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DESCRIPTIVE STUDY OF UNIVERSITY PROFESSORS.

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ANTECEDENTS OF ACADEMIC MOTIVATION:
A DESCRIPTIVE STUDY OF UNIVERSITY PROFESSORS

DISSERTATION
Presented in Partial Fulfillment of the Requirements for the Degree Doctor of Philosophy in the Graduate School of The Ohio State University

By
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CHAPTER I

Introduction

How many teachers have pondered a situation like the following?

Bob's a bright boy, but he just won't try; and there's Tom right next to him who is a real self-starter; he reads ahead in the text, and he is always bringing in something new that he is excited about. Both boys are bright, have working parents, and live in the same neighborhood. What makes them different academically? Why isn't Bob interested in academic learning?

Both parents and educators worry about situations like this. Their concern is evident in parent-teacher conferences and in the many articles related to academic motivation to be found in professional journals as well as in popular magazines. All recognize that something is operating which makes the two boys in the above situation different, but the difference is too frequently simply labeled one of academic motivation and accepted as a fact of life. The question of why the differences exist is unresolved.

Recognizing that individuals are or are not academically motivated does not explain how they became so, nor does it outline the operating mechanisms. To understand these relationships it is necessary to utilize the construct of academic motivation in education. And this understanding is impossible without identification of the variables which influence individuals to become academically motivated.
In its present state of theoretical and empirical development, academic motivation is no more than a label for a certain pattern of behavior relative to academia. It is not an operational construct used to suggest remedial steps of intervention when a pupil becomes disinterested in academic endeavors, and it cannot become useful in this way until the genesis and development of academic motivation are elucidated. There is a need for the identification of the precursors of academic motivation. This will assist in the understanding of the dynamics of behavior which is recognized as academic motivation.

Academic motivation, as presently treated in books and journals, is a state which is characterized by striving to learn and by using what one learns in productive ways. Ideally, it is an intrinsic construct which reveals itself through initiative and self-direction. Thus, academic motivation is not necessarily evidenced by high grades; it is more accurately recognized by the intellectual curiosity and independent, academically productive activity which some students exhibit.

This study was an attempt to identify variables which were present in the development of persons who have been recognized for their academic contributions. The identification of variables that were common to these people was essayed in an attempt to infer conditions and experiences which affect the development of academic motivation.
Purpose

The purpose of this study was to compare the past experiences of adults who had demonstrated academic motivation in their professional endeavors. University professors were interviewed to obtain data related to their past experiences. Similarities and differences of the childhood, academic, and social experiences of the professors were scrutinized. This was done in order to identify those factors which seemed to have contributed to their academic predilection and success. The experiences which appeared to be related to the development of academic motivation among the professors studied provided the basis for practical suggestions described in the conclusion of this dissertation.

Significance of the Study

The study was significant in two ways. First, it contributed to knowledge about a relatively unstudied group of people, university professors. Secondly, this study added to a better understanding of the forces which operate to make people strive academically.

This study differed from other studies of academic motivation in at least two ways. Studies relating to academic motivation, academic achievers, and academic underachievers have in the past used testing programs of short duration and correlational techniques to provide evidence about these groups. The advantages of that approach are that the studies are objective, provide neat
data, and are replicable. Conclusions of such studies are of the order, "Higher academic achievers come from better socio-economic backgrounds than do underachievers." This gives little guidance for the educator who is trying to foster academic motivation among all of his students, or for the parent who is trying to encourage his child to achieve academically. This study was different from previous ones in its effort to go beyond the identification of concomitants of academic motivation. The longitudinal effects of a variety of factors which relate to school effort and achievement were considered. Furthermore, the vast majority of studies of academic motivation have been done in the secondary school or the college setting. Few studies have investigated the academic motivation of successful adults. This study provided data from the life histories of individuals who had been outstandingly successful in the academic arena. Therefore, it was an opportunity to discern patterns of influence on, and development of, academic motivation.

Definition of Academic Motivation

That individuals have varying intellectual ability is commonly accepted, and their academic performance is expected to vary accordingly. However, measured intelligence is not perfectly correlated with performance; knowing an individual's intelligence quotient will not predict with one hundred percent accuracy his academic performance. There are very bright students who function at a low level academically, and there are "average-ability" students who excel scholastically. Students at any given point on an
intelligence scale display a range of academic achievement. Since intelligence alone does not account for the total variance in scholastic performance among students, academic motivation has been postulated to account, in part, for the remaining performance variance.

Academic motivation is relative in the sense that it implies comparisons among students. If all students achieved at the same level, or even if students of similar intelligence achieved equally, the concept of academic motivation would be superfluous. The construct of academic motivation derives from the observed differences in academic achievement between individuals of equal measured intellectual ability.

Academic motivation is relative in another sense. It is based upon the ratio of scholastic achievement to potential. The higher the achievement-intelligence ratio the higher a person's academic motivation is said to be.

There is a third sense in which academic motivation is a relative concept. The degree of academic motivation which an individual is said to possess is determined in part by the observer and his definition of what constitutes academic achievement. Jerry, a bright student who without studying passes all tests with scores of 95 or 100, may satisfy his teacher's criterion of academic performance and thus be judged by that teacher as an academically motivated student. Relative to his intellectual ability, however, Jerry has expended little effort. Another teacher, recognizing Jerry's lack of effort, might rate him low in academic motivation.
Whether a person is identified as academically motivated depends upon the observer's definition of academic motivation.

As a construct, academic motivation can be variously defined. The three senses of relativity mentioned above can confuse the issue. In this study, the term "academic motivation" denotes the fact that an individual has made outstanding academic contributions.

The relativity inherent in comparisons of academic achievements among individuals at a given level of ability was arbitrarily eliminated by selecting only those professors who were recognized as outstanding achievers within their respective colleges or departments. Rather than a range of achievements, the highest level of achievement was sought. This study compared those most highly motivated, not those whose levels of motivation differed widely. The assumption was made that the ability level of the subjects must, of necessity, be high for them to have succeeded in the university community.

An operational definition of academic motivation was derived from the traditional components of the professorial role, i.e., research, scholarship, teaching, and consulting. It was assumed that the professorial role is the ultimate expression of academic motivation. The activities which characterize that role constitute for this study academic motivation. Therefore, the four activities of university professors, described as follows, constituted an operational definition of academic motivation and were used to select professors for the study.
1. Active research: personally conducting research for the purpose of contributing to the basic knowledge of a discipline. Professors outstanding in this activity will be designated "Researchers."

2. Scholarship: writing textbooks, monographs, and/or reviews of research which demonstrate scholarly acquaintance with the field, but which do not report on personally conducted research. The professors outstanding in this activity will be designated "Scholars."

3. Teaching: working closely with students in a way which provides them with strong motivation in that field. Professors outstanding in this activity will be designated "Teachers."

4. Consulting: extending and applying academic activities by providing guidance in the community, in professional organizations, and in the university organization itself. Professors outstanding in this activity will be designated "Consultants."

Assumptions

This study of academic motivation is based upon several assumptions. They relate to the data gathering and analysis techniques employed and to the nature of academic motivation. Regarding the techniques employed, the following assumptions were made:

1. The interviewer will be able to elicit relevant information from the subjects.

2. Individuals can remember their early childhood and school experiences.

3. Participants will be candid about their experiences.

4. Analysis of the interview data will reveal variables which are relevant to academic motivation.

The following assumptions were made about the nature of academic
motivation:

1. Academic motivation develops gradually as a result of personal experiences.

2. Activities of outstanding university professors are evidence of their high academic motivation.

Outline

Chapter One is an introduction to the concept of academic motivation, and it states the purpose of the study. It also includes a definition of academic motivation and sets forth assumptions necessary to the study.

Chapter Two is a review of literature germane to this study.

Chapter Three describes the procedures followed in this study. Sampling and interviewing techniques are discussed, and analysis of data is explained.

Chapter Four presents the data derived from the interviews. Data for each variable is compiled for each discipline and for each part of the operational definition of academic motivation. Comparisons are drawn for each variable.

Chapter Five draws conclusions from the comparisons made in Chapter Four. Implications for increasing academic motivation and suggestions for further study are also discussed.
CHAPTER II

REVIEW OF LITERATURE

Academic motivation, relative to underachievement, over-achievement, high achievement, independent learning, number of books read, and other indicators, has been studied in numerous dissertations, journal articles, and research projects. The characteristics of "motivated" students in various disciplines, of various ages, and in various settings have been identified. A review of more than two hundred studies of academic motivation (Henry, 1965) revealed that the studies were conducted in schools with vast differences in size, setting, and tradition. The type of measurement, the discipline for which motivation was assessed, the definition of motivation, the length of time encompassed by the study, and the characteristics of the subjects also varied widely. The features of commonality were that most of the studies were done at the secondary school or college level, they were usually based on single measures of motivation, and they were descriptive in nature. They seemed to neither delineate nor suggest the dynamics underlying relationships between motivation and other variables.

Little of the work done on academic motivation has been done longitudinally or has been directed toward the study of adults. Only one study in the last ten years has included these two factors.
in regard to university professors. This excellent study was done by Gustad (1960), in an effort to answer two major questions. They were, "Why do some individuals choose to become college teachers?" and "Why do some of these later decide to leave teaching for other positions?" Gustad's study was undertaken in the southeastern region of the United States and included 1,342 white, male college professors in the disciplines of chemistry, English, and psychology and 323 former professors of the same disciplines. Questionnaires were sent to 2,665 professors and former professors with a sixty-two per cent return. Of those who responded to the questionnaire, sixty-seven were interviewed. An analysis of the life histories of the subjects was made for each discipline, and comparisons were drawn between those who had remained in the teaching profession and those who had left for employment elsewhere. Although a great deal of attention focused on the conditions of the job, personnel practices, and job activities, none of which are directly considered in the present study, the life history analyses are relevant.

Gustad concluded that the subjects became college teachers because of the kinds of people they are, that is because they are intelligent and of middle-class background. They also are people who developed early a preference for essentially solitary and intellectually stimulating activities. He reasoned that establishing this preference, coupled with the middle-class value of achievement and educational success, produced an interaction that maintained the rewarding aspects of educational endeavors and minimized the
chance that the individuals would find other types of rewards such as social involvement. The more an individual turns to intellectual, solitary endeavors, the less he is welcomed into social groupings of peers; therefore, the less he will seek reward in social activities, and the more his satisfaction will be found in his intellectual activities. Only the first statement in this line of reasoning was suggested by the data reported by Gustad; the rest is his speculative explanation.

From his data, Gustad extracted statements about professors' and former professors' family background, educational history, and social activities. He found that most of the professors were born in the southeastern region, as were their parents. A disproportionately large number (53%) of fathers' occupational levels was in the professional and managerial category. More of the professors were oldest or middle children than youngest. Socio-economically, the group as a whole came from average or slightly above average homes in villages or small towns. Except the chemistry professors, all came from moderately well-endowed intellectual climates. Education was held in high regard in the homes of most of the professors. All of these men described their attitudes toward education as well above average in the positive direction. They liked school and all that it represented. Although some found it dull because of the necessity to keep pace with slower pupils, they were particularly fascinated with independent reading and study. They were for the most part highly successful students. Most of the men reported few or no social activities beginning
from an early age. Reading was the activity most often cited; others included such hobbies as chemistry sets, insect and stamp collections, radio construction, and amateur astronomy. Sixty-five per cent of the professors were influenced by college or graduate school teachers to enter teaching. Most of them made their decision to become teachers before they received their bachelor's degrees.

As previously stated, other studies reviewed lacked cogency because they did not deal with adults in a longitudinal fashion. Hence, a review of literature concerning each of the studies which have been made of correlates of academic motivation for various groups of various ages in various settings, and a consideration of the theories out of which conceptions of motivation in general and of academic motivation in particular have been or may be derived were deemed of greater value to this study. A review of such theories not only provided a background and perspective for this study, but also offered aid in interpreting the results of the study. Both of these functions are traditionally purposes of a review of literature and are better served in this case by a theoretical rather than empirical review.

If the reader wishes to consult a treatment of research studies relative to motivation, he is referred to Henry (1965), Cofer and Apley (1964), and to the work now in progress by the Center for the Study of Human Motivation located at The Ohio State University. At the Center the objective is to annotate, catalog, and organize for retrieval all of the research published since 1900.
Most theories of psychology contain an implicit if not explicit theory of motivation, i.e., what determines the direction and intensity of man's behavior. In this chapter, psychological theories will be described in terms of their formulations of motivation. To do so, only a general treatment of those postulations most directly related to motivation will be presented. While such a treatment does not do justice to the theory as an entity, it serves the purpose of giving a framework for specific consideration of academic motivation.

Theories which are similar in assumptions, techniques of research, and content will be grouped together for descriptive purposes, and one example from each group will be given in greater detail for illustrative purposes. In this manner, the schools of psychoanalytical, S-R theory, and cognitive psychology will be described and illustrated respectively by Freud, Hull, and Lewin. The choice of the theorists to illustrate each of the schools was based upon the influence these men made to their particular schools of thought.

There have been other theorists, among them Abraham Maslow, who have contributed to the conceptualization of motivation with theories of motivation per se. These theories are not directly tied to one of the three schools of thought mentioned above, but may embrace some of the tenets of each. Due to its widespread acceptance, Maslow's theory of motivation will be described in some detail.
In the field of applied psychology, theories of career development are closely related to the question of academic motivation. Theorists in this field have postulated dynamic relationships among variables and subsequent vocational choices. Because these theories postulate relationships over a relatively long period of time and among complex rather than simple variables, their work will be presented and analyzed for its contributions to an understanding of academic motivation.

From each of the theories discussed, inferences for a theoretical conceptualization of academic motivation in that perspective will be drawn. In a sense the theory will be applied to the question of academic motivation to see what factors, within the assumptions of that theory, would affect the development of academic motivation.

**Stimulus-Response Theory**

Stimulus-response psychologists are more concerned with establishing a systematic research program than a comprehensive theoretical position. For stimulus-response theorists, the construct of motivation is almost superfluous to explanation of behavior. They are concerned with functional relationships and pay relatively little attention to intraorganic integrating principles. They focus their attention upon readily quantifiable and observable external events and tend to ignore information-processing or cognitive functions (Weiner, 1970).

The simplest explanation of behavior according to stimulus-
response theorists is that "if an event b frequently and contiguously follows an event a, then on the next appearance of a, b will follow." In other words, events are coupled by virtue of their temporal association. Thus, stimuli are considered the causal agents of behavior. If the stimuli associated with the response were removed, then the response sequence would not be initiated. This conception has led to a systematic search for the antecedent stimulus conditions, or the controlling stimuli, which determine a response.

Another view, represented by such theorists as Skinner or Bijou and Baer, is that the underlying mechanism of behavior is the conditioned reflex. They attempt to demonstrate that the acquisition and modification of all behaviors, whether motoric, social, linguistic, or logical, can be attributed to respondent and operant conditioning.

Hull supplemented the associative view of the stimulus as a behavioral determinant by adding another component to the contemporary determinants of action. He conceived of drive as the nondirective energizer of behavior. He postulated that drives supply the motor or energy for action and activate habits (stimulus-response units), and the habits determine the direction of behavior. Although he postulated many sources of drive, they were assumed to pool into one unitary source of energy. He ultimately postulated that any stimulus of sufficient intensity could function as a drive. Hull proposed that the relationship between drive and habit was multiplicative. Given a drive level of zero, the organism was
expected to remain at rest. Conversely, given some drive level, the organism would become active and hence more likely to discover an appropriate goal object in the environment which would decrease his drive (Marx and Tombaugh, 1967).

Hull's theory of learning is a mathematicodeductive system which attempts to remain as close as possible to observable events both in obtaining data and in defining terms. With the intention of preserving objectivity in an explanation of behavior, postulations of internal mechanisms are tied to the measurement of input (stimulus) and output (response) variables. Relationships among variables and the inferred internal mechanisms are mathematically specified (Marx and Tombaugh, 1967).

Hull's first concern was on the measurement of inputs and outputs, which comprise not only experimentally induced stimuli and responses but also other influences upon the organism such as prior history of training, deprivation schedules, injection of drugs, and environmental conditions. From the inputs and outputs, Hull inferred intervening variables to explain and predict behavior.

The formalized input variables in Hull's system are the number of prior reinforcements, drive condition, stimulus intensity, amount of reward, work required in responding, and habit strength from a related habit. All are defined by objective experimental conditions except the last, habit strength from a related habit, which is based on the same response conditioned to another stimulus.
Of the intervening variables, drive is conceived as the primary motivator. Drive has three functions in Hull's theory: its reduction constitutes primary reinforcement; it activates habit strength into reaction potential; and it regulates habits. Thus, drive determines which incentive is reinforcing, goads the organism to action, and steers the organism.

Other intervening variables proposed by Hull are habit strength, stimulus-intensity dynamism, incentive motivation, generalized habit strength from related habit, reactive inhibition, and conditioned inhibition. From this first set of intervening variables develop second-order intervening variables called reaction potential, generalized reaction potential, and aggregate inhibitory potential. The third-order intervening variables are net reaction potential, oscillation of reaction potential, and reaction threshold. The operation of all these variables produces output variables known as reaction latency, reaction amplitude, and number of nonreinforced responses to extinction.

Hull espoused reinforcement, defined as a reduction of drive-stimulus, as that which determines the formation of stimulus-response bonds. Learning then depends upon contiguity of stimulus and response closely associated with reinforcement. The course of learning is based on the formation of habit strength with each reinforcement. Learning is enhanced when need reduction is great, when delay between response and reinforcement is short, and when there is little separation between the conditioned stimulus and the response to be acquired.
Six major processes are going on when a learned response is evoked. Some of them are guided by environmental events, but most of the processes are inferred intervening variables. Hilgard and Bower (1966, p. 157) list them as follows:

1. Reinforcement. Habit strength is the result of a reinforcement of stimulus-response connections in accordance with their proximity to need reduction.

2. Generalization. Generalized habit strength depends both upon direct reinforcement and upon generalization from other reinforcements.

3. Motivation. Reaction potential depends upon the interaction of habit strength and drive.

4. Inhibition. Effective reaction potential is reaction potential as reduced by reactive inhibition and conditioned inhibition.

5. Oscillation. Momentary effective reaction potential is effective reaction potential as modified from instant to instant by the oscillating inhibitory factor associated with it.

6. Response evocation. Responses are evoked if the momentary effective reaction potential is above the threshold of reaction. Such responses may be measured according to the probability of reaction, latency of reaction, resistance to extinction, or amplitude.

In addition to the six major processes, eight automatic adaptive behavior mechanisms are proposed in Hull's theory. Given by Hilgard and Bower (1966, p. 184), they are the following:

1. Inborn response tendencies provide the first automatic mechanisms for adapting to emergency situations.

2. The primitive capacity to learn is the second mechanism, "a slightly slower means of adaptation to less acute situations."

3. The antedating defense reaction, arising through learning combined with stimulus generalization, provides the third adaptive mechanism.
4. The extinction of useless acts, negative response learning, is the fourth mechanism.

5. Trial-and-error learning is the fifth mechanism.

6. Discrimination learning is the sixth mechanism.

7. A second type of antedating defense reaction, depending upon the persistence of stimulus traces (rather than upon generalization, as in the case of a perceived dangerous object), is the seventh mechanism.

8. The fractional antedating reaction with its proprioceptive stimulus correlate, provides for the "automatic (stimulus) guidance of organismic behavior to goals."

Furthermore, Hilgard and Bower (1966, p. 185) present the following quotation from Hull's writing:

Further study of this major automatic device presumably will lead to the detailed behavioral understanding of thought and reasoning, which constitute the highest attainment of organic evolution. Indeed, the fractional antedating reaction with its proprioceptive stimulus correlate leads in a strictly logical manner into what was formerly regarded as the very heart of the psychic: interest planning, foresight, foreknowledge, expectancy, purpose, and so on.

Only the highlights of Hull's theory have been mentioned in this treatment of the variables, the major processes, and the automatic adaptive mechanisms. The elegance of his postulates and corollaries has been neglected as has the mathematical detail. These points were selected to give perspective in considering motivation in the Hullian view. Of all the variables which were postulated, those which relate to motivation are drive and habit strength operating under the effects of reinforcement. Drive determines which incentive is reinforcing, goads the organism to action in the direction of need satisfaction, and assumes a discriminative or steering role. Drive interacts with habit strength in some multi-
plicative fashion to produce reaction potential. Habit strength is the sum of successive reinforcements of a particular stimulus-response contiguity and is thus a simple positive growth function of the number of reinforcements.

Reinforcement is conceived in two ways, as primary reinforcement and as secondary reinforcement. Primary reinforcement depends on need reduction, reduction of drive-produced stimuli, or on the decrease of the goal stimulus produced by the fractional anticipatory goal response. The quantitative aspects of reinforcement have no influence upon habit strength, provided there is some unspecified minimum amount; only the frequency with which reinforced trials have occurred is critical. Secondary reinforcement can be provided by any stimulus regularly associated with primary reinforcement.

Intermediate mechanisms were derived from the simple laboratory experiments which furnished the constants in the postulates and corollaries. They explain the more familiar behavior of organisms adapting to a complex environment. Two intermediate mechanisms which relate to motivation are the gradient of reinforcement and the habit-family hierarchy.

The gradient of reinforcement states that the nearer the learner comes to a goal, the stronger should be the goal's response-evoking power. In other words, the responses nearer to the goal will be more strongly conditioned than those farther removed.

The habit-family hierarchy is an arrangement of alternative ways of moving from a common starting point to a common goal-posi-
The alternatives are integrated into a family by way of the factional antedating goal reaction which is present as each alternative is active. The factional antedating goal reaction provides a stimulus to which overt responses are conditioned. Through the differential action of the derived gradients of reinforcement, some responses are less strongly conditioned to the stimulus than others. For example, obviously the starting responses of longer routes are more remote from reinforcement than the starting responses of shorter routes; therefore, the latter are more strongly reinforced and more strongly conditioned to the stimulus. Alternative patterns are thus arranged in an order of preference. Only when more favored routes are blocked, are less favored routes chosen (Hilgard and Bower, 1966).

The implications of Hull's theory for the study of motivation center around his concepts of drive, habit strength, and reinforcement. The concept of drive is responsible for any actions which the organism makes, both in initiation and in direction. This ties behavior very closely to physiological needs. The gradient of reinforcement and the habit-family hierarchy give an explanation for preferences of means to achieving goals. In general, however, the organism has little or no control over which goals he will seek. Reinforcement is the result of external forces reducing internal need states. The system is a mechanical one which gives little attention to individual differences.

The fact that Hull and stimulus-response theorists ignore emotions, perceptions, and cognitions makes it difficult to extend
their work to academic motivation. Because academic motivation is a complex construct manifested in a variety of behaviors and becomes apparent only after a child is exposed to academic materials over a period of time, the stimulus-response is obscured. The important concept to be gained from perusal of stimulus-response theory is that viewed from this theoretical position motivation is externally shaped by a series of reinforcements and is inextricably bound to the physiological needs of the person. The history of reinforcement from infancy would form the roots from which academic motivation would have to grow. Unfortunately, this gathering of minute historical bits and pieces is all but impossible.

Cognitive Theory

Cognitive theory, identified with E. C. Tolman, Kurt Lewin, and the Gestaltists, developed in reaction to the purely mechanical nature of stimulus-response theories. The cognitive theorists argued that behavior is purposive rather than simply reactive to external stimuli. The research efforts of cognitive theorists have been oriented toward problems, such as individual differences and latent learning, which stimulus-response theorists could not readily explain.

Tolman and Lewin developed very different models of behavior. Tolman's theory reveals a methodological legacy from Hull although his assumptions and his interpretations of facts are markedly different from Hull's. Lewin, on the other hand, devised a totally new way of representing psychological phenomena geometrically.
Even though there are differences among cognitive theorists, the similarities among their assumptions about the nature of psychology, their opposition to a stimulus-response interpretation of behavior, and the problems that they considered form the basis for treating them as a group. General statements about their collective position can be made.

A basic assumption of cognitive theorists is that behavior is purposive; that is, behavior is always directed toward, or away from, something. This is not to say that all behavior is directed by a grand purpose; cognitive theory is not teleological. It means simply that each behavior is more significantly described in terms of an individual's goals rather than in terms of the movements which comprise his behavior.

Cognitive theorists concentrate on holistic aspects of behavior, taking into account physical and psychological characteristics. They devote particular attention to perception and cognition in determining the goal-directed quality of behavior. External objects and conditions are viewed in relation to the individual's goal.

In the eyes of cognitive theorists, individuals learn meanings rather than mere movements. This point is supported by the studies which demonstrate insightful learning, latent learning, and expectancy. From the emphasis on the importance of learning meanings comes the term "cognitive" theory.

One further point about cognitive theorists in general is important. They replaced the principle of reinforcement, e.g.,
Tolman with expectancy confirmation, and Lewin and the Gestaltists with closure. This distinguishes their basic conception of motivation from that of stimulus-response theory. For cognitive theorists, it is the psychological, that is, the personal and cognitive experiences which lend significance to a behavior. Consequently, either increasing or decreasing the probability that behavior patterns will be repeated. Cognitive dynamics are inferred from objective observation, not from introspection or self-report.

Lewin

In Lewin's theory the most important concept is that of the life space. A representation of the subjective relationship between the person and his psychological environment, the life space consists of two major parts: first, the person, and secondly, his psychological environment. Each person lives in his own unique psychological environment. A person's psychological environment contains all of the potential factors or conditions which at a given moment can influence his behavior. Past experiences, current events, or future events are not necessarily present in the immediate physical environment, but they may be part of the psychological environment. Graphically portrayed, the psychological environment is a closed figure containing regions which are defined by changing boundaries. Regions within the psychological environment represent relevant factors, and the boundaries, which change from moment to moment as new psychological variables enter the field, portray the relationships between the regions.
The life space also includes all of the processes of human life. Different areas, corresponding to motor processes which constitute behavior, perceptual processes, and inner-personal processes such as memory and emotion are included in the life space concept. Thus the life space of an individual is supposed to represent all of the variables which can influence behavior (Hilgard and Bower, 1966).

