriction in the movement area, but there was some general restriction in the color area. *F%* was not high, but responses in which *F* was not the primary determinant were extremely rare. Shading shock was generally prevalent and from mild to severe in degree. The eminent biologists as a group tend to be stubborn and persistent rather than aggressive, and have little interest in interpersonal relations, although they are superficially adequate handling such relations.

On the TAT, there is confirmation of the nature of the psychosexual development as described, and indications that most of the individuals prefer not to go

beyond the data presented; a general distaste for the imaginary and a strong preference for concrete realities is evident. Most of the individuals are rather conventional and have a fairly strong sense of responsibility.

Study of other biologists, members of university faculties, by the Group Rorschach showed a similar over-all pattern. It would seem, however, that the subjects studied by the group method showed a less balanced rational control.

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