Three dimensions characterize the different regions of the life space. They are: proximity (nearness-remoteness), permeability, or ease of movement between the regions (firmness-weakness), and responsiveness to impinging events (fluidity-rigidity). The two dimensions most frequently employed in behavioral analyses are proximity and permeability.

Outside of the life space is the physical environment which may or may not influence behavior, depending upon how it influences the psychological environment. In Lewin's geometric model, heavy lines between adjoining regions indicate barriers difficult to pass; lighter lines indicate barriers more easily crossed between regions. The relative positions and the existence of boundaries are important in the diagram, but the size and shape of the regions are not.

Directional features were also proposed by Lewin. Forces, valences and vectors, which are represented in hodological (geometry of paths) terms, depict directional forces. A vector is described as a line terminating in an arrowhead configuration. The length of the line represents force, the shaft its direction, and the arrowhead the point of its application. Vectors are a property
of the environment and not of the person. They impinge upon the person and direct his behavior. Valence refers to the attraction or repulsion with which an object affects a person. Valence, either positive or negative, is a characteristic of vectors. The valence of an object determines the direction and force of its vector in relation to a person. The force of the vector is determined by the needs and tensions of the individual.

Energy, need, and tension are the central motivational constructs of Lewin. Man's goal is to be in equilibrium, a state of balance and harmony between various regions of the life space. The major cause of disruption of equilibrium is the arousal of a need, which causes psychological energy to be expended in an attempt to return the person to equilibrium. Lewin made no attempt to list all the possible needs, but he enumerated some of them and classified them as either physiological or psychological. The latter needs he called "quasi-needs." Quasi-needs arise from a specific intention such as the preference to read one book instead of another, or they may arise from a desire to perform a particular task. Both needs and quasi-needs are capable of producing tension—which is the emotional psychological state within the inner-personal region corresponding to the need or quasi-need. Needs impart meaning to objects by giving them a momentary valence. The valence of an object indicates the degree and kind of motivational state existing within the person. If the object will reduce tension, the person will be highly motivated to achieve it, and the goal has a high positive valence. However, if an object will increase tension, the
person will be highly motivated to avoid it, and the valence is negative. Tension is characterized by its propensity to discharge energy in some type of action or locomotion, thereby returning the organism to a state of equilibrium. Achieving the original goal, reaching substitute goals, or imaginary fulfillment can discharge or reduce tension (Marx and Tombaugh, 1967).

The locomotion which reduces tension is defined by Lewin as the traversing of a path through different psychological regions in the life space. Locomotion and its direction are determined by all of the various components previously discussed. The general nature of a chain of occurrences is perception arouses a need, which confers a psychological valence on an object in the psychological environment and also causes tension within the person. The valence then creates a force or vector toward the goal, and locomotion is initiated. Upon reaching the goal the need and the tension are reduced, the force is diminished, and the person returns to a state of equilibrium. Distinctive of Lewin's theory is that it links need to the environment through valences. Certain properties of the environment determine the type of behavior that will occur. Therefore, all locomotor activity is a direct function of the environment and is an indirect effect created by needs and valences.

Relating Lewin's theory to academic motivation requires that the positive or negative valence which academic endeavors hold for an individual be identified and that the genesis of the valences be described. Although Lewin's theory offers help in explaining an individual's behavior at a particular moment, emphasis on the tem-
poral life space precludes the possibility of determining how the individual arrived at that particular life space. Furthermore, asserting that the valence of an object both indicates and depends upon the motivational state existing within a person raises the question of where the valence is determined. Did it derive from the object, and if so, why that object and not another? How do books come to have a positive valence for some children and not for others? How does one create the need within a person which graces a certain object with a positive valence? Or can the valence be attached to the object to create a need within the person? Although Lewin's theory, along with the other cognitive theorists, offers a description of motivation at a particular moment, it does not offer an explanation of why that motivation was present. Academic motivation is still a question of how certain activities, viz., academically oriented ones, came to have positive or negative valences for the individual.

In short, the cognitive theorists, while providing an avenue for taking into account individual differences, do not explain the development of those individual differences. The postulation of a cognitive factor in motivation does not remove or answer the basic questions. Only a return to the minutiae of the habit formation history of an individual since infancy can produce such an explanation in terms of cognitive theory. Even then, the explanation would be idiosyncratic rather than generic until such time as patterns and relationships among variables could be identified.
Psychoanalytic Theory

While stimulus-response and cognitive theories are primarily learning theories, psychoanalytic theory is personality theory which takes into account fantasies, emotions, and wishes, as well as perceptions and cognitions. It is the recognition of the unconscious as a strong factor in motivation which is the greatest single contribution of psychoanalytic theory to modern psychology. It has been well-documented that conscious processes can be distorted by unconscious motives.

In psychoanalytic theory specific instincts or drives are conceived as the source of motivation. They are modified by the requirements of society which are learned through experience. The question of nature versus nurture in the determination of behavior is implicit in expositions of the manifestation of various instincts or drives. Physiological needs such as hunger, thirst, and sex, constitute one main group of life drives which receive general recognition. Aggression and creativity, not unanimously accepted by psychoanalytic theorists, are other motive forces which must be handled differently.

Underlying psychoanalytic theory is the hypothesis that motivation results from the arousal of tensions by unsatisfied drives and the subsequent organization of behavior around tension reduction. Called the "pleasure principle," this hypothesis posits a movement from states of greater to states of lesser activation or tension.
Anxiety, defined as an arousable state, is the means by which tensions beyond the purely physical are postulated. Anxiety provides a link between a present situation and the individual's past. Therefore, intensity of arousal is not only related to a particular stimulus, but also to the significance of the aroused memory in the life history of the individual. Anxiety also provides a link between individual behavior and social behavior.

Defense mechanisms, displacement, repression, projection, reaction-formation, etc., are related to the hypothesized role of anxiety in the motivational system. Anxiety, a state of emotional arousal, is a form of tension, and the defense mechanisms serve to reduce that particular kind of tension.

Also characteristic of psychoanalytic theory is the emphasis on early childhood experiences as sources of anxiety and as models for later behavior development. Even though such experiences may never be verbalized or verbalizable, they provide an important foundation for the personality structure. The stages of development are disputed among psychoanalytic theorists, but all agree on the importance of early experiences.

Above all, psychoanalytic theory is a theory of intrapsychic conflict. Conflicts among personality structures, between the individual and society, and between biological and social forces produce tensions, in the form of either physical illness or anxiety, which necessitate the development of means for coping with them. It is the dynamics of the individual's struggle to cope with these conflicts that forms the basis of psychoanalytic psychology.
Sigmund Freud maintained that every organism possesses physical energy which serves to maintain its metabolic functions and from which psychic energy is derived. At birth, the psychic energy is deposited within a single system, the id, which is the reservoir that supplies all of the energy necessary for the various psychic functions. Two other components of personality, the ego and the superego, develop from the id. Operation of the id is the primary process, the prime source of motivation (Marx and Tombough, 1967).

The major function of the id is to reduce tensions which arise from unsatisfied needs. These tensions increase the amount of energy to a point which sometimes exceeds the id's capacity. The id attempts to reduce the tensions by using a proportion of the energy to form a mental image or images of a need-reducing object. The realization of such an image removes the tension and lowers the energy below the tolerance limit. Freud assumed that this process was governed by the pleasure principle, a seeking of pleasure and avoidance of pain. In this context pleasure derives from maintaining the psychic energy level within its required limits. Pain results when these limits are exceeded.

The dominant feature of the primary process and one which becomes increasingly important as the other systems develop is the id's demand for immediate discharge of tension. When tension develops, it must be dissipated; the appropriate image must be ob-
tained irrespective of the consequences. The id demands that the appropriate image or object be produced. A unique characteristic of this process is that the id is unable to distinguish between an image and its corresponding external object.

Since the human organism cannot exist on mere images and the id is unable to discriminate between mental images and objective reality, the ego is needed to postpone the immediate discharge of energy until an adequate tension-reducing object is produced or discovered in the environment. The ego attempts to identify a mental image with its corresponding physical object to produce physiological satisfaction. This process of finding appropriate physical objects is called reality testing. Whenever an object and its corresponding mental image succeed in reducing tension, there is a higher probability of their being used again when the same drive recurs—i.e., a habit develops. The more efficiently the ego reduces tension, the more energy it obtains from the id. Eventually the ego achieves more than enough energy to reduce the existing tensions, and the surplus is used for developing different psychological processes such as attending, perceiving, and learning.

The ego has several other major characteristics; it eventually obtains the majority of the original psychic energy; it can withstand tension and postpone immediate satisfaction for long-range goals; it is rational and increasingly mature; and it is in contact, not only with the id, but also with the superego and the environment. The ego serves the "executive" function of the organism.

The superego develops from the ego when a child begins to
assimilate parental standards of good and bad. By internalizing these values, the child comes to have his own inner authority or value system. This inner authority is the superego. It is the moral or judicial branch of the psychic structure and strives toward the ideal rather than the real, toward perfection rather than either reality or pleasure. Because it has no basis in reality, its strength is determined by the rigidity of the parents and by the environmental values it has internalized. Furthermore, it is composed of two subsystems, the ego-ideal and the conscience. The ego-ideal includes those internalized values which are considered good and which, when followed, are rewarded by a feeling of pride and a lessening of tension. The ego-ideal strives for perfection instead of reality testing. Conscience is composed of those internalized values which are considered bad and which bring about a feeling of guilt or inferiority. The superego, like the id, does not distinguish between the subjective and the objective; the mere thought of something considered bad will invoke guilt feelings (Marx and Tombaugh, 1967).

These three systems, the ego, superego, and the id, are in constant conflict with each other, vying for psychic energy and control of the personality. The id strives for immediate satisfaction; the superego judges whether or not immediate satisfaction is socially acceptable; and the ego tries to locate the appropriate need-reducing object in the environment. Between the id and superego is the greatest conflict, which chiefly centers around the sexual desires of the id and the inculcated mores and prohibitions.
Psychoanalytic theory differentiates between conscious and unconscious processes. The great importance of unconscious thoughts is that they exert a profound influence on behavior. They are the unconscious motivators of behavior. For example, the processes used to alleviate anxiety by disguising reality are found in the unconscious. Commonly referred to as defense mechanisms, they have four general characteristics: they are irrational ways of dealing with anxiety because they distort, hide, or deny reality and so hinder normal psychological development; they tie up psychic energy which could be more efficiently used; their overuse reduces the individual's flexibility and adaptability; and their failure to function results in the ego's becoming overwhelmed by anxiety (Marx and Tom-baugh, 1967, p. 36).

Freud believed that psychic energy produced differential motivational effects during an individual's life. He related personality development to the movement of sexual energy through the erogenous zones of the body. These zones he defined as any regions of the body where tension becomes localized and may be subsequently removed by manipulation of that region. The three primary regions, oral, anal, and genital, were held to be of the utmost importance because they are the first sources of sexual irritation and satisfaction.

Freud viewed human life as being controlled or propelled from situation to situation by the interplay and interrelations among the various motivational instincts and drives. Moreover, the
permanent effects of unfortunate early childhood experiences upon personality necessitated a rather gloomy picture of life, with little hope for changing one's pattern of behavior.

The id is largely irrelevant to academic motivation which is a socially derived and grounded motive. It is the development of the ego and the superego which is crucial to the development of academic motivation.

The ego is responsible for reality testing, finding objects which match the images demanded by the id. If the ego enjoys a history of successful and relatively conflict-free matching of images and objects, it becomes strong. This strength can then be put to uses other than reality-testing. Since independent, creative actions require a strong ego, it is important that an individual have a history of little conflict between id and ego in early childhood so that the ego will have energy to invest in activities other than reality testing. This suggests that giving an individual in infancy and childhood the opportunity for reality-testing free from the threat of too much frustration would increase the likelihood of later exploration and perhaps enhance academic motivation.

The superego, although it develops early, has limited strength until the child is about five years old. At that time the child becomes aware of and internalizes the values of his parents and significant others. For the development of academic motivation, parental attitudes at this stage of development are crucial. If a child observes that his parents value reading, then he is likely to acquire that value and consider reading good. The process of the
superego continues in its imitation of the values of the parents, and as the child grows older becomes increasingly important. Through the mechanism of the superego, the child "inherits" the values of his parents. The values of the parents are thus of utmost importance to a child's academic motivation.

While the defense mechanisms are a great contribution to psychological thought, they offer little to a general understanding of academic motivation. It is conceivable that the son of a professor might reject school entirely, demonstrating a reaction formation; but this would have to be individually diagnosed and would offer little in the way of understanding how academic motivation develops.

Beyond the parents' values, psychoanalytic theory suggests little in terms of what factors contribute specifically to the development of academic motivation. Like the stimulus-response and cognitive theories, psychoanalytic theory requires detailed analysis of the interactions of child and environment from birth through early childhood to help understand the genesis of academic motivation.

**Maslow**

The theory of Abraham Maslow, along with those of others like Carl Rogers and Erich Fromm, differs in style from traditional theories of psychology. Historically, psychologists have employed a scientific approach to their investigations. They have observed and described phenomena; defined and demonstrated factors which
antedate, explain, control, or underlie them; and integrated these factors into theoretical formulations. Theories derived in this manner are formulated so that they are testable, and value judgments about their content are avoided. In contrast, Maslow, who emphasizes the idea of self-actualization, is primarily concerned with stating the conditions and prerequisites for living a satisfactory human life. His goal necessitates that he make value judgments and assumptions at the outset.

Maslow makes at least two direct and basic assumptions about human nature. The first is that human nature, in general, has an inherent capacity for actualization and growth. The second is that given the proper set of circumstances, human nature is constructive, trustworthy, rational, unique, and individual. A third assumption relative to society is that society does not readily provide the proper circumstances for the emergence of self-actualization and in fact tends to force conformity and illusion upon the individual. These assumptions which underlie Maslow's theory of motivation represent a major break with most of the psychological theorizing of the traditional schools.

In his theory, Maslow asserts that self-actualization is the goal of human existence. However, he assumes a hierarchy of basic needs which must be successively satisfied before self-actualization can function. These needs are believed to be universal, but some of them are not strong enough to be apparent unless conditions favor their manifestation.

There are five levels of needs in Maslow's hierarchy. Phys-
iological needs like hunger, thirst, and sex are at the base of the hierarchy. They are called the most prepotent needs because they can dominate the individual if they are chronically unsatisfied. The next level is safety needs. They are manifested most often by children in our society, but they may be very apparent among adults in times of emergencies. When the physiological and safety needs have been relatively satisfied, love needs arise. Maslow says that these needs are often frustrated in our society. The fourth level in the hierarchy is esteem needs. They represent the needs for achievement and competency and for recognition and reputation. Highest in the hierarchy are the self-actualization needs which may only be reached when the lower level needs have been relatively satisfied.

Gratification of a need level is not a permanent or necessarily complete occurrence. A history of extensive gratification of needs at one level is the prerequisite for the appearance of higher needs. Gratification of a need requires that the satisfier be intrinsically appropriate. Thus it is the individual who determines which satisfier will meet his need; not the proximity or contiguity of the object which establishes it as a reinforcer. Failure to satisfy the needs on a given level will cause that level of needs to dominate the individual and prevent the higher level motives from functioning.

Although the needs are universal, it is the lower ones which are common to men. The higher needs function for progressively fewer individuals, with self-actualization operating for the
least number. While behavior directed by the lower needs, i.e., physiological and safety needs, is to a degree predictable, behavior directed by the need for self-actualization is not predictable. This is true because of the uniqueness of each individual who is self-actualized. His uniqueness prevents any prediction of his behavior. On the other hand, the behavior of individuals who are dominated by lower needs is predictable because those needs may be satisfied by only certain objects. Thus, Maslow concludes that the motivations of self-actualized persons are different from those of people who are dominated by lower needs.

The differences between self-actualized people and others (Maslow, 1955) are summarized as follows:

<table>
<thead>
<tr>
<th><strong>Self-actualized</strong></th>
<th><strong>Others</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Impulses welcome</td>
<td>Impulses feared and rejected</td>
</tr>
<tr>
<td>Gratification of impulse increases motivation</td>
<td>Gratification of impulse decreases motivation</td>
</tr>
<tr>
<td>Gratification produces health in the sense of production and creation</td>
<td>Gratification only prevents illness</td>
</tr>
<tr>
<td>Idiosyncratic, less dependent on others</td>
<td>Dependent, conforming</td>
</tr>
<tr>
<td>Objective perceptions of the world</td>
<td>Perceptions distorted by dominating needs</td>
</tr>
<tr>
<td>Independent problem-solvers</td>
<td>Seek help to solve problems</td>
</tr>
</tbody>
</table>

In order to derive from Maslow some guidelines for academic motivation, academic motivation would have to be located in the hierarchy. It obviously would not be found in the first level, and it could be placed in the safety needs only in a most unusual cir-
cumstance. However, academic motivation might be found among each of the three higher need levels. Motivation to succeed academically might be related to an individual's need to be loved, his need for achievement and recognition, or his need for self-actualization. Academic motivation could with confidence be called a "higher" need, but its exact location in the hierarchy would vary with the individual.

Placement of academic motivation within Maslow's hierarchy gives few clues as to what would contribute to its development. That it is above the physiological and safety needs would indicate that those needs must be relatively satisfied before motives for academic achievement would emerge, but it does not mean that satisfaction of those lower needs would guarantee development of academic motivation. In Maslow's terms, "intrinsically appropriate satisfiers" must be available to provide gratification for each level of needs. Whether academic endeavors would be intrinsically satisfying would be a question of individual differences, and his theory gives no formula for how objects or activities become intrinsically satisfying.

Theories of Vocational Development

Theories of vocational development have arisen to describe and predict career choice. To do so, they have utilized the postulations of the traditional theories in the development of holistic theories which consider individuals in their family, social, educational, and economic settings.

Like academic motivation, vocational development is a com-
plex, longitudinal conceptualization which reflects the influences of a variety of factors. For this reason, the theories of vocational development are potentially useful to a consideration of academic motivation.

In this section the theories of three influential applied psychologists will be considered. After a brief description of the theories of Anne Roe, John Holland, and Donald Super, the factors which might apply to conceptualization of academic motivation will be discussed.

J. L. Holland

Holland employs in his theory the popular conception that career choices represent an extension of personality and an attempt to implement broad personal behavioral styles in the context of one's life work. It also incorporates the notion that people project their views of themselves and the world of work onto occupational titles. Holland assumed that occupational stereotypes are based on the individual's experiences with work, thus being based on reality and possessing a high degree of accuracy and utility. He hypothesized that where the individual possesses little knowledge about a particular vocation, the stereotype he holds reveals information about him, much in the manner a projective test presumably exposes personality dynamics.

Holland proposed that six occupational environments exist within the American society. They are the motoric (farmers, truck drivers, etc.), the intellectual (chemists, biologists), the sup-
portive (social workers, teachers), the conforming (bookkeepers, bank tellers), the persuasive (salesmen, politicians), and the esthetic (musicians, artists).

Holland does not explicitly discuss the manner in which these modal orientations develop. He does, however, indicate the way in which these modal orientations influence vocational behavior once the orientations have been clearly established. If one orientation is clearly dominant over the others, the individual will seek an occupational environment that corresponds to that orientation. If two or more orientations are the same or nearly the same in their strength, the individual will vacillate in his selection of an occupational environment. If environmental factors interfere with the implementation of the first clear-cut orientation, then the individual will seek an occupational environment appropriate to his second strongest orientation.

The question of the level within an occupational environment that the individual chooses is a function of several other variables, referred to as the level hierarchy. The level hierarchy is defined in terms of the individual's intelligence and his self-evaluations. The self-evaluation is itself a function of the person's life history, such as his social status, his economic condition, his level of education, and his health.

The adequacy of a person's vocational decisions and the amount of difficulty he encounters in the process of making them are related to his knowledge about himself and the world of work. If he has a vague idea of what occupational environments exist, he
will have difficulty in selecting one; if he has contradictory
self-evaluations, he will vacillate in the level he selects. Environ-
mental factors which will influence the ease with which the
selection of an occupational environment exists are family factors,
such as aspirations and occupational history, which might result
in pressures toward a particular occupational environment; financial
resources; general economic conditions in society; and educational
opportunities.

The greater the amount and accuracy of information the indi-
vidual has about himself and about occupations, the more adequate
his choice will be. Holland explicitly includes other important
environmental features, such as social pressures and opportunities
available in society. He suggests that people with well-structured
developmental hierarchies will be less affected by outside pressures
than people possessing ambiguous personal hierarchies. He also
expresses the importance that social pressures in early adolescence
and childhood experiences with parents have in influencing voca-
tional choices. Since such influences occur before the stable hier-
archy of personal orientation develops, these experiences are likely
to influence the shape of the hierarchy rather than influence choices
after the hierarchy is developed.

Extensive longitudinal research has been completed by Holland
and his associates. The Vocational Preference Test, devised by
Holland, was correlated with results on a variety of other measures.
National Merit Scholars were the group studied, and their scores
on tests of personality, values, and self-description were the vari-
ables studied. Modal personality orientations, based on empirical findings, were devised by Holland for each of six personal orientations.

Comparisons of the characteristics of the six personal orientations reveal similarities between some of the groups on some of the characteristics. For example, the Realistic types were similar to the Intellectual types in personality characteristics (unsociable, masculine, persistent), but differed from them in their hobbies and activities (experimental hobbies, industrial arts, fishing, hunting for Realistic; chemistry, general science, and chess for Intellectual). Furthermore, the Intellectual types were less likely to change their college majors; they aspired to graduate study; and they engaged in daydreams reflecting learning and achievement content.

In hobbies and extracurricular activities, Holland found that the Realistic subjects were active in sports, student government, and scouting; the Intellectual subjects were not unusually active in any activities. Hobbies were arts, crafts, domestic arts, and photography for the Realistic; collecting, reading, and scientific projects for the Intellectual; domestic arts for the Social; collecting, music, and sports for the Conventional; collecting, sports, and writing for the Artistic.

Holland also investigated parental behaviors. He found that student personal orientations were correlated with some of the attitudes held by their mothers. The correlations were generally low except for the correlation between mothers' authoritarian attitudes
and "conventional students" (Osipow, 1968). In rank ordering nine goals for their sons, fathers of the different types revealed different values. Fathers of sons in the Realistic category valued ambition in their sons and hoped their income would be considerable. Fathers of boys in the Intellectual category valued curiosity; fathers of Social boys valued self-control; fathers of Conventional boys hoped their sons would be "happy and well-adjusted"; fathers of boys in the Enterprising group wished happiness and adjustment plus popularity for their sons; and fathers of sons in the Artistic category valued curiosity and independence.

Holland's theory implies that those people with the same personal orientation should be the product of similar backgrounds. To test that implication, comparisons were made between students' personal orientations and their fathers' occupations, education, student birth order, and number of children in the family. Father's occupation and son's personal orientation were significantly related.

In an attempt to resolve the question of the effects of parental inconsistency on the vocational behavior of the offspring, a point with which Roe's theory has difficulty, Holland found that parents who hold consistently democratic ideas toward their children tend to produce sons who are likely to choose scientific careers, while parents holding consistently authoritarian attitudes and values are likely to produce sons selecting realistic careers.

Holland's theory leads to the prediction that individuals will choose occupations consistent with their personal orientation. Intuitively assigning careers to a particular orientation, Holland
studied the relationship between career choice and personal orientation. The results were clear and highly consistent with his theoretical expectations. A majority of Realistic, Intellectual, and Social subjects chose careers in the appropriate fields. For the Enterprising, Social, and Artistic subjects, the theory did not hold up as well.

Studies by Schutz and Blocher and Stockin lend support to Holland's theory. A series of three studies by Osipow, Ashby, and Wall provided additional support for the theory. They tested hypotheses derived from the theory, and concluded that their results lent support to Holland's formulations (Osipow, 1968).

Anne Roe

Roe's theory of vocational development proposes that every individual inherits a tendency to expend his energies in some particular way. This tendency combined with various childhood experiences on the one hand and vocational behavior on the other that Roe attempts to make explicit. There are three basic components in Roe's theory. The first is based upon Gardner Murphy's concept of the canalization of psychic energy. The second is based upon Maslow's theory of need hierarchies. The third basic component of Roe's theory relates to genetic factors which affect vocational decisions.

Roe does not clearly articulate the nature of the interaction of genetic factors and need hierarchies. Her theory is an elaboration of the manner in which development of patterns and strengths of the basic needs is affected by childhood experiences.
She makes three specific propositions about development. First, needs that are routinely satisfied do not become effective as unconscious motivators. Second, higher-order needs, in terms of Maslow's hierarchy, will disappear entirely as motivators of an individual's behavior if he experiences only rare satisfaction of them; but lower-order needs will become dominant motivators if they are only rarely satisfied. When lower-order needs do become dominant motivators, they will block the appearance of higher-order needs. Third, needs that are satisfied after unusual delay will become unconscious motivators under certain conditions. The conditions influencing the development of unconscious motivators are strengths of the needs, the amount of delay between arousal and satisfaction of needs, and the value that the satisfaction of the need has in the individual's immediate environment. Roe proposes that child-rearing practices relate directly to both the kinds of needs satisfied and the delay involved in their gratification.

The manner in which parents interact with their child is the important factor in the child's later development. Based on their style of interaction, Roe identifies three types of parents. Overprotective parents make excessive demands upon their child. Avoiding parents neglect their child's physical requirements or reject him emotionally. Accepting parents display either a casual and unconcerned or a loving attitude toward their child.

The nature of parents' style of interaction has typical results in child development. The overprotective parent teaches his child to place a great deal of emphasis on the speed with which
his needs are gratified. Lower-level needs are fully and quickly
gratified, but his higher-order needs, such as love and esteem, are
connected to dependency on others and to conformity. The over­
demanding parent is categorized with the overprotective parent and
has a similar effect on his child. Children of rejecting parents,
unless they see other children treated differently, will suffer
from a stunted, but not necessarily distorted, development. Ac­
cepting parents offer satisfactory gratification of their children's
needs at most levels and thus enable their children to seek gratifi­
cation of their needs at all levels.

The relationship between child-rearing practices, the re­
sulting need hierarchies, and eventual adult behavior patterns in
general is a representation of the relationship of careers re­
sulting from need hierarchies and the child-rearing procedures
that determine whether an individual is oriented toward persons or
not toward persons. People in service occupations are primarily
oriented toward persons and probably come from a home which generated
a loving, overprotecting environment, while scientists tend not to
be oriented toward persons and come from a cold home atmosphere,
where rejection and avoidance of the child predominated. The home
atmosphere influences the type of vocational activities, while such
items as the genetic structure and the involuntary pattern of expendi­
ture of psychic energy influence the occupational level the worker
achieves. Such factors as the intensity of needs, influenced by
the early environment, may raise the occupational level because of
an increase in motivation, but such an increase can only be within
the limits set by the genetic factors influencing intelligence, combined with the socio-economic background of the individual (Osipow, 1968).

Roe's research which led to the development of her theory was primarily a series of investigations into personality characteristics, background factors, aptitude, and intellectual abilities as they related to vocational choice. The first study consisted of the assessment of the results of several group projective and ability tests administered to biologists, physicists, and chemists. From these studies she was able to report differences and similarities in responses to the Rorschach Inkblot Test, in some cases to the TAT, and on certain ability tests for scientists in different fields (Osipow, 1968). The second step in her research program was her investigations of the characteristics and background of eminent scientists (Roe, 1949). She interviewed them about topics such as family background, early experiences, psychosocial development, religious experiences and beliefs, and work experiences, and gave them the Rorschach, TAT, and specially constructed intelligence tests. She concluded that these scientists had childhood experiences which differentiated them from one another. For example, an unusual number of the eminent biologists came from families broken either by divorce or the death of one parent. None of the social scientists came from a home permanently broken by parental conflict, though several were broken by a parent's death. The biological scientists reported more than the usual amount of difficulty in psychosexual development. Both the physical and biological
scientists seemed somewhat distant in their relations with their parents and siblings, in contrast to the behavioral scientists who reported more interaction, though not necessarily positive, with their families.

Age at first commitment to their eventual vocation varied considerably for the different scientific groups. The physical and biological scientists tended to make their decisions earliest, the anthropologists and psychologists later.

Roe's findings led her to conclude that there are distinctions in the personality characteristics of men in different vocations, that men in different vocations report qualitatively different childhood experiences, and that the major distinction between vocational orientations is in the dimension of interest toward persons or not toward persons.

Super

Super's theory reflects the influence of three areas of psychology. The first, differential psychology, suggests that people are likely to be more satisfied if they are in an occupation which requires a pattern of interests and abilities closely corresponding to their own characteristics. A second psychological influence, self-concept theory, caused Super to propose that vocational self-concepts develop on the basis of children's observations of and identification with adults involved in work. The third, principles of developmental psychology, led Super to hypothesize that a person's mode of adjustment at one period of his life is like-
ly to be predictive of his techniques of adjustment at a later period. Also from developmental psychology, he arrived at the idea of career patterns, i.e., the career behavior of people follows general patterns which may be recognized as regular and predictable after study and examination of the individual. From the career pattern concept came the implication that the life cycle imposes different vocational tasks on people at various times of their lives.

According to Super, self-concept formation requires a person to recognize himself as a distinctive individual, yet at the same time to be aware of the similarities between himself and others. The self-concept is ideally a continually developing entity, changing as experiences in life dictate what is necessary to reflect reality. As an individual matures, he tests himself in many ways, most of which have implications for educational and vocational decisions. The process begins with the self-differentiation that occurs as part of a person's search for identity, and continues with the self-definition that occurs in adolescence. Interacting with the process of differentiation of self from others is the process of identification. Taking place first with the identification with the like-sexed parent, identification gradually occurs with more and more specific models. Eventually, identification takes on vocational implications and is facilitated by role-playing. During adolescence, reality-testing takes place which either confirms or negates tentative educational and/or vocational plans.

Vocational maturity, the congruence between an individual's
vocational behavior and the expected vocational behavior at that age, is related to the stages of vocational development, which were derived from an analysis of life stages. The life stage of 15-25 is the exploratory stage, and the years from 26-65 are the maintenance stage of vocational development.

Super along with Overstreet studied variables that might be associated with vocational maturity and classified them into several groups. Biosocial factors, such as age and intelligence, were correlated with a vocational maturity index. At the ninth grade age level which they studied, they concluded that vocational maturity is related to intelligence and that age is of less importance in vocational maturity. They suggested that bright youngsters are able to plan more effectively than less bright ones. Environmental factors, such as parental occupational level, school curriculum, amount of cultural stimulation, and family cohesiveness correlated positively with vocational maturity indexes. Vocational factors, vocational aspirations, and the degree of agreement between aspiration and expectation correlated significantly with the vocational maturity index. Personality characteristics did not correlate significantly with vocational maturity. Variables of adolescent achievement such as grades, achievement versus underachievement, participation in school and out-of-school activities, and independence, were all positively correlated with vocational maturity. Peer acceptance, on the other hand, was negatively correlated with vocational maturity.

Results of empirical studies based upon Super's theory, both
by Super and his colleagues and by others, provide extensive support for the general aspects of the theory. Most of the findings support the idea that occupational choice represents the implementation of the self-concept. The research and data relevant to the concept of vocational development seem to indicate a steady and reasonable predictable increase in both the amount of attention and the sophistication of that attention given to vocational choice tasks through the adolescent years. The attention culminates, for well-oriented people, in commitment to a position which is then carried on throughout life, though in varying degrees (Osipow, 1968).

Comments Relative to Vocational Theories

The three theories of career development presented above are perhaps more applicable to academic motivation than any of the other theories that have been considered because they attend to a variety of situational variables which affect behavior. Although not as precise as, for example, stimulus-response theory, they are longitudinal and consider more complex behavior.

The theories of vocational development, like the other theories reviewed, do recognize the importance of early childhood experiences for later interests and behavior. The addition of family influences, economic influences, and later global influences gives vocational theories a broader scope than some of the other theories studied.

Of particular interest when considering academic motivation are Roe's concern with parental styles and Super's formulations
about the effects of identification and self-concept on career choices. Since academic achievement is closely related to the type of career one chooses and is in fact a prerequisite to many occupations, it might be expected that those factors affecting vocational choices might also be very influential in producing academic motivation.

Summary

A variety of theories which have relevance for academic motivation have been reviewed. The three major schools of thought in psychology, stimulus-response, cognitive, and psychoanalytic theories, were examined for their formulations of motivation. A "specimen" theory was given for each position, and considered in some detail.

As an example of a specific theory of motivation, Maslow's theory was presented. The theories of Roe, Super, and Holland on vocational development were each abstracted for additional contributions to a conceptualization of the development of academic motivation. From each theory factors were identified which might contribute to the development of academic motivation.

Consideration of those theories emphasized the importance of early childhood experiences in the later development of the individual. The psychological theories, including Maslow's theory, offered little beyond a call for a detailed analysis of the childhood-environment interaction as a guide for identifying variables which affect academic motivation. The theories of vocational devel-
opment suggested a greater variety of variables which might influence academic motivation.

Perhaps the greatest value of this review of major theories is to be found not in the identification of factors which influence the development of academic motivation but rather in the realization that academic motivation as a construct is not delineated by any of the existing models. The present study is designed to identify factors that contribute to the development of academic motivation. In other words, it is a search for the antecedents of academic motivation.
CHAPTER III

PROCEDURES

This study of university professors attempted to identify factors in their life histories which have contributed to the academic motivation manifested in their professional role. The study focused on professors who demonstrate academic motivation in their day-to-day activities. They are a special group by no means representative of the total population of the United States either in intelligence or interest. It was, in fact, their difference from the general population, the high degree of academic involvement in their work, that made them valuable in this study. That they have sought the highest level of education and then located in an academic community professionally suggested that they are a group who have had experiences which made academic endeavors satisfying and important to them. It was assumed in this study that experiences which led them to become professors were experiences which contributed to the development of their academic motivation, that these experiences could be identified, and that analysis of these experiences would yield suggestions for fostering academic motivation among the more general population.

Essentially, this was a descriptive study of professors which relied upon their ability to remember details from their
childhood, adolescence, and young adulthood. The data of the study described those early experiences, and analysis of the data yielded inferences about their relationship to the development of academic motivation. It was recognized that the inference of a relationship from subsequent (present position and memories of childhood) to antecedent (the experiences of childhood) variables must be made with caution and can be only suggestive, never conclusive.

Sampling

The study was conducted in a large midwestern state university. Sampling involved selecting colleges and departments from which outstanding professors were to be drawn, and subsequently identifying the outstanding professors in each of the colleges or departments.

Several areas of study were included in the study to ensure that the data collected would not be representative of only a specific content orientation. With the criterion of diversity in mind, a list of the many colleges and departments on this large campus was compiled. Preliminary perusal of the list suggested that there are two different kinds of curricula offered within the university, those which seek knowledge as an end in itself and those which train people to apply knowledge in a profession outside the university setting. The former were recognized as disciplines in the liberal arts, comprising the arts, natural sciences, social sciences, and humanities; and the latter as professional fields
like engineering, education, medicine, and law.

The difference between the liberal and the professional fields is reflected in the organization of the university into colleges and departments. Disciplines within the liberal arts are art, dance, and theatre; botany and zoology; history and philosophy; mathematics and physics; and psychology and sociology, to name a few. They are organized respectively into the Colleges of Art, of Biological Sciences, of Humanities, of Mathematics and Physical Sciences, and of Social and Behavioral Sciences. Collectively, these colleges incorporate all of the liberal disciplines. In contrast, the professional fields are organized into their own respective colleges. The professional colleges are the Colleges of Administrative Science, of Agriculture and Home Economics, of Dentistry, of Education, of Engineering, of Law, of Medicine, of Optometry, of Pharmacy, and of Veterinary Medicine.

Neither the liberal disciplines nor the professional fields are by themselves representative of the academic personnel in a university. It is their complementarity which characterizes the university. Therefore, both the liberal and the professional fields were equally represented in this study. Equal numbers were drawn from departments in the liberal disciplines and from colleges in the professional fields.

In this study the liberal disciplines were labeled "Basic" areas of study, and the professional fields were called "Applied" areas of study. The Basic Areas were so called because they seek
knowledge for its own sake and constitute the sciences upon which
the professional fields are based. The Applied Areas are so called
because they are committed to employing the knowledge from Basic
Areas for development of its practical application in the world be-
yond the university.

If graduates of the Basic Areas follow directly their edu-
cation, they must stay in the academic world; graduates of the Ap-
plied Areas may choose to practice their specialty outside the uni-
versity or to remain in the academic setting doing research and
teaching. Thus, one who embarks on study in the Basic Areas has
from the beginning a purely academic goal whereas one who enters an
Applied Area probably has at the outset the practical goal of learn-
ing to perform a professional function.

The difference between Basic and Applied Areas of study
led to the speculation that people in the Basic Areas are academi-
cally motivated in a stricter sense than those who enter the Applied
Areas. Therefore, different patterns of influence upon individuals
in the Basic and Applied fields were anticipated.

Basic and Applied Areas were matched according to the simi-
larity of their content. If a basic discipline provides the knowl-
edge for a given applied area, then the content of the two curric-
ula must have similarities. To facilitate the selection of Basic
and Applied Areas which have similar content, the following list
was constructed:
<table>
<thead>
<tr>
<th>Basic</th>
<th>Applied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Art</td>
<td>Architecture</td>
</tr>
<tr>
<td>Botany</td>
<td>Agronomy</td>
</tr>
<tr>
<td>Chemistry</td>
<td>Pharmacy</td>
</tr>
<tr>
<td>Mathematics</td>
<td>Engineering</td>
</tr>
<tr>
<td>Physics</td>
<td>Engineering</td>
</tr>
<tr>
<td>Psychology</td>
<td>Education</td>
</tr>
<tr>
<td>Sociology</td>
<td>Education</td>
</tr>
<tr>
<td>Zoology</td>
<td>Medicine</td>
</tr>
</tbody>
</table>

The selection from this list of areas for the sample was guided by four concerns. The first was that in each Area at least two professors should represent each of the Activities which were specified in the definition of academic motivation. Therefore, a total of eight professors from each Area had to be considered. Four Areas, two Basic-Applied pairs from the list above, were considered the maximum number that could be adequately studied in detail. Secondly, since the most highly motivated professors in each Area were to be the subjects, only those departments or colleges which employ a faculty of at least thirty-two persons at the rank of assistant professor or above were considered. That figure was set so that not more than the top twenty-five per cent of any faculty would be represented. The third consideration was that the pairs to be included should represent different types of interests. For example, both mathematics and physics were not considered because of their content similarity. Likewise pharmacy and medicine would not both be considered because of the content similarity between them. The fourth condition was that the Basic discipline be related in content as directly as possible to the Applied Area. For instance, the relationship between sociology and education might be debated,
but the one between mathematics and engineering cannot be denied. Engineering is dependent upon mathematics as a tool, but although education can make use of the findings of sociologists, they are not essential to the field of education.

On the basis of the above four conditions, Mathematics and Engineering and Zoology and Medicine were selected as the Areas for the study. Although both pairs are science-oriented, the difference between abstract and concrete objects of study in mathematics and zoology, and between inanimate and human objects of study in engineering and medicine seemed to offer promising contrasts.

The actual selection of professors from the Areas was effected with the help of graduate teaching and research associates and chairmen of departments in the Basic Areas and of administrators of colleges in the Applied Areas.

In the Basic Areas letters were mailed to the graduate teaching and research associates in the departments of zoology and mathematics. The letters (Appendix) explained the study and requested that they identify the outstanding professors in their respective departments. They were asked to name two professors for each of the four Activities. Although response to the letter was less than fifty per cent, there was a substantial response which clearly identified the professors in the departments who are outstanding in the eyes of the graduate associates. The number of times each professor was mentioned for each activity was tallied, and the top two professors for each Activity were tentatively selected for the study.
To complement these sets of names and to provide a check on their accuracy, the chairman of each department was also asked to prepare a list of the professors outstanding in the activities described in the operational definition of academic motivation. He was asked to name three professors for each of the four Activities. The chairmen's lists were compared to the top two professors identified by the graduate associates in each Activity. The correspondence between the lists was gratifying. In both departments the chairman's list corroborated the graduate associates' composite choices. The list derived from the graduate associates' responses was accepted with confidence as the sample from the departments of mathematics and zoology.

In the College of Engineering, the Dean was approached for his help in identifying professors from departments throughout the College. The study was explained to him and the descriptions of activities of the operational definition of academic motivation were offered as a basis for his identification of professors. He was asked to name professors in those areas of engineering which relied most heavily on mathematics as a tool. Electrical and mechanical engineering were suggested as desirable departments in contrast to chemical engineering which relies more on chemistry than on mathematics. The resultant list of names which he submitted had four professors for each Activity. Selection of two professors for each Activity was made with an eye toward including as many different departments of engineering as possible while avoiding a predominance by any one department. The final sample from engineering included
three professors of electrical engineering, one of engineering mechanics, one in metallurgical engineering, one in mechanical engineering, one in welding engineering, and one in aeronautical engineering.

Several administrators in the College of Medicine were independently consulted and requested to submit names of professors outstanding in the four Activities of the operational definition of academic motivation. An ex-dean, an assistant dean, an administrative assistant, and the chairman of a department who has been associated with the College of Medicine for twenty-five years submitted names of professors whom they felt were outstanding in the different activities. Although the coincidence of names was great, they were not always assigned to the same Activity. This problem was solved by placing a professor in an activity if he was mentioned at least twice in that activity. A list of two professors for each Activity was thus compiled, again with an outlook toward diversity of departments within the College of Medicine. The final list included two professors in Medicine, one in Anatomy, one in Urology, one in Pathology, one in Neurosurgery, one in Physical Medicine, and one in Radiology.

The final sample included eight professors in each of the four Areas, Mathematics, Zoology, Engineering, and Medicine. Each professor was categorized according to the Activity from the operational definition of academic motivation which he exemplified and according to the department or college which he represented.
The four Activities of the operational definition of academic motivation and the four subject Areas were used to construct a four by four matrix with sixteen cells. Each professor was assigned to one cell so that there were two subjects in each cell. The figure below represents the sampling design of the study.

<table>
<thead>
<tr>
<th>Researchers</th>
<th>Scholars</th>
<th>Teachers</th>
<th>Consultants</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematicians (BASIC)</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Zoologists</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Engineers (APPLIED)</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Physicians</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
</tr>
</tbody>
</table>
Collection of Data

The thirty-two professors were contacted by telephone and notified that they had been selected for participation in the study. It was described to them as a study of outstanding university professors attempting to determine what leads people to be motivated toward academic endeavors. Each professor was told how he had been identified for the study and asked if he would participate. The nature of the interview was explained, and he was asked to think about those experiences which he considered significant in his development before the interview. The mathematicians and zoologists cooperated one hundred per cent. Only one engineer declined, pleading an already overburdened load for the quarter. Two doctors declined for similar reasons. Replacements for the engineer and the two doctors were quickly obtained from the lists that had been prepared.

The nature of the information needed for this study necessitated some form of self-report technique. A semi-structured interview was chosen as the most appropriate means of gathering data on experiences which would not be public record. The advantages of the technique, speed, immediate clarification of questions and responses, and possibility of eliciting relevant but unanticipated data outweighed the disadvantages of relative lack of objectivity and reliability.

The alternatives, within the self-report technique, to a semi-structured interview as a means of gathering data of a per-
sonal nature include structured and unstructured questionnaires and structured and totally unstructured interviews. Each was considered in relation to the purposes of this study and rejected in favor of the semi-structured interview.

Structured questionnaires, while offering more objectivity and reliability, restrict the possible responses and thus limit the information which may be elicited. Unstructured questionnaires are time-consuming and offer no insurance that complete and direct answers to questions will be provided.

A structured interview is clumsy when interviewees are being asked to relate long-past experiences where one memory may trigger another and that another, all of them relevant but answering different questions of the interviewer. It was tried with several professors of history and education preliminary to the study. On the basis of that experience, structured interviews were rejected for this study. Questions became redundant, and the interviewees made comments such as, "I told you about that when I was talking about my first grade teacher," or "That's what I meant when I said that my mother was the one who encouraged us most in school." Furthermore, the structured interview makes the interviewee more dependent for guidance on the interviewer. He waits to be asked specific questions, and as the interview progresses offers less and less in the way of spontaneous reports. Because this study was a search for a variety of variables which affect academic motivation, questions in the interview had to come from the interviewer's intuitive grasp of relationships as they were expressed in the interview.
The interviews were only slightly structured. Four broad areas of importance to the development of academic motivation were postulated on the basis of current theories of growth and development, career development, and education. The areas were family and early childhood, school experiences, social development, and career development. Specific variables within these areas were not hypothesized, but were expected to be evident in the data themselves.

Interviews were started with simple, factual questions about place of birth, and background of parents. From that point on less specific questions were asked. Typical phrasing of a question about family was, "Tell me what your family was like. How did the members react to one another, what did they do together? What kind of people were they?" Obviously there is more in that set of questions that one could expect to have answered specifically. The point was to get the professor talking about his family and see what kinds of things he thought were important.

In the area of schooling, phrasing was similarly vague in questioning. Professors were prompted to talk about their schooling experiences with questions such as, "How did you feel about school in general? Do you have any outstanding memories about school that you think had an important influence on you as a student? Were there any teachers you particularly remember or experiences that were very stimulating?"

Social development was approached through questioning about friends and activities that were shared. Professors were asked specifically when they began to date and at what age they married.
Career development was the easiest area of questioning. All professors were willing and even eager to discuss the history of their careers. As they talked, questions about what they liked and why they liked it were asked directly. They were also asked if they had ever held any jobs outside the academic setting and what their response to those jobs was.

Generally, most of the professors were very helpful and open during the interviews. Of the eight professors interviewed in the preliminary interviews and the thirty-two professors in the study itself, only two were noticeably guarded to the point of being recalcitrant and defensive. After the first hour or so of the interviews, even they became more open. The interviews were in themselves an interesting and instructive experience for the interviewer, and according to the comments after the formal session of the interview, for the professors themselves. Several commented that they had never thought about their lives and careers in such detail from the point of view of what led them to their present positions.

The interviews averaged two hours in length and ranged from one that was only forty minutes to several that were three hours long. They were held in the professors' offices, and each was tape-recorded. During the interview I took notes because I had found in the preliminary interviews that there are several advantages to taking notes. One was that it gave me an immediate record which I could review during the interview to note omissions, contradictions, or ambiguities and modify my questioning accordingly. An-
other was that by writing I gave the professors time to think over what they had said and to clarify their thoughts. In some cases it seemed to exert a subtle pressure for them to continue talking without any prompting from me.

At the end of each interview I asked the professor for a curriculum vita and requested that he complete the Allport-Vernon-Lindzey Study of Values. I left the Study of Values in a self-addressed envelope with the professor so that he could respond to it at his leisure and return it to me conveniently. There was a one hundred per cent return on the Study of Values.

Treatment of Data

The tape-recordings of the interviews were used to fill out my notes, and in some cases complete transcripts of the interviews were made. Quotations that illustrated particular experiences were taken from the tape-recordings of those professors for whom I did not make complete transcripts. Upon completion of the interviews and filling in the notes I had taken, I had eight to ten pages of data in addition to a curriculum vita and a bibliography for each professor, which gave me several hundred pages of data to process.

Reduction of Data

The first step was to read through the interview notes to get a feel for the data. As I did so, I began to recognize variables that seemed important and that were recurring among the professors. I began a list of them and added to it as I reviewed the
Interview notes. The result was a list of twenty or so variables in no particular order. Classifying them under the four broad areas of questioning, family and early childhood, school experiences, social development, and career development revealed that some were duplicates or so closely related that they could be treated together. As I sorted out the variables I was able to reduce them to sixteen. The following variables were the result of my scrutiny of the raw data:

Family and Early Childhood
- Parents' birthplace
- Parents' education and occupation
- Place of birth and childhood environment
- Description of and relationship with parents, relatives
- Siblings

School Experiences
- Outstanding teachers
- Important experiences (classes, programs, projects)
- General attitude
- Higher education
- Extra-curricular activities

Social Development
- Relations with peers
- Dating
- Age at marriage

Career History
- Work experiences
- Early aspirations
- Autonomous activities

Identifying the variables from the raw interview data was the first step in reducing the data to a form where analysis was possible. Because the purpose of this study was to identify variables which have contributed to the development of academic motivation, the analysis of data was designed to focus on the variables, not on the individuals who were interviewed. For this reason, case
studies were ruled out, and compilation of the data on each variable was selected as the form of analysis.

From the raw data, the information for each professor on each variable was entered on an index card so that the data could be separated and rearranged for analysis according to academic area and then according to activities of the operational definition of academic motivation. The result was sixteen cards for each of the thirty-two professors, or 512 cards with one datum per card.

Analysis of Data

For each variable the data were compiled within the Areas of study, Mathematics, Zoology, Engineering, and Medicine, and again within the four Activities of the operational definition of academic motivation. In other words, the data on each variable were entered in the proper cells of the sampling design matrix, page 64, and compiled horizontally and vertically.

The compilations revealed similarities and differences within the groups. If there were a trend evident among a group on a variable, its connection to the development of academic motivation was sought; if not, the several data were analyzed for each professor or group of professors to determine what effect that variable had on academic motivation.

The compilations of data on each variable for each group also allowed comparisons among groups. These were made seeking differences between groups which could have resulted in their present role in the university.
From the comparison between groups and the compilations within groups, predominant trends were identified and used to construct suggestions for educators and parents who are trying to promote academic motivation among children.
Chapter IV consists of two sections: Part I describes the participants at the time of the study, and Part II presents the data from the interviews.

Part I: A Description of the Professors

Thirty-two professors, eight representing each of four Areas, Mathematics, Zoology, Engineering, and Medicine, were the subjects of the study. They were a group of men of different ages and university rank. On the basis of their accomplishments within the university, they were classified as Researchers, Scholars, Teachers, or Consultants for the purpose of comparing data.

The professors included in the study ranged in age from 25 to 70, and the average age for them was 46.5. A breakdown of average age and range of age for each of the four Areas and for the four Activities is presented below.

<table>
<thead>
<tr>
<th>Areas</th>
<th>Average Age</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering</td>
<td>43.9</td>
<td>39-54</td>
</tr>
<tr>
<td>Medicine</td>
<td>50.0</td>
<td>37-69</td>
</tr>
<tr>
<td>Mathematics</td>
<td>45.6</td>
<td>25-64</td>
</tr>
<tr>
<td>Zoology</td>
<td>46.4</td>
<td>36-70</td>
</tr>
<tr>
<td>Activities</td>
<td>Average Age</td>
<td>Range</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
<td>-----------</td>
</tr>
<tr>
<td>Research</td>
<td>47.9</td>
<td>37-69</td>
</tr>
<tr>
<td>Scholarship</td>
<td>43.8</td>
<td>25-70</td>
</tr>
<tr>
<td>Teaching</td>
<td>44.5</td>
<td>36-53</td>
</tr>
<tr>
<td>Consulting</td>
<td>50.5</td>
<td>33-65</td>
</tr>
</tbody>
</table>

The professors' ranks in the university community included assistant, associate, and full professors, but most were full professors. In Mathematics there were two assistant and one associate professors; in Zoology there were one assistant and two associate professors; in Engineering there were two associate professors; and in Medicine there was one associate professor. The remaining twenty-three professors had full professorial rank.

Seven professors of foreign origin were included in the study. Two mathematicians, and two physicians, and one zoologist were born and reared in European countries. Two engineers were born in European countries, but came to this country as young children and attended American schools. Inclusion of foreign-born professors in the study was debated at first, but accepted because they most certainly did fit the criterion of being outstanding professors. Their inclusion also offered a possibility for extending the generalizability of the study.

All of the professors except one engineer and one zoologist hold the degree Doctor of Philosophy or Doctor of Medicine. The two who do not have made contributions of national scope and have throughout their lives demonstrated a high degree of academic moti-
vation. They were both among the top professors suggested by the teaching associates and the administrators who made the nominations for the study.

Among the professors were several who have done post-doctoral study. Five Zoologists were post-doctoral fellows at Universities including Cornell University; University of Aberdeen, Scotland; Ohio State University; University of California at Los Angeles; Queen's University of Belfast, Ireland; and Yale University. Three Mathematicians did post-doctoral study at the School of Mathematics, Tata Institute of Fundamental Research, Bombay, India; California Institute of Technology; and Glasgow University, Scotland, respectively. Two Physicians were post-doctoral fellows at Harvard Medical School and one at Washington University. One Engineer was a Fulbright Scholar at Bristol University, England.

Bibliographies of the thirty-two professors collectively contain over a thousand journal articles and almost forty books. Many of these professors have been the recipients of awards on the state, national, and international levels. Membership in professional societies and honorary societies were too numerous to mention. In sum, these professors represent a high level of academic productivity.

The Study of Values by Allport, Vernon, and Lindzey was administered to the professors following the interviews. Based on Edward Spranger's Types of Men, this instrument indicates the relative strength of six value dimensions for each individual. It was used in this study for descriptive purposes to compare the relative values of the groups of men being studied. Of particular interest
were the dimensions of theoretical and economic values. The other four dimensions measured by the instrument were of less importance in this study.

The professors were expected to be considerably higher than the average male on the Theoretical dimension because theoretical orientation is a factor of academic motivation. Since the Basic Areas were identified as ones which had a higher component of academic motivation, professors in the Basic Areas were expected to score higher than professors in the Applied Areas on the Theoretical dimension. On the Economic dimension professors in the Basic Areas were expected to score lower than the professors in the Applied Areas since Physicians and Engineers entered college to study for professions which have a definite function and promise a certain financial return, in contrast to those professors who entered a Basic discipline with no definite occupational expectation. No speculations were made regarding the other value dimensions of the inventory.

The Study of Values was chosen to provide the information because it was brief and has been widely used. No statistical tests of differences were made because the numbers in the groups were so small. The ipsative nature of the instrument also restricts the appropriateness of statistical analyses.

The average profiles, constructed from the mean score on each value, for each Area are shown in Figures 1 through 4.

As expected, the Basic Areas had higher averages in the Theoretical dimension and lower averages on the Economic dimension of the Inventory than the Applied Areas. Rank ordering the Areas on
Figure 1

STUDY OF VALUES PROFILE OF MATHEMATICIANS
Theoretical Economic Aesthetic Social Political Religious

Mean 54.1 30.6 45.6 37.0 38.7 35.3
Range 41 - 64 25 - 42 35 - 66 26 - 49 26 - 60 16 - 58

Average Zoologist (N = 8) ———— Average Male ————

Figure 2

STUDY OF VALUES PROFILE OF ZOOLOGISTS
Figure 3

STUDY OF VALUES PROFILE OF ENGINEERS
Figure 4

STUDY OF VALUES PROFILE OF PHYSICIANS
the basis of their average scores on the Theoretical dimension produced almost the same order as was produced by rank ordering men's occupations according to the mean Academic Achievement score of a subscale of the Strong Vocational Interest Blank (Campbell and Johansson, 1966). From highest to lowest on the Theoretical dimension, they were Mathematician, Zoologist, Physician, and Engineer. In the Campbell and Johansson study the order was Mathematician, Biologist, Physician, and Engineer. In both studies, the biologists' and the mathematicians' scores were very close together at the high end of the scale while the physicians were considerably lower, and the engineers were substantially lower still.

Also as expected, the Basic Areas were lower, although not decidedly so, than the Applied Areas on the Economic dimension.

Some differences were noted on the other dimensions among the four groups. The Mathematicians were the lowest group on the Aesthetic dimension. Compared to the average male, the Mathematicians were in the average range, but the other groups were in the high range on Aesthetic values. All of the groups were in the average range compared to the norms for males on Social values. The Mathematicians and the Engineers were as groups low on Political values, but the Zoologists and Physicians were average. Finally, the Physicians were low on Religious values while the rest were average.

Part II: Data on Sixteen Variables

The professors were interviewed using a semi-structured format. The interviews focused on the family and early childhood, schooling,
social development, and career histories. Professors were asked general questions about their experiences in the four categories. The data from the interviews were perused to identify recurring variables within the four categories. Sixteen variables were identified as ones which seemed to be influential in the professors' development. The data on those variables for each professor are presented in the remainder of this chapter.

The sixteen variables to be considered are the following:

**Family and Early Childhood**
1. Parents' Birthplace
2. Parents' Education and Occupation
3. Place of Birth and Childhood Environment
4. Siblings
5. Relationship with Parents

**School Experiences**
6. General Attitude
7. Outstanding Teachers
8. Important Classes, Programs, or Projects
9. Extra-Curricular Activities
10. Higher Education

**Social Development**
11. Relations with Peers
12. Dating
13. Age at Marriage

**Career History**
14. Aspirations
15. Work Experiences
16. Autonomous Activities

The sixteen variables form side headings in the remainder of this chapter. Under each side heading will be the data which are organized according to the four areas and reorganized according to the four activities of the professors from whom they were gleaned.
Parents' Birthplace

Mathematicians

Parents of the Mathematicians included two European couples, one couple who immigrated to the United States when they were both children, one couple who immigrated to the United States when they were young adults, and four couples who were born in Indiana, Kansas, Pennsylvania, and Wisconsin, respectively.

Zoologists

One zoologist's parents were born in England and remained there. Two zoologists' parents immigrated to the United States; one set came over as children and the other came as adults after they were married. One of the immigrant families settled in Ohio, the other in New York State. Of those born in the United States, the parents of only one zoologist were born outside of Ohio, in New York City. Four zoologists' parents were born in Ohio.

Engineers

One engineer's parents were immigrants in childhood; another's parents immigrated as adults when their son was three years old. The parents of one engineer were born in Europe and did not immigrate to this country until he was ten years old. The parents of four engineers were born in Ohio, and the parents of one were born in Minne-
sota of Swedish descent.

Physicians

Two of the Physicians were born and reared in Europe as were their parents. The parents of one physician immigrated to this country when they were children. The parents of the other five physicians were born in midwestern or eastern states. Illinois and Massachusetts were the home states of the parents of two doctors, and three doctors' parents were from Ohio.

Researchers

The parents of three researchers were European. One researcher's father was a European emigrant who came to the United States as a child and married an American woman. Two researchers' parents were from Ohio, another's were from New York City, and another's from Illinois.

Scholars

Three of the Scholars' parents were immigrants to the United States from Europe. One scholar was born of English parents and was reared in England. One scholar's parents were born in Indiana, and three scholars' parents were from Ohio.

Teachers

One teacher's parents were Europeans, and another's were European immigrants to the United States. The parents of two teach-
ers were from Ohio. The others were from Kansas, Massachusetts, and Pennsylvania respectively.

Consultants

One consultant's parents were European, and two consultants' parents were European immigrants to the United States. The parents of two other consultants were from Minnesota and Wisconsin. Three were from Ohio.

Parents' Education and Occupation

Mathematicians

The fathers of the Mathematicians had educations ranging from eighth grade to university. Seven completed high school and five continued through the university. One had a doctorate degree. Their occupations classified by major orientation were mechanical (2), commercial (1), administrative (2), and labor (2). One mathematician's father was a physician, but he died when his son was four years old. The mothers of the Mathematicians had educations ranging from fifth grade to university level. Six completed high school, two completed college, and one had a graduate degree. Six of the mothers were housewives, one was a college professor, and one worked as a personnel manager.

Zoologists

The fathers of the Zoology professors had educations ranging from none to college degrees. One father was a farmer and had no
education. One who completed only the third grade was also a farmer and a businessman. Three completed high school and continued to college to earn undergraduate degrees. Of the two who completed only eighth grade, one worked as a laborer, the other owned a construction company. Classified by major orientation, their occupations were mechanical (4), commercial (2), and labor (1). One zoologist never knew his father and could not say what his occupation was. The mothers of the Zoologists had educations ranging from none to bachelor's degrees. Seven had finished the eighth grade. Three completed high school and two earned bachelor's degrees. Three of the mothers worked. One was a personnel manager in a bank, one a clerk in a clothing store, and one was a writer and editor of women's magazines.

Engineers

The fathers of Engineers had educations ranging from six years to university degrees. One completed only the seventh grade, another completed the eighth grade, four completed high school, and two earned university degrees. The occupations of seven of the fathers were mechanically oriented, and the eighth was a farmer. The educations of the Engineers' mothers ranged from six years to university degrees. Seven finished eighth grade or above; four completed high school; and two earned college degrees. One mother died when her son was two years old. Six of the other seven mothers were housewives and one was employed as an unskilled factory laborer.
for three years during World War II.

Physicians

The fathers of the Physicians had educations ranging from eighth grade to university. Seven of them completed high school, and two earned university degrees. Their occupations were mechanical (1), commercial (3), service (2), and managerial (2) in orientation. The mothers of the Physicians all completed the eighth grade or above. Six completed high school, and two of them earned college degrees. One was a physician herself and maintained a private practice. The others did not work.

The education and occupation of parents are presented in Figures 5 and 6.

Researchers

In the Research group, five fathers had university degrees, one was a high school graduate, and two completed only the eighth and ninth grades respectively. In this group the occupations of the fathers were mechanical (5), administrative (1), service (1), and commercial (1) in orientation. The mothers had all completed at least the eighth grade; one stopped after tenth grade, three terminated their education with high school; and two received college degrees. Only one of the mothers worked. She was a writer and editor of women's magazines.
<table>
<thead>
<tr>
<th>Fathers</th>
<th>Mothers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Education</strong></td>
<td><strong>Occupation</strong></td>
</tr>
<tr>
<td>Engineers</td>
<td>2 college</td>
</tr>
<tr>
<td>4 high school</td>
<td>1 agricultural</td>
</tr>
<tr>
<td>1 seventh grade</td>
<td>1 sixth grade</td>
</tr>
<tr>
<td>1 sixth grade</td>
<td></td>
</tr>
<tr>
<td>Physicians</td>
<td>2 college</td>
</tr>
<tr>
<td>5 high school</td>
<td>2 private business</td>
</tr>
<tr>
<td>1 eighth grade</td>
<td>2 management</td>
</tr>
<tr>
<td>1 academic</td>
<td>1 religious</td>
</tr>
<tr>
<td>Mathematicians</td>
<td>5 college</td>
</tr>
<tr>
<td>2 high school</td>
<td>2 private business</td>
</tr>
<tr>
<td>1 eighth grade</td>
<td>2 academic</td>
</tr>
<tr>
<td>2 labor</td>
<td>1 fifth grade</td>
</tr>
<tr>
<td>Zoologists</td>
<td>3 college</td>
</tr>
<tr>
<td>2 eighth grade</td>
<td>2 private business</td>
</tr>
<tr>
<td>1 third grade</td>
<td>1 labor</td>
</tr>
<tr>
<td>1 none</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 5**

**EDUCATION AND OCCUPATION OF PARENTS BY PROFESSORS’ AREAS**
<table>
<thead>
<tr>
<th>Fathers Education</th>
<th>Occupation</th>
<th>Mothers Education</th>
<th>Occupation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Researchers</td>
<td></td>
<td>Scholars</td>
<td></td>
</tr>
<tr>
<td>5 college</td>
<td>5 mechanical</td>
<td>2 college</td>
<td>6 none</td>
</tr>
<tr>
<td>1 high school</td>
<td>1 private business</td>
<td>3 high school</td>
<td>1 publishing</td>
</tr>
<tr>
<td>1 ninth grade</td>
<td>2 academic</td>
<td>1 tenth grade</td>
<td></td>
</tr>
<tr>
<td>1 eighth grade</td>
<td></td>
<td>2 eighth grade</td>
<td></td>
</tr>
<tr>
<td>Scholars</td>
<td></td>
<td>Teachers</td>
<td></td>
</tr>
<tr>
<td>3 college</td>
<td>3 mechanical</td>
<td>4 college</td>
<td>5 none</td>
</tr>
<tr>
<td>3 high school</td>
<td>2 private business</td>
<td>3 high school</td>
<td>1 clerical</td>
</tr>
<tr>
<td>1 third grade</td>
<td>1 religious</td>
<td>1 eighth grade</td>
<td>1 academic</td>
</tr>
<tr>
<td></td>
<td>1 academic</td>
<td></td>
<td>1 management</td>
</tr>
<tr>
<td>Teachers</td>
<td></td>
<td>Consultants</td>
<td></td>
</tr>
<tr>
<td>2 college</td>
<td>3 mechanical</td>
<td>1 college</td>
<td>6 none</td>
</tr>
<tr>
<td>3 high school</td>
<td>1 private business</td>
<td>2 high school</td>
<td>1 clerical</td>
</tr>
<tr>
<td>1 eighth grade</td>
<td>1 sales</td>
<td>1 tenth grade</td>
<td>1 medical</td>
</tr>
<tr>
<td>1 seventh grade</td>
<td>1 management</td>
<td>1 ninth grade</td>
<td></td>
</tr>
<tr>
<td>1 none</td>
<td>2 labor</td>
<td>1 eighth grade</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 fifth grade</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 none</td>
<td></td>
</tr>
<tr>
<td>Consultants</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 college</td>
<td>3 mechanical</td>
<td>1 college</td>
<td>7 none</td>
</tr>
<tr>
<td>2 high school</td>
<td>2 private business</td>
<td>3 high school</td>
<td>1 clerical</td>
</tr>
<tr>
<td>3 eighth grade</td>
<td>1 management</td>
<td>3 eighth grade</td>
<td></td>
</tr>
<tr>
<td>1 sixth grade</td>
<td>1 labor</td>
<td>1 sixth grade</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 agricultural</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 6

EDUCATION AND OCCUPATION OF PARENTS BY PROFESSORS’ ACTIVITIES
Scholars

In the group of Scholars, one father completed only the third grade, six completed high school, and three earned university degrees. Their occupations were mechanical (3), commercial (2), and service (1). One father, a physician, died when his son was four years old. Another left home before his son ever knew him. The mothers of the Scholars all finished at least the eighth grade. Seven of them graduated from high school; three earned bachelor's degrees, and one earned a master's degree. One was a college teacher, one a personnel manager, and one a clerk. The other five were housewives.

Teachers

The fathers of the Teachers were a diverse group. One had no education at all. Two stopped attending school in the seventh and eighth grades. Five graduated from high school and had some post-high-school education. Only two of them earned a college degree however. Their occupations were classified as mechanical (3), labor (2), administrative (2), and commercial (1). The mothers of the Teachers similarly represented a variety of levels of education. Grades five, eight, nine, and ten were the termination points for four of them. Three graduated from high school, and one continued to college to earn a medical degree. One mother had no education. One practiced medicine, one was a bookkeeper, and one worked for three years as a factory worker. Five were housewives.
Consultants

The Consultants' fathers had educations ranging from sixth grade to doctoral degree. One father completed only the sixth grade; for three, the eighth grade was their last year; three graduated from high school; and one continued to attain his doctorate. The occupations of these fathers were mechanical (3), commercial (2), labor (1), administrative (1), and farmer (1). The mothers' education ranged from grade six to master's degree. One mother stopped attending school after sixth grade; three stopped after eighth grade; four finished high school; and one of the high school graduates continued for her bachelor's and master's degrees. All of these mothers were housewives.

Place of Birth and Childhood Environment

In the interest of brevity, the data on professors' birth and childhood environment are presented in Figures 7 and 8. The data are organized only according to the Areas because of the lack of variety among them.

Siblings

The number, sex, and highest level of education of the siblings of the professors are presented in Figures 9, 10, 11, and 12. These four figures are organized on the basis of the professors' Areas.

A single trend is apparent in all of the groups, whether
### Mathematicians

<table>
<thead>
<tr>
<th>Professor</th>
<th>Birthplace</th>
<th>Childhood Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Yugoslavia</td>
<td>Moved frequently from village to village</td>
</tr>
<tr>
<td>2</td>
<td>Germany</td>
<td>Middle-class urban</td>
</tr>
<tr>
<td>3</td>
<td>Indiana</td>
<td>Middle-class suburban</td>
</tr>
<tr>
<td>4</td>
<td>Illinois</td>
<td>Middle-class suburban</td>
</tr>
<tr>
<td>5</td>
<td>Ohio</td>
<td>Urban ethnic</td>
</tr>
<tr>
<td>6</td>
<td>Kansas</td>
<td>Middle-class suburban</td>
</tr>
<tr>
<td>7</td>
<td>Wisconsin</td>
<td>Middle-class suburban (Family lived in a series of German towns for seven years after WW II.)</td>
</tr>
<tr>
<td>8</td>
<td>Indiana</td>
<td>Middle-class suburban</td>
</tr>
</tbody>
</table>

### Zoologists

<table>
<thead>
<tr>
<th>Professor</th>
<th>Birthplace</th>
<th>Childhood Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>England</td>
<td>Middle-class suburban</td>
</tr>
<tr>
<td>2</td>
<td>Ohio</td>
<td>Small town</td>
</tr>
<tr>
<td>3</td>
<td>New York</td>
<td>Small town, farm</td>
</tr>
<tr>
<td>4</td>
<td>Illinois</td>
<td>Middle-class suburban</td>
</tr>
<tr>
<td>5</td>
<td>Ohio</td>
<td>Working-class neighborhood</td>
</tr>
<tr>
<td>6</td>
<td>Ohio</td>
<td>Small town</td>
</tr>
<tr>
<td>7</td>
<td>Ohio</td>
<td>Suburban ethnic</td>
</tr>
<tr>
<td>8</td>
<td>New York City</td>
<td>Middle-class suburban</td>
</tr>
</tbody>
</table>

Figure 7
### Engineers

<table>
<thead>
<tr>
<th>Professor</th>
<th>Birthplace</th>
<th>Childhood Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ohio</td>
<td>Small town</td>
</tr>
<tr>
<td>2</td>
<td>Delaware</td>
<td>Middle-class suburban (Ohio)</td>
</tr>
<tr>
<td>3</td>
<td>Germany</td>
<td>Rural Ohio (since age 3)</td>
</tr>
<tr>
<td>4</td>
<td>Ohio</td>
<td>Middle-class suburban</td>
</tr>
<tr>
<td>5</td>
<td>Ohio</td>
<td>Middle-class suburban</td>
</tr>
<tr>
<td>6</td>
<td>England</td>
<td>Rural (England), Working-class suburban (Ohio)</td>
</tr>
<tr>
<td>7</td>
<td>Ohio</td>
<td>Urban ethnic</td>
</tr>
<tr>
<td>8</td>
<td>Minnesota</td>
<td>Rural ethnic</td>
</tr>
</tbody>
</table>

### Physicians

<table>
<thead>
<tr>
<th>Professor</th>
<th>Birthplace</th>
<th>Childhood Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Germany</td>
<td>Village</td>
</tr>
<tr>
<td>2</td>
<td>Latvia</td>
<td>Middle-class urban</td>
</tr>
<tr>
<td>3</td>
<td>Illinois</td>
<td>Small town (Illinois) (Family moved to Louisiana when son was fourteen.)</td>
</tr>
<tr>
<td>4</td>
<td>Ohio</td>
<td>Middle-class suburban</td>
</tr>
<tr>
<td>5</td>
<td>Ohio</td>
<td>Upper-middle-class suburban</td>
</tr>
<tr>
<td>6</td>
<td>New York</td>
<td>Small town (Family moved four times while son was in school.)</td>
</tr>
<tr>
<td>7</td>
<td>Ohio</td>
<td>Middle-class suburban</td>
</tr>
<tr>
<td>8</td>
<td>Massachusetts</td>
<td>Middle-class suburban</td>
</tr>
</tbody>
</table>

Figure 8
## Siblings of Mathematics Professors

### Figure 9

<table>
<thead>
<tr>
<th>Professor</th>
<th>Oldest Brothers</th>
<th>Oldest Sisters</th>
<th>Youngest Brothers</th>
<th>Youngest Sisters</th>
<th>Total Number of Siblings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-</td>
<td>-</td>
<td>(1) 7 yrs. BSc</td>
<td>(1) 3 yrs. PhD</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>-</td>
<td>-</td>
<td>(2) 3 yrs. MD, MD</td>
<td>(1) 3 yrs. MD</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>-</td>
<td>-</td>
<td>(2) 3 yrs.</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>-</td>
<td>-</td>
<td>(1) 2 yrs. BSc</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>(1) died age 2</td>
<td>-</td>
<td>(1) 10 yrs. High School</td>
<td>(1) 2 yrs. BEd</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>(1) 7 yrs. BSc</td>
<td>(1) 5 yrs. High School</td>
<td>(1) 1½ yrs. - Killed in WW II</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>-</td>
<td>-</td>
<td>(2) 2 yrs. BSc</td>
<td>(1) 10 yrs. MA</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>2</td>
<td>1</td>
<td>10</td>
<td>4</td>
<td>17</td>
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</table>

*(1 died)*
### Siblings of Zoology Professors

**Figure 10**

<table>
<thead>
<tr>
<th>Professor</th>
<th>Older Brothers</th>
<th>Older Sisters</th>
<th>Younger Brothers</th>
<th>Younger Sisters</th>
<th>Total Number of Siblings</th>
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<tbody>
<tr>
<td>1</td>
<td>(1) 2 yrs.</td>
<td></td>
<td>(1) 2 yrs.</td>
<td></td>
<td>2</td>
</tr>
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<td></td>
<td>(died age 1)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td>(1) 3 yrs. - Killed</td>
<td></td>
<td>1</td>
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<td></td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>3</td>
<td>(3) 14 yrs.</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
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<tr>
<td></td>
<td>CPA</td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>10 yrs.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MD</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
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<td>7 yrs.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BSc</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
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<td>(2) 3 yrs.</td>
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<td>2</td>
</tr>
<tr>
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<td></td>
<td></td>
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<td></td>
</tr>
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<td>5</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
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<td>(1) 2 yrs.</td>
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<tr>
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</tr>
<tr>
<td>Total</td>
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<td>5</td>
<td>2</td>
<td>3</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>(1 died)</td>
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</table>
## SIBLINGS OF ENGINEERING PROFESSORS

### Figure 11

<table>
<thead>
<tr>
<th>Professor</th>
<th>Older Brothers</th>
<th>Older Sisters</th>
<th>Younger Brothers</th>
<th>Younger Sisters</th>
<th>Total Number of Siblings</th>
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<tbody>
<tr>
<td>1</td>
<td>-</td>
<td>-</td>
<td>(1) 4 yrs. High School</td>
<td>(1) 8 yrs. High School</td>
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<tr>
<td>2</td>
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<td>-</td>
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<tr>
<td>3</td>
<td>(1) 6 yrs. Ninth grade</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
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<td>-</td>
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<td>1</td>
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<td>-</td>
<td>(1) 2 yrs. BA</td>
<td>(1) 5 yrs. High School</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>-</td>
<td>-</td>
<td>(1) 4 ½ yrs. High School</td>
<td>(1) 8 yrs. High School</td>
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<tr>
<td>7</td>
<td>-</td>
<td>(1) 1 ½ yrs. (died age 10)</td>
<td>-</td>
<td>-</td>
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</tr>
<tr>
<td>8</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1</td>
<td>1</td>
<td>4</td>
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</table>
## Siblings of Medical Professors

**Figure 12**

<table>
<thead>
<tr>
<th>Professor</th>
<th>Brothers</th>
<th>Sisters</th>
<th>Brothers</th>
<th>Sisters</th>
<th>Total Number of Siblings</th>
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<tbody>
<tr>
<td>1</td>
<td>-</td>
<td>(1) 3 yrs. High School</td>
<td>(1) 5 yrs. BSc</td>
<td>(1) 2 yrs. PhD</td>
<td>3</td>
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<tr>
<td>2</td>
<td>-</td>
<td>-</td>
<td>(1) Step-brother, same age Tech., High School</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>(1) 2 yrs. died age 1</td>
<td>-</td>
<td>(1) 12 yrs. High School</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>-</td>
<td>-</td>
<td>(1) 2 yrs. Tenth grade</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>(1) 4 yrs. BEd</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
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<td>(1) 3 yrs. BA</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>-</td>
<td>(2) 8 yrs. BEd 5 yrs. BEd</td>
<td>-</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1</strong></td>
<td><strong>3</strong></td>
<td><strong>4</strong></td>
<td><strong>3</strong></td>
<td><strong>11</strong></td>
</tr>
</tbody>
</table>

*(died)*
by Areas or by Activities, and that is that in twenty (sixty-six per cent) of the thirty-two cases, the professors were the first born child in the family. Four other professors had older siblings who died before they were born, which makes a total of twenty-four cases (seventy-five per cent) in which the professor was in effect the first born in his family. Of the remaining eight professors, only three had older brothers. Thus, twenty-nine (ninety-one per cent) of the professors were the oldest sons in their families. Five of the professors were only children. The data were not reorganized according to Activities of the professors because of the small degree of difference among the professors on this variable.

It was also noted that the men in the Applied Areas had, as groups, a smaller number of siblings than did the men in the Basic Areas. In the Mathematics group there was a total of seventeen siblings; in Zoology, fourteen, in Engineering, seven, and in Medicine, nine. The largest number of children in any one family was reported by a zoologist who had four brothers. Four mathematicians, one zoologist, and one engineer had three siblings. The mode number of siblings was one, reported by a total of eleven professors.

Relationship with Parents

Mathematicians

Four mathematicians reported that they saw little of their fathers. The father of one died when his son was four years old.
The mother in this case re-entered the university and obtained bachelor's and master's degrees after her husband's death. The boy was reared in an academic ambiance, but he saw little of his mother because of it, and reported that the neighbors were "substitute parents" for him. The other three who said that they didn't see their fathers often were alluding to the amount of time that the fathers spent working. One of these fathers did work that was seasonal and was unemployed for five or six months of the year. He was "aloof from the family" and would go to the Union Hall to play cards. That father died when his son was seventeen years old, and the family was subsequently supported by the eldest son. His mother was not openly affectionate. She was described by the mathematician as one who "concentrated on the home; she had no time for socializing and frivolities; her main objective in life was to run the house on the least amount of money possible." The other mathematician whose father was not around the home very much said that his father was actually not living at home for a period of two or three years. He was closer to his mother, but he expressed pride in the fact that his father was an engineer and spent time on engineering pursuits. The fourth mathematician whose father was not at home much said that his father was "too hard-working and got interested in projects and organizations; was more distant from us (three children) than Mother was." The mother was described as "pleasant enough." This mathematician also made the statement, "My parents never show any great pleasure or displeasure." No refer-
ence to affection in the family was made.

A fifth mathematician also reported that his father was not home very much due to the demands of his job, but the difference lay in the fact that his father would take him out to do things when he did have free time. This mathematician expressed preference for his father's over his mother's company.

Two mathematicians reported that they were close to their fathers. Both fathers took their sons with them whenever possible. One was a physical-fitness enthusiast and took his son to the gymnasium to work out with him. The other father was an engineer and took his son to the mines and workshops with him. Neither of them offered much information about their mothers. One did say, "I was moderately close to Mother," but he did not mention her in any other way.

The eighth mathematician did not seem close to either parent, not because they rejected him, but because he rejected their guidance. His father was eighteen years older than his mother and was very sick for several years before his death when the mathematician was twenty-seven. The mother was the dominant parent, but the son described himself as "a tyrant." He did not move away from home until he was twenty-eight years old. His mother never forgave him for the move.

Zoologists

Three zoologists came from broken families. One lived with his father and older sister after his parents divorced when he was
eight years old. His father was a laborer and was seldom home. When he was home, the relationship was "not what you would consider in this country as a father-son relationship; I didn't see much of him in terms of companionship. We didn't have much in common." The sister who reared him had little control over him because she was too young to really command his respect being only six years older than he. A second zoologist's parents divorced when he was seven years old. He and his mother and younger brother stayed with his maternal grandmother for three years until his mother remarried. At that time he elected to stay with his grandmother rather than go to live with either his mother or his father. He was very close to his grandmother, and through her he knew everyone in the small town where they lived. He professes to have been reared by the whole town. After the divorce, he saw his mother about once a week and his father less often than that. The third zoologist who came from a broken home never knew his father who left when the son was three years old. He lived with his mother, and her father lived with them for several years. No one at home controlled him, however; he was very self-willed. He had a deep affection for his grandfather, who was "the only male image I ever had."

Two of the Zoologists' fathers were seldom home to spend time with their children because they worked long hours. One of the fathers "didn't have time to relax on things." When he did try to do things with his son he "was a bit impatient with me for slow development. He aimed at too high a level for me in the engineering
direction." His mother was aggressive and ambitious for her children, and tended to overlook the boy for his two younger sisters. The other zoologist's father worked ten or twelve hours a day, six days a week, and sometimes on Sunday. When he was home, he did spend time with his son mushroom hunting and fishing. The zoologist as a boy spent much time with his grandfather fishing and just sitting by the river. His mother spent a great deal of time with him. The family was a close one.

Two zoologists were very close to both their mothers and fathers. One was an only child, and the other had a younger sister. Both were encouraged by their families to pursue their interests, and both families enjoyed family excursions.

Engineers

Three of the Engineers had dominant mothers who seemingly ruled over both husbands and children. The fathers were all working men (farmer, machinist, and carpenter), and the mothers stressed what a lack of education had done to hold them back. Comments on the mothers were "Mother liked to run things, and if things didn't go her way, she wasn't too happy sometimes," "She sort of steered things in the family," and "Mother was dominant in running the house." Corresponding comments about the fathers were, "He was easy-going, enjoyed life," "He was easy-going," and "Father was not terribly demanding." These fathers were always home after work and spent time with their children. The sons all identified with their fathers as indicated by statements like, "I always felt that I was a lot like
"Dad," "Father read whatever we kids read at school," and "I always liked doing anything with him." One interesting commonality among these three engineers is that they are the three oldest in the group. All are in their fifties while the other five engineers range in age from thirty-nine to forty-six.

Two other engineers were close to their fathers and shared activities with them. One said that he and his father worked together on repairing the automobile and the tractor. He did not mention his mother very much except to say that she was "healthy, happy, and active." The other engineer who was close to his father was reared by his father and his paternal grandmother. His mother died when he was two years old. An only child, he was treated by his father as an adult and attended meetings and dinners with his father where no other children were present. The boy was not close to his grandmother, who spoke very little English. In fact, he referred to her death when he was fourteen as "a blessing, a relief." His relation with his father was ambivalent. Although his father spent much time with him, encouraged him scholastically, and gave him all of the advantages, the son recognized in adolescence that his father was trying to realize his own unachieved ambitions through the son. The son married early in college which caused a severance of their relationship which lasted for five years and has never really been mended.

One engineer declined to talk about either his father or mother in personal terms. He said that his father didn't enter
into the lives of the children very much. He elaborated somewhat on his mother. A German immigrant, she never really adjusted to the United States. His description of her was that she "tended to be introverted," the same phrase which he used to describe himself. The parents of another engineer were second generation immigrants. They had his interests at heart and offered him encouragement, but he did not describe either of them in specific terms or express the nature of their relationship. The last engineer whose parents were not described in terms of personal relationship said that he spent week ends with his maternal grandparents. His parents delivered him there each week end and left his brother with the paternal grandparents. This engineer was closest to his grandfather who retired when the boy was eight. The grandfather puttered around the yard and spent long hours telling stories to the boy. The engineer said that his father did not spend time with him like his grandfather did. His description of his mother was, "She ran the household and was active in various bridge clubs."

Physicians

Two physicians' families were close, and their fathers spent time with them "doing the usual things that fathers do with their sons, playing ball, talking..." The family unit was close, and both spoke of doing things with the entire family as well as with their fathers.

One physician was very close to his father, but not so close to his mother. The family did not ordinarily do things as a group.
The father would get his son out of school to take him along on business trips, and they went boating and camping together. The physician described his father as "a good person, but very volatile." His mother was the balance; she was "fundamentally unflappable."

The two physicians who were born and reared in Europe both mentioned that their fathers took them to work with them. One was an engineer and took the boy to the plant with him occasionally. This physician described his father as "a practical man; business took up most of his time." His mother was "always busy with the household." The other European physician's mother was a physician herself, and his father was an administrator in the forestry department. The boy accompanied his father on trips checking forests. He said about his father, "He always worked. When he had leisure time he worked around home doing things like building fences."

This physician identified with his father. His comment was, "I'm like my father. I discovered that the apple doesn't fall very far from the apple tree."

The other three physicians seemed to have very little affection for their families. One actually expressed animosity toward his mother and pity for his father. "I didn't feel close to them" summed up his sentiments. The other two were less vituperative in their descriptions of their families, but again there was no expression of affection. In one case, the father was a traveling salesman and was away from home six months of the year. The physician said, "I was not very close to him. I don't think I'm very close to anyone anyway, so it was a function of me rather than any-
thing else." Of his mother he said, "I'm probably closer to her than to my father. We talked more, but I would say that I wasn't close to her very much because we didn't have common things to talk about. I had my life at school and she didn't enter into that." The other physician who did not describe a very close family sentiment said, "I was not particularly close to my own father. The War was on; he was busy." He did not speak in specific terms about his mother, but he did decry the fact that they talked constantly about his becoming a doctor or an attorney or a politician.

Researchers

Two of the Researchers, a zoologist and a physician, reported that their families were close. They both reported that they did things with the family group as a whole and especially with their fathers. Two other physicians were close to their fathers and shared activities with them, but not with their mothers. These two mothers receded into the background in the narration of both physicians. Their fathers took them to work with them and let them play with the machinery at their job sites.

Another researcher whose mother died when he was two years old spent a great deal of time with his father. They played cards and checkers and went fishing together. His father took him places with adults and treated the boy as an adult. Their relationship continued to be close until the boy entered college and married. That displeased his father so greatly that he would not speak to his son for several years thereafter. Basically, the father was rearing
his son to fulfill his unrealized ambitions.

Two researchers were close to their fathers, but made little mention of their mothers. Both of these fathers took their sons to their places of work and let them play with the machinery there. One of these described the relationship thus, "There was not outward show of affection between Dad and me, but it was a secure relationship. We worked a lot together. I helped Dad take automobiles apart." The other said, "My early life was very much influenced by living in small mining towns and watching my father working."

The three remaining researchers were not really close to either parent and gave no indication that their families had an element of affection. One did say that his father took him to his plant, but there was no expression of affection between them. Another said, "My father didn't have time to relax on things." When this father tried to help his son on projects, he set too high a level of achievement for his son and would become impatient with him when the boy could not achieve the goal. This researcher was closer to his grandfather who was much more accepting. The third researcher who did not describe his family in affectionate terms described himself as a "tyrant" who was not controlled either by his father, a sick and elderly man, or his mother, who was not very successful in her efforts to control by psychological means. He described his mother as having "a strong personality; she was dominant." He lived with her until he was twenty-eight years old, and even then when he moved away she was never reconciled to his leaving her.
Two scholars spoke of their families as close. Both talked at length about their mothers and fathers. One was also close to his maternal grandmother who lived with the family. The fathers worked with their sons on academic tasks and encouraged their interests. The mothers in both cases were warm and gregarious and always interested in what their children were doing.

The remainder of the Scholars had less close families and were especially distant from the fathers. Two of them did not know their fathers. One father died when his son was four years old, and the other left home when the boy was four years old. Both mothers went to college after the loss of their husbands and were involved with their studies and later their jobs. Consequently, one of the scholars was closer to his grandfather who was retired and living with them, and the other viewed the neighbors as his "substitute" mother and father.

One scholar, the son of immigrants, said that his parents "kept to themselves" and so did the children, but the family was not close. His father commuted to work in the city from the farm on which they lived and spent his time at home working in the orchard. He did not enter into the lives of his sons very much. This mother had many health problems and did not adjust to life in the United States well. She "tended to be introverted," according to the scholar, a term he used to describe himself later in the interview.
Three of the Scholars did not give any indication of the level of affect in their families. One said, "My parents never showed any great pleasure or displeasure," and he said that his father was too hard-working, did not spend time with his sons. His father was, he said, "More distant from us than Mother was." Another scholar, who was taken to his grandparents' house by his parents every weekend, viewed his father as an authoritarian figure. He liked his grandfather better because the grandfather spent time with him. His mother, who was around the house all the time, was not described in terms of personality or personal relationship with the children at all. The final scholar expressed negative feelings toward his parents. He described his mother as "the most self-centered person I have ever known," and his father as one who "had to work all the time and was a very disillusioned man." He did not feel close to either of his parents.

Teachers

None of the Teachers described their family lives as close ones. Several did speak of being close to their fathers, but none of them disclosed intimacy with his mother.

The two teachers who explicitly stated that they were close to their fathers did not say much about their mothers. Both teachers worked with their fathers, one on the farm and the other for relaxation in the gymnasium. One of the mothers worked, and the boy was watched at home by his grandmother who lived with the family. The other's mother was a housewife and not active in other areas.
One teacher's parents divorced when he was seven. When his mother remarried four years later, he elected to remain with his grandmother. He was close to his grandmother and through her to everyone in the small town where they lived. He seldom saw his father, and saw his mother, who lived in another town, only once a week or so.

One of the Teachers, a European, was reared in a family where both parents were professionals. His mother, who was a physician, worked in a children's hospital, kept office hours, and made house calls. Although there were some times when the family was together, it was infrequent and mostly on weekends. He used to accompany his father on business trips occasionally. He expressed no particular attachment for either parent.

Another teacher was reared in a home where the mother was dominant. She set up a strict schedule for the children to follow which placed top priority on school work and allowed little time for play. "Leisure" time was devoted to chores and repairs around the house. The father was a "do-it-yourselfer" and kept busy reading when he was not working. The family took walks and trips together primarily for educational and cultural purposes. They were not designed to entertain, but to improve their minds. No affection was expressed.

Three of the Teachers said that their fathers worked long hours and were home little. One of them said that his father "was aloof from the family" and spent his spare time at the Union Hall. His mother was most interested in running the house on very little
money and had no time for "socializing or frivolity." In general, in these three families the members each had his well-defined role which he fulfilled independently of the other members of the family.

Consultants

None of the Consultants reported particularly close families. Two of them were close to their fathers, but did not express affection or closeness with their mothers. In one family, the mother "sort of steered things in the family" and the father was "easy-going." The boy felt happy doing things with his father who participated in boy scouts with him and took him fishing. They worked together on repairs around the house. In the other family, the father took his son with him on business trips and went boating and camping with him. The mother did not figure very strongly in his description of his family. His only comment about her was that she was "fundamentally unflappable."

The third consultant identified with his father, but did not indicate that they were close. His mother was also dominant in the family, and according to the consultant "liked to run things, and if things didn't go her way, she wasn't too happy sometimes." They lived on a farm and had many relatives in the surrounding area.

The remaining five consultants all said that their fathers were not home much because of their work. None indicated that he was close to his mother. In fact, one of them lived with his father after his parents were divorced when he was eight years old, and saw
his mother only occasionally. The others were with their mothers more than their fathers but did not feel especially close to them.

School Experiences

General Attitude Toward School

Mathematicians

Half of the Mathematicians reported liking school, and the other half reported attitudes toward school that border on the negative side. The latter group's comments were:

I was not a very serious student until my junior year in college. I didn't like elementary or high school. I never found the subjects very exciting.

I hated school, not because of the subjects, but because it imposed a time limit on me.

I didn't like school particularly.

There was unanimous agreement among the Mathematicians that mathematics was their favorite and best subject from an early age. Subjects that require thinking which deviates from the strictly logical were generally disliked by the Mathematicians. For some, slow reading ability was the reason given; for others, it was the ambiguity of the humanities and social sciences which was unpleasant to them. Two comments that illustrate the feelings of Mathematicians about their school subjects were:

English was what I liked least although grammar was all right. I preferred subjects which were unambiguous, had logic, hard facts. History and social studies were bad. Psychology was good.
In elementary school I was a slow reader; later I didn't like literature or history although I did like grammar and Latin. Biology was so-so; I could take it or leave it. I've never been a good reader and have avoided any courses that would require reading like history, political science, psychology.

All of the Mathematicians reported that they were good students whether they liked school or not. None was the top in his class, but five reported being in the top three or four.

Zoologists

Only two of the Zoologists reported a liking for school in general. One of these had to quit school at age 14 because of health reasons, but he kept up with his studies on his own. The other was in the upper ten per cent of his graduating class, and did well in most subjects. He liked history and geography and biology better than mathematics or physics. The remaining six zoologists expressed boredom with or dislike for school. Illustrative comments were:

I was never really a good student. I saw little relevance in the things I did in school. I never cared much for courses other than science, and many of the science courses bored me too.

I was a poor student all through primary and secondary school. The routine of school seemed sort of dreary. I didn't drill much on math and was rarely able to see the attractiveness and orderliness of mathematics as a discipline. Geometry was a high point. I managed to get by generally doing badly in everything. High school was just another thing to interfere with the things I wanted to do. I just did my high school work in a very casual, sloppy fashion so I could do other things.

Two zoologists mentioned specific courses besides biology or science courses. One spoke of algebra II as "a game--it was fun," and mentioned liking literature very much. The other remembered an
early (second or third grade) fascination with ancient people which was stimulated by the discovery of the Tomb of Tutankhamen at that time, and good progress in English during his junior and senior years of high school due to the fact that he was allowed to begin writing about nature then.

In all, the Zoologists seem to have vague and mostly negative memories of school in general. Few of their experiences were perceived as influences upon later development.

Engineers

One half of the Engineers expressed a definite liking for school, and the other half were explicit in their disaffection for school. In all four cases of the latter group, boredom was reported. Of those four, two were valedictorians of their high school graduating classes and one was salutatorian. The four who liked school reported being serious students; one said that he had to work hard scholastically, but the other three said school was easy.

They did not report disliking specific subjects in school. Emphasis of interest was in the sciences and shop, but difficulty and disinterest were not expressed for courses in the humanities and social sciences. Latin and French were mentioned as enjoyable courses by two engineers, and two others mentioned that they enjoyed writing reports.

Physicians

Five physicians reported liking school in general; the other
three were bored or disliked school. They all reported achieving well above average in school, however.

Comments from the two who found school boring were:

School was too slow and repetitious. I was moderately interested, well above average, of course. I found school in general rather boring except later on when there were courses in science, physics, and chemistry. Then I had a great interest and began reading a great deal for myself.

I led the class in chemistry, set the curve. Some of the things we had in class I had already learned in my own experiments. I think my interest was from an ego base rather than from intrinsic interest in the subject matter. It was something that I was good at. I found school overall boring, especially history.

Most of those who liked school were primarily interested in the sciences, but other subjects were mentioned as well. The following comments are examples of their attitudes:

I had a very good time in high school. I did well in school, it came easy to me, and I enjoyed it. Knowing that I wanted to be a doctor, and having been warned that you had to have good grades to get into college and that you had to have good college grades to get into medical school, I worked hard in school. I liked biology, chemistry, and physics more than other subjects, but I had all A's in high school.

I liked algebra and mathematics and I made honor society in high school.

I had practically a straight-A average in high school. I liked social studies and history.

The Physicians as a group reported a variety of interests that went beyond the sciences. The two who found school boring appeared to have had narrower interests, restricted to the sciences, than those who liked school. The ones who liked school did well in all subjects.
Researchers

The Researchers, except for the zoologists, were good students in school in all courses, but especially in the sciences and mathematics. The zoologists both did work far below their capacities in secondary school. One said he found the routine of school "sort of dreary." The other said that he saw little relevance in the things he did in school. Although others expressed boredom with school, they applied themselves and excelled. One engineer was the top of his class in eighth and twelfth grades, one mathematician said that he was always among the top three in each year of school, and the others said that they were well above average in their studies. None expressed a great affection for school.

Scholars

Most of the Scholars liked school. Only the mathematicians and one zoologist said that they did not enjoy school. One mathematician did not like elementary or high school because he never found the subjects very exciting. He preferred mathematics and science because they were unambiguous and had logic and hard facts. The other mathematician described himself as "not a very serious student. I didn't take school seriously but I made fairly good grades." The zoologist did not like school because teachers tried to impose a discipline on him which he had successfully resisted at home. He was strongly self-willed and used to getting his own way; he resented
the didactic way in which courses were taught, but he did well.

The other zoologist, who had to quit school at age fourteen, liked it, as did the two physicians. The physicians were especially motivated to study in school because they realized that they would need high grades to get into medical school. The engineers both said that they liked school, but one said that "the stuff came so easily that I would get bored." Both of them did well in high school and had almost straight-A averages.

Teachers

Three of the Teachers, a zoologist, an engineer, and a physician disliked school because they found it boring. However, they all did well in school. The engineer and physician liked science and foreign language courses better than history and literature. The zoologist rejected school categorically, preferring to expend his energies on his father's farm.

The other teachers liked school and liked most of their subjects. The zoologist who liked school did so primarily because of his involvement in extra-curricular activities, sports, and band. He said that he was not a very good student, but he did like his biology teacher and made straight A's in that class. The two mathematicians did well in all of their courses, but liked mathematics best. Both did a lot of reading outside of school. The engineer enjoyed high school and said that he did not have any dislikes among his subjects. The physician also said he liked all of his subjects, but he had
somewhat less interest in literature than in mathematics, physics, and chemistry.

Consultants

Three of the Consultants, a mathematician, a zoologist, and a physician, reported that they did not always like school. The mathematician attended several German schools from the time he was nine to sixteen years old and developed a dislike for history and biology, both of which were more difficult for him than mathematics because of the language problem. He always liked reading and enjoyed school more when he returned to the United States for his last two years of high school. The zoologist and physician liked school more when they got into high school. The zoologist said of his schooling up through eighth grade, "Everything up to that time in school was very basic and didn't have the fascination of later work. All the way through school, if there was a fascination or suspense involved, I was right there. Once I understand something, though, I'm really not interested anymore." He liked reading and literature but not grammar. He commented that biology as he knew it and as a course were two different things. The physician liked school more in high school because he was attending a military school where the structure of the school gave him an opportunity to excel academically which was his forte. The other consultants liked school in general.
Outstanding Teachers

Mathematicians

As might be expected, the Mathematicians reported mainly mathematics teachers as outstanding in their school careers. The reasons cited for teachers' prominence varied among the professors. Notable were references to teachers who gave individual attention, teachers who were enthusiastic about mathematics, teachers who gave interesting or challenging assignments. Four professors commented on teachers who gave individual attention. Two are quoted below as examples.

The mathematics teacher my senior year in high school developed a group of students, about five of us, who were pretty close. The course became a real seminar course after a short period of time, and we were expected to work pretty much on our own.

My geometry teacher encouraged me and took a personal interest in me. She made me work hard, and during that year pushed me through an algebra II book. Every year several students were sent to take the mathematics examinations at the state university, and she always worked hard to get them ready. I had her again the following year for trigonometry and solid geometry.

Four professors commented on their teachers' enthusiasm for their subjects. Comments regarding enthusiasm among teachers were the following:

The teacher's interest stands out in my mind.

They were very able to develop the liking for mathematics.

It was obvious that Father H-- really enjoyed mathematics.

Teachers who gave interesting, challenging work were described as follows:
We could see from the first lesson or class that it was worthwhile to study.

My fifth grade teacher used to arrange competitions in the class. I always got first place in the class, and then competed with the teacher. That's my first remembrance of a feeling of accomplishment in mathematics.

She always gave materials which were interesting. I respected her because she was scholarly.

My ninth grade mathematics teacher gave challenging extra problems to be worked when the regular work was done.

One mathematician recalled a good teacher who demonstrated none of the above qualities. He was just "very dedicated."

His style was nothing unusual; he just did a very good job of communicating his subject. He got it down us. There was no enthusiasm, just drill work. There was no nonsense at all during the class, and the material went down. He didn't encourage initiative, but he rewarded it when he found it. I think this was a weakness of his that he did not encourage innovation and ingenuity. He acknowledged something that he had predicted would not occur in a student.

Even so, he was remembered as a fine teacher by his student.

Only three mathematicians commented on teachers outside the field of mathematics. The respective reasons for naming them were that the teacher 1) "made a subject (botany) interesting," 2) "did a good job of teaching (French)," 3) "let us go wild writing anything we wanted to (in English)." The mathematician who named the botany teacher as outstanding did not recall any mathematics teachers as outstanding.

Zoologists

Only two zoologists commented on high school biology teachers. One said that he liked his biology teacher very much and that he made
straight A's in biology although he was not a superior student in other subjects. The other zoologist's high school biology teacher hired him to take care of the school solarium and to do some work around her house.

Two zoologists remembered teachers from other disciplines. One was a physics teacher who recognized his interest in electronics and appointed him to supervise audio-visual equipment. That physics teacher also told him to teach a unit on electricity to the class. The second zoologist remembered only two grade school teachers from third and sixth grades whom he liked because "they let me do things."

The remaining four zoologists did not recall any teachers who were important in their development.

Engineers

Like the Mathematicians, the Engineers recalled mainly their mathematics teachers along with some physics teachers. The Engineers mentioned their teachers' ability to motivate students as an outstanding quality. Allowing their students to work ahead of the class was also cited as an important feature of the remembered teachers. Three engineers did not recall any teachers who had particularly helped them or made an impression on them.

References to the ability of teachers to motivate students were made by four engineers. Excerpts from the comments of two were:

When I was a freshman in high school, the Principal taught algebra. He was an excellent teacher because he gave prize problems which motivated the students. They were problems which you really had to work on, sometimes for a week or more.
My physics teacher in high school was also my homeroom teacher. He was a very good teacher; he motivated his students with tricks that made physics come alive.

Allowing students to work at their own pace was a quality of the teachers remembered by three engineers. Two of them described it this way:

My eighth grade mathematics teacher acted as a consultant. We were allowed to go at our own pace. There were several texts. We set goals and got there as fast as we wanted to. I was greatly impressed by the way that was handled.

I started to get a serious interest in mathematics in junior high school when I first started to get algebra. I had a splendid teacher who started me out well in algebra and I got off to a good start in it. I found myself ahead of other students when I moved to another school, and the teacher there gave me problems to work on that were harder than the classwork. That gave me a feeling of accomplishment.

Other positive comments made by the Engineers about their teachers were centered on the teachers' interest. About such teachers, the following comments were characteristic:

My high school mathematics teachers really seemed interested in their subjects.

My mathematics teacher was a very impressive guy who worked a lot with kids.

They all showed a great deal of interest.

The three engineers who did not recall specific teachers made these comments:

My teachers did not impress me one way or the other. I didn't have a favorite subject in school. I wasn't extended in high school.

I had ordinary teachers, no individuals were outstanding.

I knew all my teachers well.
Physicians

Five of the Physicians remembered specific teachers from a variety of disciplines, but mostly from the sciences. The quality of teachers which was perceived as most outstanding among the Physicians was the ability to make students think. Two illustrations of their comments were the following:

There was one teacher who was an interesting person. He never knew much about his subject, but he stimulated you to think. He taught physics and most anything they didn't have a teacher for.

My science teacher in seventh grade would ponder the enormous complexity of the heart. This little thing that weighs 3/4 pound pumps millions of gallons of blood in a lifetime, and has its own intrinsic electricity and everything. And he'd ponder some of these tremendous questions whereas other teachers would say, "Well, this is the genus hymanoptera and these are butterflies." Straight fact devoid of concept isn't very interesting. Science teachers who are very factual are not very effectual.

History, art, language, and mathematics teachers were also mentioned by the Physicians. The reasons for remembering them were that they were dedicated or that they were pleasant, had nice personalities. Three physicians did not report any influential teachers.

Researchers

Four researchers named teachers that were outstanding in their memories. Three of the four were reared in Europe and spoke of the outstanding training their teachers had as well as the fact that they were able to give personal supervision to students who showed promise in their studies. The teachers they recalled were all science teachers. The teachers' interest for the subject and
for their students was evident. The fourth researcher remembered his third and sixth grade teachers as the only ones he liked in school; the reason that he liked them was that they let him do things. The remaining four researchers did not recall individual teachers as outstanding. One said that he had "ordinary teachers," and another said, "There were no teachers who affected me one way or the other."

Scholars

    Half of the Scholars did not speak of individual teachers as influential in their development. One did not mention any teachers before the university level, and another said that he had no outstanding teachers. The third said, "I don't think we had very good teachers... It was bad teaching." The fourth scholar said, "My teachers did not impress me one way or the other."

    The other half of the Scholars did comment on the effects that certain teachers had on them. Two had teachers in high school who recognized and encouraged their talent in mathematics. The Principal, who had a master's degree in mathematics, taught one of them. The other was coached by his geometry teacher who in two school years pushed him through three years of mathematics. She sent him to the state mathematical examinations where he received medals three years in a row. That same teacher made arrangements for the professor-to-be to attend a university extension during his senior year of high school in order to take mathematics beyond the level offered by the high school.
Another scholar was also taught algebra by his high school principal. The professor described the Principal as "an excellent teacher because he gave us prize problems which motivated the students. They were problems which you really had to work on, sometimes for a week or more. He also coached us for the State examinations. All of us finished in the top fifteen of the state competition."

Finally, one scholar recalled his seventh grade science teacher and his high school chemistry teacher. Both of them went beyond mere recitation of facts and pondered big concepts which brought exciting questions to the minds of their students. The chemistry teacher had a master's degree and had contributed several articles to scientific journals.

Teachers

Only two of the Teachers did not recall outstanding teachers from high school. Not only did the other teachers recall teachers, but several remembered good teachers from several different areas, not just the science teachers. Qualities of the teachers that were remembered varied from being stern but having the students' interests at heart to treating their students as adults and aspiring professionals, to listening to students, motivating students and making the subject "come alive," to allowing students to set their own goals and work at their own pace. There was no single quality which was common to the teachers that the professors named as outstanding, but the professors classified as Teachers did enumerate many teachers whom they remembered by name.
All of the Consultants remembered teachers who were outstanding in their high school years. An English teacher was cited for his practice of letting students "go wild in writing anything we wanted to write about. It was kind of fun. Before that I didn't particularly like to write." A botany teacher who was "a very interesting person" encouraged a professor's existing interest in morphology and plant physiology. Two consultants remembered teachers who assigned them responsibilities of taking care of school equipment. Both perceived this as a compliment to their interest and abilities. Because of these assignments, they spent after-class hours working with their respective teachers.

Two other engineers each remembered teachers from seventh grade and from twelfth grade. One went to a one-room school, worked ahead in mathematics and other subjects, and, aided by his teacher, skipped eighth grade. Later, his physics teacher, whom he described as "a wonderful man," was interested in him and actually made arrangements for him to attend college. The other had a mathematics teacher whom he described as "a splendid teacher who started me out well in algebra." He also had "an old gentleman for geometry and trigonometry who could highly motivate a student to work hard." This mathematician mentioned his English teachers as "the ones who got more work out of me than anybody else."

Two consultants each named several teachers. One recalled vividly his first grade teacher, an art teacher, a mathematics teacher,
and a history teacher. He decided that he liked the mathematics teacher because he liked mathematics, but the others he liked because they were nice people. One teacher whom he found particularly interesting was a teacher who taught physics and "most anything they didn't have a teacher for. He didn't know too much about the subject, but he could really make you think." The final consultant recalled his Latin teacher who "got me interested in the way man thinks," an English teacher who read Shakespeare and other poets aloud and gesticulated widely, and another English teacher who required that students memorize two hundred lines of poetry of their choice. This consultant revealed that he still enjoys reading poetry and literature and occasionally "gets off on a poet."

**Important School Experiences**

Mathematicians

The school experiences perceived as important by the Mathematicians focused on competition or on experimental programs. Four of the Mathematicians commented on the motivating effects of a competitive situation, and two others described the salutary effect of the experimental schools they attended.

The competition mentioned was of varying scope and at different levels. One professor simply said, "Scholastic competition in my high school was keen and widespread. There were large groups of people who were interested in mathematics." Another mentioned competition among his fifth grade class. The winner of class competition on arithmetic problems would then compete with the teacher.
He was always the winner in the class and remembers those sessions as his first feeling of achievement in mathematics. The third professor who mentioned competition as a motivating factor spoke of a mathematics class during his senior year in high school. Toward the end of the year the teacher took a poll of the class to see who the students thought were the two best in the class. This professor got only one vote for second place in the class. However, the teacher bestowed upon him the third place, a recognition that somehow motivated him and gave him confidence. He also remembered that when he was ten or eleven the teacher "flipped out little algebra problems" orally, and the students called out the answers. He used to get the answers to those problems much more quickly than the other students. The final professor who recalled the motivating effects of competition named state and national examinations as very important in his development. Starting in his sophomore year in high school, his geometry teacher coached him and he participated in all competitions on the state and national level, ranking highly in both for three successive years.

The Mathematicians who named experimental school programs as important in their development cited different reasons for it. One was a school where each teacher could do what he wanted according to his own principles. The professor's comment was,

It was not so much bent on formalized learning so I didn't fall into the routine, rote learning as early as some others. I was given enough time to do research. We independently went through books, formed an opinion, wrote an essay, and presented it to the class and the teacher.
In particular, he described a cultural core course where students spent half of their time with one teacher who combined history, art, literature, and music. In that course he did research on areas of my own interest. I went to various museums and libraries and took a number of major books written by competent people. I tried to form my impressions from books and memoirs trying to do a job as a historian would do. I was not taught very much; I was on my own. It was an amateur's job, but one of testing myself. The main thing is that I got pretty early in my life the idea of forming my own opinion.

This professor was born and reared in Europe.

The second experimental school described by a mathematician was also a European school.

It was the best school in the country, an experimental school where half of the professors had doctorates. We had special instructors, classes were small, and the quality of students was different from the small town schools I had been accustomed to. I really had to work to keep up with these students.

Two mathematicians did not report any school experiences which contributed to their development.

Zoologists

Four of the Zoologists mentioned school experiences which had an ultimate effect on the course of their development. Two of these experiences were general in nature and two were specific.

The general experiences perceived as important to their development by two zoologists were, for one, attending military school where he "learned to exploit the system without ever committing myself to it," and for the other, who attended an English
public school, the fact that while he was sixteen, seventeen, and
eighteen years old he had nothing but science, physics, chemistry,
botany, and zoology in school.

The specific experiences perceived as important to their
development by two other professors were due to the attention of
specific teachers. In one case, the professor recalled the biology
teacher in high school who hired him to take care of the school
solarium and help set up for laboratory sessions. In the second
case, the professor reported that his high school principal signed
him up for algebra, trigonometry, and chemistry, none of which
he had intended to take. In his physics class, he worked closely
with the teacher and was appointed head of the audio-visual equip­
ment. This gave him experience with maintenance and repairs of the
equipment. Also, the physics teacher told him to teach his class­
mates the unit on electricity and then left the room. Our future
professor was left with a sink-or-swim situation.

The other four zoologists did not report any school experi­
ences which to them seemed instrumental to their subsequent develop­
ment.

Engineers

The school experiences perceived as important to the Engi­
neers were those which allowed them to proceed at their own pace,
including skipping grades for three of them, accelerated programs,
and competition.
The three who skipped grades did so under different conditions. One was attending a one-room schoolhouse, and in the seventh grade became interested in the work being done by the eighth grade. He began to work along with them and the teacher encouraged him to do so. At the end of the year, he passed enough of the eighth grade examinations to enter high school the next year. Thus, he combined his seventh and eighth grades of school. The other two professors skipped grades in primary school at the suggestion of their teachers. Of these two, both subsequently had experiences with experimental school programs. One attended a special project for talented students which combined nine, ten, and eleven year old students in one class. There were twelve students of each age, and special teachers for art, music, and French were provided in addition to the regular classroom teacher. The other professor went to a junior high school which drew the best students from all over the city. He disliked the school intensely because he was taken away from his neighborhood friends and thrown with a group of children from a higher economic level who had established social circles which did not admit him. He skipped school for the first two weeks until the Principal summoned his father. The Principal explained to his father, and the word was relayed to him, that this was an outstanding opportunity for the boy to break out of the impoverished circumstances of his existing life. The father appreciated the Principal's advice, and insisted that the boy remain at that school. He did and now attributes to his association with the academically oriented children
there his entrance to college and his success there.

One engineer attributed his liking for mathematics to the fact that he got off to a good start in algebra. Changing schools in the middle of the year, he found himself far ahead of his new class. The new teacher gave him extra work because he was ahead. He said, "That really established my interest in mathematics because it was something I felt I could do better than others."

Competition was a factor mentioned by the professor who attended the experimental program in fourth, fifth, and sixth grades. It was also mentioned by two professors who represented their schools in state competitions on mathematics examinations. One of them was tutored after school by the Principal, who taught algebra, in preparation for the examinations. Both placed high in the competitions. Informal competition was mentioned by another professor who said that there were many students in his high school who were interested seriously in mathematics. He described the competition among them as "widespread and keen."

Physicians

Only two of the Physicians mentioned what could be called important school experiences. One attended a military school instead of a public high school. He felt that it was important that he went to school there because he did not feel pressured to perform athletically, and he did feel free to exert his energies toward academic tasks. In the junior high school which he attended he was taunted by the other boys because he was so small and because he
spent so much time on his studies. He felt that the military school was a more democratic institution because he could be more of an individual.

The second physician who reported an experience of importance during his school career referred to a declamation contest which was held as an extra-curricular activity at the school. With his father's coaching, he won the contest at his school and went to the district contest. His success in those contests gave him confidence, and he attributes his later success in public speaking to those occasions.

Although all of the Physicians were good students throughout school, none could remember specific outstanding experiences associated with the school.

Researchers

Four researchers reported no school experiences that they perceived as important to their development. One said that his attendance of military school taught him "to exploit the system without ever committing myself to it." Three researchers attended experimental schools. One of them commented on the competition with the best children in the country, and another who also attended an experimental school spoke of the stimulating competition with the best students in the city. One researcher attributed his present accomplishments in research to the type of education he had in secondary school where he was allowed to do research, write reports and present them to the class. Another researcher who attended an exper-
imental program likewise commented on the early experience of preparing reports with ample time in the library and giving them orally to the class. In a traditional high school setting, the experience of the district examinations in physics, chemistry, and mathematics were important school experiences for one Researcher.

Scholars

Four of the Scholars recalled important school experiences involving competition. One recalled participation in the district declamation contest; two cited state competitions in mathematics examinations as important; and one more named his early competition with a fifth grade teacher as a stimulating school experience.

Two scholars who did not report specific school experiences which they perceived as important had rather unique and unusual educations. One was English and attended an English public school, where during his sixteenth, seventeenth, and eighteenth years he had nothing but science, physics, chemistry, botany, and zoology. The other was forced to quit public high school when he was fourteen, and his education was thus left to his own reading. He read avidly, studying intensively about birds and fishes and making careful observations of both in the areas surrounding his home. Both of these men were self-directive and immersed in areas of their interest at relatively young ages.

Two scholars reported that there were no experiences in school which stood out in their memory.
Teachers

Six of the Teachers recalled no school experiences which were of importance to their development. The important experiences reported by the others varied in nature.

One skipped third grade. He also attended an experimental, accelerated program which was designed for the best students in the city at the junior high level. During the time he went to school there, he mixed with students who had a more academic orientation than the children from his own neighborhood. He was a stranger there and rejected by the already formed social circles, but he managed to find some other boys who were in a similar situation, and they became friends.

One teacher recalled a seventh grade mathematics class where each student was allowed to go at his own pace. The classroom teacher acted as a consultant, had several textbooks available for classroom use, and administered tests to students when they were ready for them.

Consultants

Three consultants could recall no specific school experiences which were influential in their development. One felt that the experience of attending a military school was beneficial in that it allowed him more freedom than the public school, with its pressures of socialization, to pursue those academic as opposed to athletic activities in which he could achieve.
Two other consultants were both given responsibilities in high school for the maintenance of science-related equipment. One was currently interested in electronics so was given the task of maintaining and scheduling the audio-visual equipment of the school. The other took full charge of tending the school solarium and setting up laboratory equipment for his biology teacher.

Three consultants perceived the special attention of teachers as important to their development. Two were allowed to work ahead of their classes in mathematics, and received special attention and encouragement from their teachers in their efforts. One received an unexpected accolade from his mathematics teacher in his senior year of high school, an experience which he felt was in part responsible for his subsequent pursuit of mathematics.

**Extra-Curricular Activities**

**Mathematicians**

Few extra-curricular activities were reported by the Mathematicians. Those that were reported were mainly intellectual in nature. The two professors who reported that they had no extra-curricular activities at all were of European origin.

Two mathematicians reported that they were active in sports in high school. One played football on his high school's varsity team, and the other pitched softball for a city league.

Of the intellectual extra-curricular activities that were reported, academically-oriented clubs organized around disciplines
were predominant. One mathematician, along with a group of his friends, formed an astronomy club when they were in eighth grade. Later he and a group of friends studied mathematics beyond what was offered in high school and eventually began studying at the university while still in high school.

Another mathematician recalled membership in a mathematics club which he said "did not really get off the ground." He also attended Hebrew School from 4:00-5:00 p.m. four days per week from age nine to thirteen. A similar experience with an inactive mathematics club was recalled by another mathematician.

Finally, one mathematician was on the debating team in high school. His comment on the experience was,

This gave me a valuable experience because I was an insider in a group. It was a way to be part of a smaller group; I felt that I belonged. I wasn't a particularly good debater, but I enjoyed it.

Zoologists

The four zoologists who reported participating in extra-curricular activities named a variety of activities. Four others did not report any extra-curricular activities in high school or college.

The Zoologists who participated in extra-curricular activities engaged in sports or entertainment; none were academic in nature. One person was very active in the school programs of sports and entertainment. He played the tuba in the band, played on the football and basketball teams, and acted in several plays put on by
the school. In fact, by his own report he was not a good student, but he excelled in extra-curricular activities. In this respect he was unique because the other zoologists were more concerned with their schooling or their after-school jobs than with extra-curricular activities at the school. One, however, did belong to the glee club and the choir, another wrestled and ran track, and a third man was on the school rowing team.

Of the four who did not report extra-curricular activities, one hated school and was absorbed in his own interests and insect collections; another preferred to spend as much time as possible on his father's farm, and consequently left the school grounds as early as he could each day to get out to the farm; and one had to quit school at age fourteen because of poor health. Although the professors did not cite these circumstances as reasons for not participating in extra-curricular activities, they offer at least a partial explanation for their lack of involvement in school sponsored activities.

Engineers

Five of the Engineers were active in a variety of extra-curricular activities. The other three reported none and gave reasons why they did not participate in extra-curricular activities in school. Those who did not participate in the extra-curricular activities of the school did have active hobbies which they pursued independently or with friends.
Of the five who participated in extra-curricular activities, all were active in sports. Four of them played on high school varsity teams of baseball, football, or basketball. One was an individual sportsman and ran track and cross-country as well as playing on the high school varsity tennis team. One was active in 4-H Club for seven years, another was in Boy Scouts for several years, and another took art lessons one summer during high school.

In high school two of the three who did not participate in extra-curricular activities lived on farms and could not stay after school or return to school for after-hours events. The other was "the littlest runt in the class" and never had a chance to participate in sports. He just watched.

Three engineers reported involvement in extra-curricular activities in college. One said that he joined professional societies in undergraduate school, another sang in the symphonic choir, and another joined a social fraternity. Presumably, the rest concentrated on their studies.

Physicians

Five of the Physicians did not report extra-curricular activities. Two of them were from European countries where extra-curricular activities were not offered as part of the school program. The other three, reared in the United States, did not participate in any organized programs sponsored by the school. Three physicians did engage in extra-curricular sports, primarily of an individual nature. One was on the high school swimming team and had a swimming
scholarship to college; one fenced in high school and college; and another wrestled in high school. The last man also played on the high school baseball team and in the band.

Researchers

Six of the Researchers did not participate in extra-curricular activities in their schools. The two who did were both engineers. One of them ran track and cross-country in high school and sang in the symphonic choir in college. The other was on the championship baseball team of his high school as the chief pitcher. He was also in 4-H Club for seven years and did some gardening projects.

Scholars

The Scholars were active in many extra-curricular activities in their high schools and in college. Only one scholar did not participate in any extra-curricular activities, and he was the one who had to quit school because of poor health.

All of the Scholars engaged in sports. Collectively, they were represented on swimming, baseball, basketball, and football teams. Rowing and wrestling were also mentioned. In addition to sports, two played musical instruments; one of them was in the high school band. None belonged to clubs organized around school subjects.

Teachers

Four of the Teachers were uninvolved in extra-curricular activities in high school and college. Three of the remaining four
were active athletically, and two of them belonged to academic clubs. One of them ran track, played ball with the neighborhood children, belonged to French Club and Future Teachers of America, and took art lessons in the summer. Another pitched softball for a city league. Football, basketball, drama, and band were the activities of one Scholar. Finally, one scholar attended Hebrew School four after­noons a week from the time he was nine until he was thirteen. He was not active in any sports.

Consultants

Three consultants did not report any extra-curricular activities in high school. The other five were not very involved in extra-curricular activities but did report participation in a few.

Sports were not very popular among this group. Two reported engaging in individual sports, fencing and wrestling respectively. One of them also ran track, but gave it up because "another boy was so good that I didn't see any point in following him around the track." One consultant was a member of the glee club and the church choir. The remaining two consultants, both mathematicians, took part in more intellectual activities. One helped form an astronomy club with some friends who shared his interest. The other joined the debating team in high school. He considered that experience important more for its social qualities than for its academic stimu­lation, however.
Mathematicians

Three of the Mathematicians did not aim at graduate study when they entered college, but the others all knew that they would continue at least for a master's degree. One of the three who did not plan ahead was a European who graduated from high school during World War II. He began attending college in search of something intellectually challenging, did well, and earned a scholarship. When he received his undergraduate degree, he was offered a fellowship for graduate study which set the course of his present career. During his graduate study he worked with internationally known mathematicians who gave him models worthy of imitation. He resolved to try to be like them and thus continued his education. Another mathematician was "unwilling to commit myself more than one step at a time." After he received the first degree he decided to try for the next; when he received that he went on for the doctorate. The third mathematician who did not aim at graduate study from the beginning of his college degree said that it was one of his professors in his senior year of college who convinced him to study for a master's degree, and it was his wife who convinced him when he graduated with a master's degree to remain in school for doctoral study.

Higher education was financed for the Mathematicians in a variety of ways. Four were financed by their families in undergraduate school. Two worked their way through undergraduate school.
Two attended undergraduate school with the help of the GI Bill. Six served as research or teaching associates while completing their graduate work.

**Zoologists**

Two of the Zoologists did not know when they entered college that they would seek graduate study. Although both had had an early interest in biology, they had not considered it as a career. One took an undergraduate degree in agriculture, and the other was within one semester of graduating in electrical engineering when he decided to change the course of his career. The other zoologists all knew when they decided on zoology as their field (for three this was after military service) that they wanted to continue for graduate study.

Five of the Zoologists went through undergraduate school on the GI Bill. One supported himself during undergraduate study, and one was supported by his family. During graduate study, one had a fellowship, one worked with the state department of conservation as a research aide and later as a director, one taught high school, and the other four were research or teaching associates. One zoologist did not attend an institution of higher education to receive formal degrees. His was a self-education complemented by tutoring from university professors and museum curators.

**Engineers**

One engineer did not receive a degree higher than the bach-
elors. Of the other seven engineers, only one had intentions when he entered college of working toward a graduate degree. The other five only went into graduate study as a continuation of undergraduate work or after working for industry.

Three engineers took jobs with industry after completing their first degree. Two of them earned their master's degrees at the same time that they earned their bachelor's. For them the interruption of their higher education lasted one year and three years, respectively. The latter included two years of military service during which he became interested in research and saw the necessity for more schooling. The former realized a deficiency in his facility with mathematical systems when he found the engineers at the company where he worked using mathematics which he did not understand. His return to the university was motivated by the desire to overcome that deficiency. The third engineer who left the university after receiving his bachelor's degree did so as a matter of financial necessity. After several years of working for industry, he was hired by the university as a full time researcher and began graduate work then.

Four engineers went straight through their higher education to receive their doctorates. They were encouraged to do so by their professors, and it was made possible financially by research assignments or teaching assistantships.

Five of the engineers attended undergraduate school supported by their families. One worked his way through school on the college-run farm. Two went through undergraduate school on the GI Bill.
The higher education of medical professors is of a different order from that of the professors in the other fields. For one thing, it is a unified, four-year program which does not involve the decision of going on or not which is faced by students contemplating continuing from a master's degree to a doctorate. For another, the internship and residency requirements for physicians are actually further study although not formalized by degrees. Therefore, the higher education of physicians is contingent upon the decision to attend medical school, the choice of specialty and areas of residency.

Without exception, the choice of a specialty for the Physicians was influenced by someone with whom they worked during their residency or their internship. The two researchers were especially influenced by the quality of work done by their directors. Explanations for this phenomenon of influence were that the personality, care for people, degree of scholarship, or excitement displayed by the superior was communicated to his subordinates.

For five of the Physicians, medicine as a career was an early decision (before high school). For the other three, the decision came when they were in college.

The Researchers all knew when they entered college which field they wanted to study. All except one engineer continued
straight through graduate school to obtain their doctorates. The exception worked in industry for one year after getting his bachelor's and master's degrees. All of them served as research associates during their graduate education.

Graduate school was "inevitable" for most of the Researchers. One mathematician said that he was unwilling to commit himself more than one step at a time and did not decide to continue for each higher degree until he had earned the preceding one.

Six researchers were supported during their undergraduate study by their families. Two of the Researchers attended undergraduate school on the GI Bill.

Scholars

One scholar, a zoologist, had no higher education. He was forced by poor health to quit school when he was fourteen and at that age embarked upon an intensive program of self-education. His interest in zoology, particularly fishes, was already established, and he began systematic observations of local fishes. When he was eighteen he began studying with a professor at the university in return for obtaining specimen for the university museum's collections. Since that time he has been closely allied with the university in various capacities including curator of the Museum of Natural History.

Three of the Scholars did not intend to do graduate work when they entered college. One earned a degree in agriculture and became a soil surveyor for three years before he returned to school for his graduate degrees. Two other scholars attributed their
decisions to attend graduate school to a combination of circumstances, not their self-direction. One said that his doing graduate work was "a slap-dash, casual decision, partly motivated by avoiding the draft and mainly a matter of economics." He was offered a research assistantship and decided to take it. Later in his graduate program he became an instructor. The other scholar became interested in research when he was in the Air Force and saw that he needed more schooling. He applied to several schools and received a fellowship from one. In his graduate program he associated with professors who were stimulating and were interested in teaching as well as research. It was their influence which convinced him to remain in the university setting.

The Mathematical Scholars knew that they wanted to attend graduate school when they entered college. Both were financed by their families through undergraduate school, and both received Teaching Assistantships for graduate school.

Teachers

All of the Teachers went straight through their higher education to obtain their doctorates. One of them knew when he started college that he would want to continue for graduate education. Close work with professors and the ensuing encouragement from them caused four of the Teachers to make the decision to stay on for graduate study. Another was encouraged by his wife to remain in the university for a doctorate rather than seeking a job after receiving his master's degree.
All of the Teachers except one who was financed by his family in undergraduate school received their first degree with the help of the GI Bill. Five of the Teachers were teaching assistants in graduate school.

Consultants

One engineering consultant did not receive a degree above his bachelor's degree. He graduated with a degree in physics and had to take a job for financial reasons after that. He worked his way into a series of jobs with the Federal Government and took graduate courses in engineering, but never formally received an advanced degree. During his undergraduate study he was a research assistant for two years with the chairman of the department of physics.

The other engineering consultant also had to leave the university after his bachelor's degree to earn money. He worked in industry for eight years before returning to work on his master's degree. During his graduate study, he worked full time in research at the university.

One of the Consultants worked his way through undergraduate school doing a variety of jobs. He received a research assistantship which supported him through his graduate study. Another was family financed in undergraduate school. Two consultants attended undergraduate school on the GI Bill.

Four consultants went straight through school to obtain their doctorates. Each knew early in his undergraduate study that
he wanted to continue for graduate degrees.

Social Development

Relations with Peers

Mathematicians

Four mathematicians reported that they played with many children from their neighborhood and school during their childhood. Their activities were attending movies, playing ball, going to sports events, and just talking. Their friends were diverse and represented many interests. The other four had relatively limited social interaction with their peers in elementary school. One was an American child in German schools, moving frequently from one town to another, so he did not get to know other children well until he returned to the United States for high school. Another was a European whose father was the Principal of a school and who played only with his brothers and sister and the janitor's son. The third did not play with children in his neighborhood, but only with the children of friends of his parents. The last one was small for his age and did not participate in the usual childhood games and interests.

Zoologists

"I was introverted," "I was a striking introvert," "I spent quite a bit of time alone," and "I did not get on well with my peers" are comments by four zoologists about themselves in elementary school
and high school. They had their own interests which they pursued without the company of others. Three other zoologists did not make such flat statements about their social development, but they did indicate that they spent more time alone than with their peers. One whose father owned a farm outside of town looked forward to getting out of school each day so that he could go out to the farm and work around the animals. Another engaged in fishing, independent study, and bird-watching. Another simply said, "I spent most of my time alone." None of these men had childhood friends who shared their interests in zoology.

Engineers

Three engineers used the expression, "I was a loner" to describe themselves. Another who was a year younger than his classmates described himself as "not socially adept in high school." Still another said, "My friends in high school were the better students but there were not too many of them." Three of the Engineers spoke of having a group of friends with a variety of interests. Two of these men were active athletically, and one, who was interested in radio, met a variety of people on the air.

Physicians

The medical professors reported that they knew many people and engaged in a variety of activities. In general, the high school friends of the Physicians represented a variety of interests rather
than a mainly intellectual orientation. Playing bridge, swimming, playing ball, riding bicycles, and attending movies were activities which they enjoyed. Although many friends and groups were mentioned, few close friends were described. One physician suggested that the reason for this was the fact that his family moved several times while he was in secondary school. Another claimed that he is "not particularly good with people." A third physician moved from a midwestern state to a southern state after ninth grade, a move which he described as very traumatic. A fourth physician was very small as a teenager, and felt that that handicapped him somewhat in social situations.

Researchers

Two of the Researchers, a mathematician and an engineer, reported that they played with groups of children when they were young. The remainder reported that they had only one or two good friends or were "loners." They reported spending much time alone.

Scholars

One mathematician and one physician reported that they played with other children in their neighborhoods. The other scholars had limited interaction with other children. They described themselves as introverts or loners.

Teachers

Two teachers, an engineer and a zoologist, did not play
with a close group of children in their childhood. The others all reported playing with diverse groups of children that lived nearby or went to school with them.

Consultants

Two consultants, one zoologist and one engineer, reported that they played with a group of children. They both had specialized interests in building things, and often instead of playing games had projects under construction. The others did not play much with other children before secondary school.

Family situations accounted for lack of involvement with other children in three cases. One of the Mathematicians lived in seven different towns in Germany from the time he was nine to sixteen years old so he was unable to develop and maintain close friendships. The other mathematician did not play with the children of his neighborhood but with the children of his parents' friends. The second engineer's mother would not allow him to play with the neighborhood children because she said, "They are only wasting time."

One physician was small physically and was not athletically adept; he felt that he was rejected by the neighborhood boys for this reason. The second physician and the second zoologist seemed to be more serious than the other children in their neighborhoods, and reported spending much time alone reading.
**Dating and Marriage**

**Mathematicians**

In high school, the friends of the Mathematicians were described as intellectuals by six. Two said that their friends were athletically inclined and that many friendships revolved around sports.

Only one mathematics professor reported dating in high school; the others said that in high school they dated very little or not at all. The average age of these Mathematicians at marriage was 25.8 years old.

**Zoologists**

Seven of the eight Zoologists did not date when they were in high school, and three of them who were in the service before or during their college years did not date until they got out of the service. The average age at marriage for these Zoologists was 29.5 years.

One zoologist described himself as gregarious and friendly with people of all ages. He dated in high school, and married when he was 23.

**Engineers**

Five of the Engineers spoke of their friends as the better students, ones who had similar interests in scientific things.
Seven of the Engineers reported that they did not date in high school or dated very little. They all dated in college, however, and their average age at marriage was 23.3.

Physicians

Five of the Physicians said that they started dating in high school. The other three started dating in college. The average age of Physicians in this group when they married was 27.5.

Researchers

The Researchers reported little socializing in high school; one physician and one engineer dated before their high school graduation. The others did not begin dating until they entered the university.

The mathematical researchers and the zoological researchers all married later in life (30, 30, 30, and 29) than the physicians and engineers (24, 27, 19, and 23).

Scholars

In secondary school the group of Scholars became more socially active. The two who had played with their neighborhood friends in childhood continued to engage in social activities in high school, and, in contrast to the others, dated in high school. The others developed a few close friendships and established groups of male friends but did not date even if their friends did.
The average age at marriage for the Scholars was 24.4 with a range of 22-29. The zoologists both married late (31 and 39) but there was no agreement between Scholars in the other disciplines.

Teachers

In high school all of the Teachers except one zoologist had a close group of friends, but only two, an engineer and the other zoologist, dated at that time. The others did not date until they were in college or in the service.

The average age at marriage for the Teachers was 26.1, ranging from 21 to 36. There was no particular pattern according to discipline or basic-applied areas in the ages at marriage.

Consultants

Only one of the Consultants dated in high school. The physician who attended military school dated in the summertime and for the three annual formal dances sponsored by the school. There was no particular pattern in the ages when Consultants married. The range was from 22 to 33 years old, and the mean age was 27.

Career History

Aspirations

Mathematicians

Six of the Mathematicians stated that their interest in mathematics grew out of interests in science or engineering. All
naturally had the facility in mathematics, but of the six none was initially interested in mathematics per se. Two of them were aiming at chemical engineering and mechanical engineering respectively during their high school years. One found after his first year in college that he did not like the laboratory work necessary for chemical engineering, and the other, living in Europe during the years of World War II, turned away from practical pursuits to purely theoretical endeavors as a mental escape from the tribulations of the times. Two others had double majors in undergraduate school, physics and mathematics. Their decisions to specialize in mathematics were influenced by their teachers in college. The other two mathematics professors were first interested in science, using mathematics as a tool, and became more theoretical as they matured. One of them was interested in astronomy when he was twelve, and the other was actively interested in space travel. Both gradually became more interested in mathematics as they began to study higher mathematics in late high school years.

Two of the mathematics professors were interested from an early age in pure mathematics. One of them said that he never considered any other pursuit although he was interested in physics. He preferred the exactitude of mathematics. The other also indicated that he was attracted to the precision of mathematics.

As a group the mathematics professors were not concerned during their higher education with what they would do later as mathematicians. A pure love for the subject gave them direction and led them to continue their study. Five of them were teaching
assistants during their graduate study and reported that they liked
teaching then and began to consider teaching as a career at that
time.

Zoologists

All of the Zoologists had childhood interests in the out­
doors and animals. However, their aspirations took different forms. Some planned to enter other areas, some always knew that they would enter some field of biology, and some had no particular direction until after their experiences in the service.

Of those Zoologists who had planned other careers, one had a goal of veterinary medicine, one wanted to be a lawyer, and one planned to become an electrical engineer. All three were interrupted in their preparation for their respective careers by active duty in the service. One was in the infantry in the Pacific during World War II. He was wounded and confined to a hospital for several months, and their came to know a fellow who was an entomologist. Also the lieutenant in the hospital was the head of parasitology and gave him some books to read. As a consequence when he returned to college he switched from pre-law to parasitology. The second zoologist's aspirations were altered by the time he spent in the service simply by allowing him time to mature. His duty was within the United States as a conservation officer. Observing the ecology of the preserve to which he was assigned broadened his existing interest in domestic animals and veterinary medicine to include wild animals and their habitats. The aspiring engineer studied engi-
neering in the navy, and was continuing his study in college when
an occasion changed the course of his interests. Questions of broad
philosophical import caused him to reconsider his early interest in
biology and change his plans for a career in the last semester of
engineering school.

Three zoology professors had little direction in high school.
Two of them had had insect collections from the age of nine or ten,
but neither considered it a potential career. The other was in-
terested in some sort of profession as forestry or ecology,
but was at that time ignorant of professions in general.
three went into military service after high school and subsequently
made their decisions to attend college for formal study of biology.

The two zoologists who knew from an early age that they
wanted to be zoologists had very different experiences. One re-
ported that:

I always figured I'd be an entomologist and collect things
and identify things and write monographs describing species.
All the people at the Museum had written things. I knew
them and knew that they were human beings, that they had
all written things. I knew that what they did was not so
exceedingly far beyond my talents.

He also had two years in the service during which he increased his
resolve to become an entomologist. The other zoologist who had an
early intention of being a zoologist did so as an avocation. His
father owned a successful and lucrative plumbing business which he
helped run until he was thirty years old. He devoted what amounted
to full time work to his study of fishes and birds in addition to
his work in the business up until he was thirty. Then he gave up
the plumbing business and devoted double time to zoology.

Once they entered zoology seriously, all of these men anticipated teaching as a career, mainly because that would allow them to do research. They all reported liking the activity of teaching although it was admittedly secondary to their research.

Engineers

Six engineering professors chose academic life as a result of teaching assistantships or positions as instructors. Of those six only two interrupted their school careers to go out and work in industry. Those two had differing responses to industry. One said:

When I took a job as a mechanical engineer and found the people there talking about mathematics that I didn't understand, I decided to go back to graduate school so that I could read and understand any article in any field.

Another who worked in industry, but was not a graduate associate, returned to the university for graduate work as a result of interest in research being carried on in the Air Force. His brief encounter with industry was negative in that he saw people being paid to punch a clock and, not having enough work to keep them busy, sitting around all day. That experience convinced him that he would not be happy working in industry.

The other who worked in industry before continuing for graduate work came back to the university at the request of the chairman of the department to fill a position of instructor. When he came back to the university, he began taking courses and decided
that he wanted to become a professor.

After receiving his bachelor of science degree, the remaining engineer worked in industry for a period of twenty-five years before coming back to the university as a professor. His return was based on a desire to motivate students to carry on the work he had begun, but could not hope to complete in his lifetime. As he put it, "Now I get out there and motivate maybe three students, and in the next 30 years I'll get 90 years work accomplished. This is real satisfaction."

The early aspirations of Engineers were almost unanimously single-minded. All reported success with and interest in mathematics and science throughout school, and six of the engineering professors knew that they wanted to be engineers at a fairly young age. One wanted to be an aeronautical engineer from the time he was six years old. Four of them made their vocational choice in junior high school, and one had chosen engineering by high school.

The other two engineers made their vocational choices as a result of the guidance of teachers their senior years in high school. They were ones who had not had a firm resolve to enter engineering in high school. All of the engineering professors declared engineering as their major in college when they enrolled, but there was some changing among the areas in engineering. One who started in electrical engineering changed to mechanical; one whose original interest was electronics specialized in welding engineering.
Physicians

The majority of medical professors knew at an early age that they wanted to be physicians. For four of them it was a junior high school decision, and for one it was a high school decision. Two others first planned to enter other fields, but changed to medicine in college. The remaining professor of medicine reported no particular direction throughout high school and entry into pre-medical school was for him a rather circumstantial occurrence.

The medical professors who decided early to enter medicine did so for various reasons. The following are samples of their comments on the decision:

I wanted to be a physician from the time I was 10 or 12 years old. I wanted to be my own boss. There are special ego satisfactions about being a physician. People question their lawyers, they question their teachers, and they question just about everybody, but they don't question their doctors. It's something worth all the work.

I knew at a very young age that I was going to be a doctor. I was sort of a serious-minded kid. I decided about age thirteen. My father had indicated that it would be a good idea to go into a profession, and that I should be thinking about things.

I decided to enter the medical profession when I was in the eighth grade. There was a family doctor whom the whole family admired. My father was really pleased that I wanted to be a doctor. He admired teachers and doctors.

The two medical professors who changed their original career plans did so after high school. One was living in Europe during World War II and was forced to work in German labor camps. He had always wanted to be a mechanical engineer, but during the war years, things gradually changed for him. He became less interested in
mechanics and more interested in medicine. He had thought before of studying medicine because his mother was a physician. The other medical professor intended to be a minister when he first started college, but found in the university that he couldn't get the answers to the questions he asked. He decided then that he didn't want to be a minister and drifted toward physiology and then zoology.

The remaining medical professor entered college during World War II. He simply went down to the Naval Recruiting Station and inquired about college programs in which they had openings. They did have a pre-medical program open and he took it.

Their desire to stay in academic medicine was attributed by seven of the eight Physicians to the personality and competence of people under whom they worked as a resident or an intern. None of the medical professors had an aspiration to teach. Their reasons for remaining in academic medicine fell into three categories: opportunity for research, variety of responsibilities, and ability to control their schedules. The first and the second were much more common to the group. Only two people mentioned the third reason for choosing academic medicine. Of the professors of medicine interviewed, five carry on private practices beyond their university duties.

Researchers

All of the Researchers had inclinations toward their respective fields during or before high school. Both mathematicians excelled in mathematics and found it their easiest subject in school.
One said that he thought in nothing but mathematical terms from the time he learned to count. He never considered any other field of study except physics because all others were too ambiguous and based on assumptions which he considered to be lies. The other wanted to study engineering, but World War II made it impossible. The hardships imposed by the war on Europeans made him, and many of his friends, give up all practical pursuits and turn toward purely mental exercises. He came to study mathematics because it was his easiest subject.

The zoologists were both interested in insects from an age of about ten. One started his first insect collection when he was at camp and the counselor there, who had courses in entomology, became interested in an unusual type of beetle that he found. The counselor helped him make his first insect collection and appointed him the curator of the camp museum. He continued to collect insects as a hobby for many years thereafter, although he had no firm resolve to be an entomologist until after his military service. The other zoologist said that he always figured that he would be an entomologist and "collect things and identify things and write monographs describing species." His early experience with the Museum of Natural History in his hometown was instrumental in forming his aspirations.

The engineers both had direction toward engineering when they were young. One was attracted to large machinery and wanted to enter a professional field. The other was guided by his father into the field of engineering.

The physicians were attracted to medicine in different ways.
For one it was a natural attraction to science which led him into medicine when he entered the university. The other decided to study medicine when he held a job after school in a pharmacy. He was attracted to the profession as one which commanded respect.

Scholars

Three of the Scholars knew from an early age what career they wanted to pursue. Two who had decided by the eighth grade had talked with their fathers about selection of a profession, and both were expected to go to college. The decision for each, however, was an independent decision based upon what they knew about the profession. Both were applauded and encouraged by their families for their decisions. Another also decided when he was quite young what field he wanted to study. He had to quit school because of poor health when he was fourteen, but he continued studying on his own, and began to have private tutoring with professors from the university when his accomplishments were such that he could perform services for them as well as they for him.

The other five scholars were less decisive in their career choices. The mathematicians were both interested in science when they came to the university; in fact, one of them majored in physics in undergraduate school. They both became teaching associates when they entered graduate school, and decided at that point on an academic career.

Both engineers claimed that their being in engineering was the result of a series of coincidences. One said that he wanted
to be a forest ranger until he entered high school because he always enjoyed being outdoors and hunting and fishing. He said about the change to engineering, "I'm not one to plan my life. Little things have nudged me when I could have gone in one direction or another. It has just unfolded." The other said that his first step toward his career was "the good start I had in mathematics with my algebra teacher. The second step and those that followed were just odd coincidences." He came to major in engineering because a magazine article he saw said that engineering would have the highest demand in five years. He signed up for engineering when he came to college, never considering graduate work at the time. After graduation, his experiences in industry and his introduction to research in the Air Force influenced him to return to school, where he studied with a very inspiring man whose enthusiasm "rubbed off."

The zoologist whose career also evolved from a rather nebulous state did have an early interest in zoology. He collected butterflies and bird skulls when he was young, but never thought of that as leading to a career. He studied agriculture in college thinking that he might like to be a farmer. Upon graduation, he went to Canada where he worked as a soil surveyor. His social contacts with scientists there revived his early interest in zoology.

Teachers

Three of the Teachers decided on their field of interest at an early age. One engineer decided at age six that he wanted to be
an aeronautical engineer, at least he knew that he wanted to design airplanes, and he never deviated from that ambition. The other engineer decided on electrical engineering in the seventh or eighth grade. One mathematician decided when he was in junior high school that mathematics was his best subject, and that he wanted to be a teacher.

The other five teachers all had early aspirations that differed from their eventual careers. One zoologist wanted to be a veterinarian, and the other wanted to be a lawyer. Each served in the military after one year of college, one during World War II and the other considerably later. The former decided to study parasitology during the time he was in a hospital in the Pacific. The latter decided when he returned to college that he would rather do research and teaching than take care of other people's pets. The second mathematician originally wanted to be a chemical engineer, but found that he didn't like the laboratory work in college. One physician always wanted to be a mechanical engineer and design machinery and build devices when he was in secondary school. After being forced to work in a wartime labor camp in Europe, he changed his plans and decided to study medicine. The other physician had no particular direction when he graduated from college other than wanting to become a professional. He graduated during the war and entered pre-medical school on a Naval program.

All of the Teachers except the physicians served as teaching associates during their graduate education. That was an important experience for all of them; it was especially critical for the en-
gineers who had planned to seek employment upon graduation.

Military association was influential in the career development of all except one of the teachers, an engineer. For four of them it was a time to reconsider their previous goals and to meet people different from the ones they had previously known. For both physicians, it subsidized their schooling or residencies and helped them decide upon a field of specialization. For one engineer it was a time to mature and see more clearly the necessity for studying in college.

Consultants

The Consultants all had specific aspirations when they entered college. All, except one zoologist and one physician, realized their aspirations of pre-college days. The zoologist who did not was interested in electrical engineering, studied it while he was in the Navy, and entered college to get an engineering degree. When he was within one semester of graduating, he had a change of heart and began to question his choice of career. He left school to work in an engineering capacity for six months and decided definitely to return to school to study biology. The physician who changed his original aspiration had intended to be a minister. His interest was intellectual and philosophical rather than religious. When he had had several courses in college and found that they had no answers for his deep questions, he changed to physiology and then to zoology. He worked for a year after graduation in executive Boy Scout work, and while thus employed, he decided to return to school to become a
The engineers both decided definitely in junior high school that they wanted to become electrical engineers. Both obtained their degrees and went to work for industry; both subsequently returned to the university setting, but for different reasons. One returned to the Antenna Laboratory on full salary and went to school at the same time. His work there gave him a chance to teach a course, and he liked it so much that he decided to remain in the academic setting. The other had worked in industry for what amounts to a full career, twenty-five years. He came to the university as an associate professor to attempt to motivate students to solve problems in which he is interested.

The two mathematicians studied mathematics because they enjoyed it; they were not aiming at any occupation such as teaching or working in industry. They were single-mindedly interested in mathematics. After they entered graduate school, one was a teaching associate, and the other a research associate. The research associate was primarily interested in research for most of his career, but has become an administrator and director in recent years. The other, a man half his age, is also interested in program development and administration.

One zoologist had an early interest in biology, and had thought about some sort of profession that would involve the outdoors in some natural study. Because college was financially impossible, he entered the service and later attended college on the G.I. Bill.
The other physician knew from the time he was twelve years old that he wanted to be a physician. His grandfather and his uncle were both physicians so there was a family tradition to maintain. His father encouraged him in this thinking.

Both of the zoologists served military duty during their college careers, but none of the other Consultants did.

**Work Experiences**

**Mathematicians**

Dividing the work experiences of Mathematicians into pre-college, college, and post-college periods shows that few of them worked in the first period, most of them worked during college and during graduate school as graduate assistants, and most of them went straight into university teaching after receiving their doctorates.

Before college three men reported that they worked. One worked in a restaurant, another delivered papers at thirteen and fourteen, worked in a drug store at night, and worked at the public library during his high school years. Another worked part-time for a couple of hours after school as a draftsman, one summer as a draftsman, and one summer as a "hard-hat" in a steel mill. The drug store job and the drafting jobs were especially disliked, but the work in the library was very much liked.

During undergraduate school three men worked. One was a stenographer for a newspaper in Europe while he was attending the
university. The second worked at the bookbindery, the mathematics library, which was his favorite, and in the dining room. The third man taught recitation sections in mathematics during his senior year in college.

In graduate school seven of the Mathematicians were graduate assistants. Five of them were teaching associates, and two were research associates. One did not work at all during his graduate study.

All of the Mathematicians proceeded straight through their higher education. Upon receiving their doctorates, all except one joined a college faculty. He worked for the Department of Defense in cryptology for one year. He began teaching as soon as he found a position.

Zoologists

Half of the Zoologists went straight through college and graduate school and then into university teaching. For all of them this was either interrupted by or preceded by military service. These four were all graduate assistants. Two of them had had experience working in a big museum mounting and labeling insects during their junior high and high school years. Another worked from the time he was twelve years old "doing all kinds of things" like working in a meat market, a clothing store, and a shoe store.

The other four zoologists had a broad variety of work experiences. One, whose father was a plumbing contractor, took the journeyman plumber and the master plumber examinations in his late
teens and worked in the plumbing business for twelve years until he was thirty years old. In addition to that he was commissioned to make a survey of Ohio fishes, which he did at night and on week ends.

Another zoologist was interested in electronics during his high school years. He worked at a radio repair shop after school and on Saturdays, ran the projector at a local movie theater at night, and delivered newspapers. After three years of engineering school, he took a job for one year as an engineer building grain elevators. After making the decision to change to biology, he became a high school teacher in a small high school where he taught many subjects as he worked on his graduate degrees.

Another zoologist worked during junior high school and high school doing gardening jobs for neighbors. In the summers during high school he worked as an automobile mechanic. He got the job through an employment agency, and returned to it for several summers. While in college he worked as a research aide in the state department of conservation.

The final zoologist entered military service immediately upon graduation from secondary school. An Englishman, he returned to England after his military service and worked in the office of a rich uncle. He found that all he was was "a glorified office boy," and, dissatisfied, he quit and entered the university where he got a degree in agriculture. After graduation he went to Canada to work as a soil surveyor for three years before entering graduate school in zoology.
Engineers

The work experiences of the Engineers fall into three categories, pre-college part-time employment, work during college years (including summer jobs), and post-dissertation jobs.

Five engineers worked at a variety of jobs before they entered college. One started working at age eleven in a model airplane shop doing odd jobs. He worked there until he was in high school, and it took up much of his time after school and on weekends. He got the job on his own by convincing the owner of his intense interest in model airplanes. In twelfth grade he worked in the public library with other high school students. He had always liked books, and he enjoyed that work. He continued when he was going to his first year of college. Another engineer worked in grades seven through nine on a delivery truck for a fruit market. He also assisted a man with odd jobs like building garages and sidewalks. In the summers he worked in big construction work as a pipe layer and later a plumber. Starting at age sixteen one engineer worked on a gas pipeline job. The next summer he was a waterboy on the railroad. He drove some spikes and replaced bad ties just to get some exercise. Beginning at age eleven, another worked on a truck farm during the summers for sixty hours per week. He began work at lumber yards the summer he was sixteen and continued that for three summers. The fifth engineer who worked before college worked during the summers for farmers.

Summer jobs during college included assembly work in a
small plant, "semi-engineering" jobs, construction work, machine shop work, and tool designing. All of the jobs reported were active and some involved manual labor.

Also while they were doing graduate work, four were research assistants or associates and two were instructors. For all of them this experience was what introduced them to the thought of teaching rather than working in industry. These six became Assistant Professors immediately after receiving their doctorates. Only one of them worked in industry between his bachelor's and master's degrees. His experience with punching in for a full day of idleness soured him on working for industry.

The remaining two professors worked during undergraduate school and then worked in industry after graduation. One had a distinguished career with the government and later in industry before coming to the university to teach. The other worked in industry for eleven years before returning to the university as a research associate. Each was interested in furthering research by his return to the university.

Physicians

Most of the Physicians of this group had a job of some kind during their high school years, but only a few of them worked during their undergraduate study, and none of them worked during his professional training until he entered his internship and then his residency.

The high school experiences of the Physicians were diverse.
One worked in a shoe factory for one summer, an experience which made him decide that he never wanted to be a laborer. Another worked as a lifeguard during the three summers after his high school years. The third physician worked in a drug store during his three years of high school. The fourth physician who was employed during high school worked during the summer in a hospital as a maintenance man's helper. The fifth physician had paper routes in junior high school and was the janitor of his father's church for two years.

During college, the three men who worked had jobs associated with the university. One worked for the Dean of Men and lived with the Dean. His job was to do whatever needed to be done around the house as well as to look after the Dean, who was an old man. The second physician who worked during his undergraduate college days worked in the college office twenty hours a week. The third worked in the infirmary doing laboratory work and setting up records.

One physician, a European, worked between graduation from secondary school and university study for one year in a forced labor gang in Germany. Originally intending to be an engineer, he decided after that experience to study medicine instead.

Another physician who was very much interested in research took one year off from his four years of medical school to work as a research associate in the College of Medicine.

Researchers

Three of the Researchers did not work while they were in secondary school. The others all held summer jobs or jobs after
school beginning at early ages.

The two zoologists both worked in museums of natural history, and coincidentally both began at age fourteen. One made contact with the curator on his own initiative, and the other was taken by his mother to the museum to see the insect exhibits and to meet the curator. Both continued their relationships with the museums throughout his school. The physician who worked during high school worked in a drug store from the time he was fourteen until he entered college. The two engineers had a variety of jobs. One began working sixty hours per week on a truck farm when he was eleven years old. He continued that job for five summers. When he was sixteen he began working at lumber yards with adults for three summers. The other engineer worked one summer on a gas pipeline and another summer as a waterboy on the railroad. The summer after graduation from high school he worked as a drill press operator in a machine shop. It was a job that he found very boring, but he allayed his boredom by trying to set a production record each day.

During undergraduate school only one researcher who married while in college worked. He worked as a tool designer during the summers and earned enough to support himself and his wife throughout college. During his last year in undergraduate school he worked as a technical assistant on an Air Force research project determining heat generation and transfer in rubber.

In graduate school the zoologists were both teaching associates, and the other Researchers except one mathematician were all research associates in their respective fields.
All went directly into university teaching upon receiving their doctoral degrees, and all went straight through school except the engineer who worked his way through college. He took a job in industry for one year and found a kind of mathematics which he did not understand being used. Because of that, he determined to return to graduate school so that he could learn to read and understand any mathematical system. He described his current position at the university as applied mathematics more than engineering.

Scholars

The zoologists were the only Scholars who did not work while they were in high school. The others held a variety of jobs, generally unrelated to their future careers.

One engineer worked during summers in high school for farmers near his home. The other engineer worked during the school year on Saturdays on a delivery truck for a fruit market. He also worked after school for an odd-job man helping him on projects like building garages and sidewalks. He worked during summers in big construction work as a pipe evener and a plumber. He liked being outdoors and doing hard physical work. One mathematician began working when he was fourteen as a busboy in a restaurant after school. During summers, he held a variety of jobs including waiting on tables and construction work. The other mathematician worked after school for a couple of hours per day as a draftsman at a small sheet steel company. One physician had a paper route for several years in high school and was janitor of his father's church. The other worked only during
the summers as a lifeguard at the local pool.

Only one of the Scholars worked while he was in undergraduate school. His first year he worked at the soda fountain on campus, and for the remainder of his college years he lived with the Dean of Men, taking care of him and doing odd jobs around the house.

The two mathematicians and the two engineers were teaching or research associates during their graduate school days. Neither of the zoologists was employed, nor were the physicians.

Upon graduation from doctoral study all of the Scholars began to teach in the university.

Teachers

Four of the Teachers worked when they were in high school. An engineer started working at age eleven in a model airplane shop. He did odd jobs for the owner after school and on weekends. During twelfth grade he worked at the public library. One of the mathematicians had a paper route when he was thirteen and fourteen, and a job at a drug store when he was fifteen. He hated that job because of the hours and was very happy when his school acquaintances told him of an opening at the library. One zoologist had a series of jobs, starting when he was twelve years old. He worked at a meat market, a clothing store, and a shoe store, first in stock and later in retail before he graduated from high school. One physician worked as a maintenance man's helper in a hospital during high school.

All of the Teachers except the physicians and one engineer went through undergraduate school on the G.I. Bill. All except the
physicians were teaching assistants or instructors during their years in graduate school. Only one of the whole group of Teachers worked outside the university before he began his teaching career. He worked for the Department of Defense in cryptography for one year only because he could not find an opening to teach in a university at that time. He disliked the work because it was not mathematical enough, not precise enough. He also disliked the regimentation and the security problems that were involved in the job.

Consultants

Only three of the Consultants had jobs before they graduated from high school. One zoologist began doing gardening jobs before he entered high school. In high school he was paid to take care of the school solarium and did odd jobs for his biology teacher. In the summers during high school he worked as an auto mechanic. The other zoologist had a series of part-time jobs during high school. He delivered newspapers when he was eleven or twelve. Then he began working after school in a radio repair shop. Next he began threading the projector at the local movie theater after he finished his work at the radio repair shop. One physician worked in a shoe factory during the summer after high school graduation. That experience convinced him that he never wanted to be a laborer so he entered college forthwith.

During undergraduate school one mathematician worked in the book bindery, the mathematics library, and the dining room of the university. One engineer paid his way through college by working
on the school-operated farm and later by being a research assistant to the chairman of the physics department. The two zoologists went to school on the G.I. Bill, and did not work while they were in school. The other four Consultants did not work while they were in undergraduate school.

In graduate school one mathematician was a research associate and the other was a teaching associate. One zoologist who went through engineering school on the G.I. Bill taught high school to earn money while he was working toward his degree in biology. While he was in graduate school, the other zoologist worked for the state department of conservation as first a research aide, then a research biologist, and then became the assistant director of a wildlife experimental station. One engineer worked as an instructor when he was in graduate school. The other engineer did not attend graduate school, but went straight to work teaching high school. He went from that to working for the government and from there to industry. His return to the university after a twenty-five year career in industry was predicated upon the desire to have others carry on his work. Neither of the doctors worked while they were in medical school.

When they received their doctoral degrees, all began teaching in universities.

**Autonomous Activities**

**Mathematicians**

The independent activities reported by Mathematicians varied.
Common to seven of them were extensive reading. Besides reading and visits to libraries, four of them studied subjects of interest on their own.

One professor who was interested in astronomy made his own telescope when he was thirteen. Another became fascinated with a chess set that he saw in a store window. Because the set was beyond his means, he modeled his own pawns from clay he found by the creek. At that point he had the pieces, and an old checker board, but he didn't know how to play. He looked the game up in an old encyclopedia and learned the rules. Then all he lacked was an opponent so he taught his father and older and younger brothers to play. This same professor taught himself to play the piano when he was in the Army. His ear was not good enough to enable him to do more than pick out melodies with one finger so he bought several books and learned just enough about chords and harmony to be able to fill in when he played the melodies. He still can't read music.

Still another professor spent his time in the library reading about mathematics and history and writing reports for school. For weeks on end he would go to the library alone instead of attending classes. At the university level, he wrote numerous mathematical papers to please a professor whom he admired. The fourth professor read avidly and intensively from the age of twelve. When he entered high school, he found himself with students who had been studying foreign languages for four or five years, and he managed by study on his own to catch up with them in a period of five months.
Two mathematicians were noticeably more gregarious than the others and reported few individual activities. Although they both read widely, they enjoyed team sports and games with other children more than the other Mathematicians. The remaining two mathematicians reported only reading as their autonomous activities. The reading they reported was for entertainment, adventure stories and Westerns, rather than purposive.

Zoologists

The most common activities reported by Zoologists as solitary leisure time activities entailed involvement with nature. Observation of animals and collection of insects were early interests. Reading was also an important part of their early lives. The following are examples of their comments about their independent activities:

In elementary school I tried to learn everything about the animals in and around the river so I could "show off" to my friends. I knew what fishes and animals would appear at each time of year at each point along the river. When I got into junior high school that interest was gradually replaced by an interest in radio and electronics. I made progressively longer telegraph systems and wireless and crystal sets. I saved money to buy tubes and went to the junk yard to pick out good parts from old radio sets. At home I had a tinker room where I worked until the wee hours of the morning. I spent a lot of time wandering around the fields around home. I collected things from an early age, beginning with rocks and sticks at about age seven. I enjoyed assembling information in some orderly fashion.

I visited the Museum of Natural History and the zoo by myself frequently. When I was fourteen I applied for a job in the museum and was hired to help classify and label specimen. I collected insects from age ten, and read widely.

One zoologist did not engage in independent activities
which presaged his future profession.

Engineers

Two activities stand out above others in the Engineers' reports of how they spent their time alone. They are reading and constructive projects. One engineer did not recall any projects or activities which he pursued alone.

Examples of the Engineers' activities follow.

Radio was my hobby in high school. I had one of the first three or four radios in our community. I built it myself according to things I read in magazines and books. Other boys and I would get together to talk and read about radios. We got used to using our heads to make things. The state university had a lending library. I wrote to them and asked them for a list of books on radio. They sent me what I call eighteen inches of book. Today they wouldn't fit into eighteen rooms, but then it wasn't an impossible task to read everything about radio. I started with book one and finished the whole series.

I was building model airplanes by the time I was eight. I was competitive and entered several contests. I was always mechanically inclined. I was always an odd one as far as my neighborhood was concerned because I spent a lot of time reading. I got a lot of books as gifts from my aunt and uncle.

I read a lot of outdoor novels. There was a bookmobile that came around once a week, and I used to ride my bike over to meet it and get books. Mostly I read a lot of outdoor novels. In high school I taught myself to play the piano. I had a piano teacher for two weeks, but I can't read music. What I know I learned from experimenting with the piano.

For several years I was actively interested in model airplane building. Then I got interested in woodworking--making lamps and end tables. I put together a shop by myself with some old tools Dad picked up someplace. I also spent a lot of time reading. The girls in my class used to get mad because I spent lunch time reading things like Horatio Alger, Tom Swift, science fiction, and Western novels.
Physicians

Six of the eight Physicians reported that they were avid readers in their spare time. Several of them said that they used the library extensively to pursue their own interests outside of school. In this group two had active hobbies which they developed on their own. The remaining two physicians reported few independent activities. The following are examples of the descriptions of activities that were given:

I've always been a compulsive reader almost to a fault. I get on to certain authors and read them exclusively. If I'm not reading, I'm doing something with my hands like fussing around with cameras or automobiles.

The Scopes trial was going on when I was in high school and that stimulated my interest in evolution and genes. I learned about it just from reading in the library. I don't think they had biology in my high school. I believed in evolution because I was reading about it, but my family didn't particularly, and people around at that time didn't.

I spent very little time on school work. I spent most of my time reading what I was interested in using books from the library. There was a very large library close to the school. I was probably an exception in that case. My teachers did not know that I was studying on my own. Before I entered high school I learned that the large state library would send out books upon request if you were a certain age. I said that I was a year older than I was, and got many books, mainly scientific ones. I heard about different books from various sources.

Photography was my hobby. I was always interested in it as long as I can remember. I saved money and bought a reasonably good camera at the age of twelve or thirteen. I read a great deal about photography. I sometimes worked with some other friends in school.

One of the other two physicians was actively interested in baseball and organized a baseball team in his hometown. The other remembered no particular independent interests or activities.
Researchers

The autonomous activities which were reported by the Researchers were, with the exception of one engineer, characterized by academic interest and product orientation. The engineer who was the exception reported that his father stressed independence and gave him a great deal of responsibility starting at a tender age. However, the activities which he pursued outside of school were all in the form of organized study. He went to a university at age eight for special French classes and took piano lessons for two years at the local institute of music. He did not pursue academic subjects without the guidance of teachers and classes. One physician did not report any independent areas of interest and activity at all. He did what was required of him in school but no more.

The other researchers all reported that they read avidly and widely. For two of them, an engineer and a mathematician, this extensive reading served the purpose of entertainment. For the other four reading was a means of learning more about their particular interests. All four of them visited museums and libraries frequently. One of them studied science in general, and the other three were product-oriented. Their reading helped them to achieve a specific end. One, a European mathematician, did research on the War of 1812 and produced a paper using the techniques of a historical researcher seeking primary documents. He also studied mathematics on his own. The other two, both zoologists, began insect collections at about age ten and read to identify and classify species.
One engineer also demonstrated product-orientation, although not of an academic nature, in his construction of a woodworking shop and his farming activities in a 4-H Club. Those who were product-oriented demonstrated their independence by spending very little time on school work and studying intensively those areas in which they were interested.

Scholars

The autonomous activities of the Scholars revealed few commonalities. Essentially they were non-academic in nature and were not product-oriented except in the cases of the zoologists. They both had collections, one of fish and the other of butterflies and bird skulls, which they started in childhood. The budding ichthyologist was the professor who had to drop out of school at age fourteen; much of his self-education centered around fish. The only other academic autonomous activity that was reported was chemical experimentation by one of the mathematicians in high school. He was interested in rocketry at that time and used chemicals purchased at a drugstore to try to launch missiles of any sort. Being unsuccessful in those efforts, he turned to the production of fireworks.

The remaining scholars engaged in a variety of activities independently. The second mathematician played the clarinet from the time he was seven, built model airplanes, and swam. The other engineer taught himself to play the piano when he was in high school, drew and sketched outdoor scenes, and read many outdoor
novels. One physician saved stamps and coins. He also diligently cut out the headlines of all the events of World War II. He was first interested in the maps (when he was eight years old); by 1943 he became interested in the people involved; by 1944 he was interested in the events; and by 1945 he appreciated that these were very significant reports. The second physician and the second engineer did not report any autonomous activities.

Teachers

The autonomous activities reported by the Teachers involved reading and product-oriented or activity-oriented tasks. All but one, a zoologist, mentioned that they "did a lot of reading" or "spent a lot of time reading." Three of them read a wide assortment of books mainly for entertainment. The others were purposeful in their independent reading. The two physicians read about their respective hobbies, chemistry and photography. One engineer asserted that his original interest in electricity was stimulated by the science sections of the Book of Knowledge which his parents had at home. He read all the science sections in it and checked books out of the library to learn how to make things. His description of himself was, "I was interested in the most complicated things and would go beyond my schoolwork to satisfy my own curiosity. I always wanted to know more than they presented in school." The mathematician consulted books whenever he came to something he wanted to know. For example, when he wanted to learn to play chess, he borrowed a friend's encyclopedia, looked up the rules, learned them for himself, and then
taught his father and brothers to play. He also taught himself how
to play the piano when he was in the service. He bought several
books and learned just enough about chords and harmony to be able to
accompany melodies he picked out. In other words his reading was
purposeful; when he identified a goal he used books to help him
reach it.

Product-oriented activity was exemplified by one engineer's
building model airplanes, and the photography of a physician. Pur­
poseful activity was shown by one zoologist's raising horses and a
physician's experimentation with his chemistry sets.

Consultants

The Consultants all reported that they spent a great deal
of time in their youth reading. Three of them reported reading
novels and adventure stories for entertainment; the others read
more purposefully. One engineer read everything that the state
library had on radio at that time ("which was not such a formidable
task in those days," he added). One physician gave as an example
of his reading learning about evolution and genes, a subject not
introduced by the school at that time. A mathematician was in­
terested in astronomy, and as a result of his reading built a tele­
scope.

The Consultants were inventive and creative about making
things. The two engineers both made their own radios, and so did
one of the zoologists. The mathematician referred to above made his
own telescope. The other zoologist fashioned his own fishing poles
and hooks out of odds and ends.
CHAPTER V

COMPARISONS, IMPLICATIONS, AND CONCLUSIONS

In Chapter IV the data from interviews with thirty-two professors were presented for each of sixteen variables. Data were organized under each variable according to Area of study, Mathematics, Zoology, Engineering, or Medicine, and were reorganized according to the four Activities which were specified in the definition of academic motivation. Comparisons among the four Areas of study and among the four Activities are made for each variable in this chapter. From the comparisons, implications and conclusions are drawn.

Several major historical events were recognized as causes of unique conditions which had noticeable but unmeasured effects on the people in this study. Briefly, they were the advent of radio, the Great Depression, and World War II. References to those events were scattered throughout the interviews, but there was no way in this study to assess their influence. One factor which argues against the existence of biases in the data as a result of those historical events is the variety of ages of professors. Ranging from twenty-five to seventy years of age, the professors would certainly not be systematically and consistently affected by those events. Therefore, similarities observed among professors would have occurred in spite of the effects of historical events.
Family and Early Childhood

Parents' Birthplaces

The birthplaces of the parents of the thirty-two professors did not differ greatly among the groups. In comparing the Areas on this variable, the Mathematicians' parents represented a greater geographical variety than any other group. The Mathematicians were the only group in which not one professor's parents were born in Ohio. Four zoologists, four engineers, and three physicians were born of Ohioans. First generation immigrants were represented among the parents in all the Areas.

Parents' Education and Occupations

Of the four Areas, the Mathematicians' parents were the best educated group. Only one father had less than a high school diploma, five graduated from universities, and one of the five earned a doctorate. Two of the mothers of Mathematicians had less than a high school education, but two of them obtained master's degrees. The group whose parents had the least education was Zoology. Only three fathers and three mothers graduated from high school in that group. The fathers who graduated from high school all also graduated from college, and two of the mothers graduated from college. In the two Applied Areas, education of parents was similar. Two fathers and two mothers in each Applied Area graduated from college. Most of them finished high school.

Of the four Areas included in this study, mathematics is the
most abstract. Engineering and medicine are less abstract because both have specific applications and are basically oriented toward use of theory for the solution of practical problems. Zoology, however, is the only Area of study which arises through and remains concerned with purely concrete phenomena, i.e., insects, fishes, birds, etc. Zoology, is, then, the most concrete of the Areas considered. This relates directly to the education of professors' parents. Professors in the most abstract Area had parents with the most education, and parents of professors in the most concrete Area had the least education. An inference from this finding is that better educated parents in some way endow their children with concern for more abstract disciplines and that children of less educated parents tend to focus on more tangible disciplines.

A practical implication for teachers comes from this inference. Knowing the level of parents' education should provide a guideline for the kinds of activities which will interest students. A student whose parents have little education is unlikely to be motivated by purely abstract endeavors; he needs more concrete activities to enlist his interest. Also, his parents are more likely to praise and encourage his learning when it is in areas they can understand. A student of parents with college educations is more likely to hear conversations about abstract topics at home and to receive understanding and encouragement in his own efforts in abstract thinking. This is an important consideration for teachers in designing activities for students, particularly at the elementary level.
Looking at the data organized according to the Activities, the Researchers' parents were the best educated. Five fathers had university degrees and two of the mothers did. Two of each did not finish high school, but none of them had less than eight years of school. As a group, the Consultants' parents had the least education. Half of their fathers and half of their mothers did not finish high school. Only one of each attended college, but both of them earned graduate degrees. If research can be called the most abstract of the Activities, these data support the inference of a relationship between parental education and professors' Area.

Fathers' occupations were varied among each of the Areas except the Engineers. Fathers of seven of the Engineers worked in occupations with a mechanical orientation. It may have been that the jobs of the Engineers' fathers provided the sons with an opportunity to see their fathers solving problems and applying their knowledge in concrete ways which influenced the sons to strive toward knowledge.

Fathers' occupations were varied for each of the Activities except one. Among the Researchers, five had fathers whose occupations had a mechanical orientation.

In assessing these data on the education of the professors' parents, it must be remembered that in the first thirty years of this century an eighth grade education was respectable. Those who terminated their education before high school were not in those days labeled "drop-outs" and disparaged. Rather, those who completed high school were esteemed, and those who completed college.
were elite.

Birthplace and Childhood Environment

Somewhat more diversity was found in the birthplaces of Mathematicians and Physicians than of Zoologists and Engineers. That may reflect nothing more than the hiring practices in the different colleges and departments of the university. A more provocative comparison was discerned in the childhood environments of the various groups. The Mathematicians were predominantly from middle-class suburban neighborhoods. Half of the Zoologists were from small towns. The childhood environments of the other two Areas were varied.

Half of the Researchers grew up in either small towns or villages. The other half were reared in suburban environments near large cities. Both settings provided an opportunity for study. The small towns allowed acquaintance with a variety of natural phenomena and with the basics of machinery, agriculture, and business. Access to large libraries and museums in the large cities fostered self-reliance in learning and familiarity with academic materials. The Researchers commented on their academic interest in and use of facilities available in their environments. The Scholars, in contrast, did not refer to use of such facilities or to familiarity with nature and community activities. Although good students, the Scholars restricted their intellectual activities to the school setting of their suburban environments. No trend was evident among the other groups.
Basically, the difference between the activities of Researchers and Scholars lies in degree of originality. Researchers are on the front line of knowledge, constantly pushing against the unknown. Scholars work with that knowledge which has been uncovered by others. The difference in the nature of the two activities and the difference between the childhood interaction with the environment is significant.

Early academic involvement with their environments evidently activated in the Researchers self-confidence, independence, and curiosity, all of which are prerequisite to research activities. Childhood environment, then, can be viewed as influential in determining the nature of activities which will be pursued. However, the difference between the Researchers and the other groups, whose academic motivation manifested itself in other activities, precludes the assertion that academic attention to the environment is necessary to the development of academic motivation.

Siblings and Birth Order

For the total sample of thirty-two professors, the variable of birth order was most significant. Twenty-three (71 per cent) were the first born in their families. Of the nine who had older siblings, only three had older brothers. Therefore, twenty-eight (87 per cent) of the professors were the first-born sons in their families. This finding was so strikingly characteristic of the sample that it did not differentiate among the groups.

The predominance of first borns in this sample of outstanding
ing university professors is evidence that childrearing techniques and the family relations for first-born children must differ from those used with subsequent children in some ways which foster academic motivation. Identifying those differences is an important task for future studies which seek to determine the causes of academic motivation.

An implication relative to education is also present in the discovery of the predominance of first-born children among outstanding professors. Educators should be prepared to modify their expectations for children other than first borns. Helping later-born children to find a way of establishing self-identification and self-worth other than in academic endeavors is a significant task which teachers seldom consider. More often, they hold up the first born as an example to siblings who follow. Living up to the standard set by an older brother or sister has caused unhappiness and wasted efforts for many children. Teachers should be aware of the tendency for first-born children to achieve scholastically at a higher level than later ones.

The families of the professors in the Basic Areas tended to be larger than those of the professors from the Applied Areas. Only one engineer and one physician had older brothers. With smaller families, fathers of professors in the Applied Areas were probably able to give their sons more guidance in vocational matters. Following the ancient law of primogeniture, the eldest son is the most important child in a family and thus receives more attention and encouragement than later ones. Traditionally, the eldest son also
is the embodiment of his father's hopes for realizing ambitions which he himself did not fulfill. The eldest son therefore represents a greater psychological investment for the father than do later ones. In smaller families, this would be especially so.

Relationship with Parents

Certain family patterns were more numerous in one group than in the others. Homes broken by divorce were reported by three zoologists, but no parents in the other groups were separated or divorced. Family solidarity and warmth were reported only by professors in the Applied Areas, three engineers and two physicians. Closeness to fathers was also more characteristic of the Applied than the Basic Areas. Six engineers and five physicians indicated that they identified with their fathers while only two mathematicians and three zoologists indicated a positive relationship with their fathers. Perhaps similarity of interests contributed to the closeness in the cases of the Engineers whose fathers were employed in occupations which were mainly mechanical. Similarity of interests was not characteristic of the Physicians and their fathers, however. Coupled with the earlier finding that Physicians and Engineers came from smaller families than the professors in the other Areas, this suggests that fathers of the Engineers and Physicians devoted more time to their sons.

Looking at the four Activities for comparisons among the relationships with parents revealed more striking differentiation among them than among the Areas. None of the Teachers or the Con-
sultants described their families as close ones. Two in each group were close to their fathers, but they either did not mention their mothers or spoke of them in neutral terms at best. The Teachers and Consultants seem to have come from homes that were less warm than those of the Scholars and Researchers. This finding supports Anne Roe's theory that children from warm homes will seek careers that are objective and less people-oriented, while children from less warm homes will seek careers that are more people-oriented. Although not all of the Scholars and Researchers came from warm homes, two in each group did discuss their families as close units who shared many activities. Three other researchers were close to their fathers but not to their mothers. The Scholars who did not come from close families were especially distant from their fathers because they did not have common interests.

In the total sample of thirty-two professors, comparatively few came from homes characterized by warmth and affection. Only four professors explicitly or implicitly indicated that their families were close. An additional six stated that they were close to their fathers and two others were close to their mothers. In four cases where the professors were not close to either parent, a grandparent was named as an important person and source of affection.

These data indicate that warm, close family relationships are not necessarily related to the development of academic motivation. An important implication for educators resides in this point. Academic motivation or the lack of it cannot be attributed to a child's relationship with his parents. The classic explana-
tion that a student's performance is determined by the "caring" atmosphere of his home is untenable. Educators must look beyond this elementary assumption to see why children from similar home environments react to academic situations differently. Teachers must seek ways to help children find for themselves means of self-expression which are not dependent upon the nature of their home environment. To accomplish this task, teachers must realize that academic motivation may arise as a result of parental affection or as a compensation for lack of parental affection.

**School Experiences**

**General Attitude Toward School**

More Physicians liked school than any other group. The smallest number who liked school was in the Zoology group. Mathematics and Engineering were evenly divided. The invariable reason for disliking school in all four Areas was boredom. All of the professors in all of the groups except Zoology reported that they were good students whether they enjoyed school or not.

Mathematicians and Engineers were more restricted in their preferences for courses than were the Physicians and Zoologists. The Physicians reported no dislikes, but the Mathematicians unanimously disliked literature, social sciences, and history. The Engineers had a definite preference for science and mathematics courses over humanities courses.

None of the Researchers expressed enthusiasm for school.
Five professors in each of the other Activity groups stated that they liked school. The Researchers' unanimous disaffection for school was a product not only of boredom, but also of school demands on their time. They each had definite interests which they would have preferred to pursue independent of classes. Certainly, it can be concluded that the schools should encourage and provide the setting for bright students to proceed with their studies at their own pace. It is an indictment of the educational system that the brightest and most original thinkers were bored in school.

Outstanding Teachers

More Mathematicians than any other group remembered teachers as influential in their development. Seven of them recalled mathematics teachers who gave them individual attention, assigned stimulating work, were well-educated, and/or were very enthusiastic about their subjects. Only three teachers of subjects other than mathematics were recalled by the Mathematicians. In the other Areas fewer professors identified teachers who were important to them. Three professors in each Area, Zoology, Engineering, and Medicine, said that they had had no teachers who were particularly outstanding. The others who did remember teachers recalled mostly science teachers. The Physicians were the ones who recalled teachers from the greatest variety of subjects.

The comparison of data for the four Areas indicates that outstanding teachers are more important to development in mathematics than in the other disciplines. The subjects taught by teachers who
were remembered underscores the primarily scientific orientation of the professors in this study. That Physicians remembered teachers from many different subjects suggests that they had a broader orientation and a more open approach to school in general.

Among the Researchers, Scholars, Teachers, and Consultants, there was a definite contrast in the teachers remembered. Each of the Consultants and six of the Teachers recalled at least one teacher who influenced him. The teachers whom they remembered were credited with a variety of good qualities, and they represented a variety of subjects. The Researchers and Scholars, on the other hand, remembered fewer teachers than the other groups. Half of them recalled no influential teachers. Those who did, recalled science teachers who had extremely good educations, enthusiasm for their subjects, and the ability to make students think.

Comparisons of the Activity and Area groups reveal some differences among them. These data are, however, more striking when considered for the total sample. One-third of the professors recalled not one teacher whom they considered outstanding. The other professors all remembered teachers for specific contributions to their intellectual development. The implication here is that for one-third of the professors, teachers had little or no effect. Those professors achieved without, or in spite of, teacher influence.

Important School Experiences

The Physicians remembered fewer important school experiences than any other group although they were the group who reported liking
school most. Only two described anything about their school careers which they felt was important. Four zoologists felt that they had had experiences in school which strongly affected them, but one of these was negative. Most of the Mathematicians and Engineers recalled school experiences to which they attached importance. Most prevalent among experiences cited by Mathematicians and Engineers were competitive situations and situations which allowed them to proceed at their own pace. In either case, they found themselves ahead of the rest of the class. Competition among bright students, according to these data, seems to be an effective motivator.

In considering the differences between reports of the Physicians and those of the Mathematicians and Engineers, it is apparent that the traditional school curriculum offers courses more relevant to the interests of the latter two groups than to those of prospective physicians. Mathematics and physics courses are directly related to the college experiences in those fields, but biology and chemistry courses are far removed from college preparation for medical school. Unless a student has decided independently in high school that he wishes to become a physician, there is little in the school curriculum to help him identify such an ambition and to motivate him to achieve in science courses which are prerequisite to later study of medicine. A way of making apparent the relationship between high school science courses and a variety of vocations might be an excellent means of stimulating academic motivation.

The Teachers and Consultants differed from the Researchers and Scholars in the types of school experiences which they considered
important. Almost half of the latter two groups recalled positive effects of academic competition, but competition was not mentioned at all by the former groups. Individualized instruction was a significant factor in the schooling of three consultants and two teachers, but was not among the important school experiences of any Researchers or Scholars.

**Extra-Curricular Activities**

Extra-Curricular Activities refers to organized programs sponsored by the school. The activities which the professors pursued on their own are presented under Autonomous Activities.

Comparing the Areas, Physicians reported the least number of activities. Five of them did not participate in any of the school's extra-curricular activities. The other three engaged only in individual sports. Although the other Areas were not exceptionally active, over half of the professors in each reported that they participated in some form of extra-curricular activity. Engineers were the most athletically inclined, and Mathematicians' extra-curricular activities were of a predominantly intellectual nature.

Six of the Researchers participated in no extra-curricular activities. Seven of the Scholars were active athletically. The Teachers and Consultants did not form any particular image as groups. Half of the Teachers were not active in extra-curricular affairs; the Consultants were slightly more active, but not in one type of activity.

These data indicate that as a group the professors in this
study devoted relatively little time to school-sponsored extra-curricular activities.

Higher Education

Since all but two of the professors have comparable academic degrees, differences among the Areas and Activities on the variable of higher education were small. Almost all of the professors studied continuously until they earned their doctoral or medical degrees. Only five, four engineers and one mathematician, interrupted their scholarly progress to take non-academic jobs. Excluding the Physicians who had no such opportunity, over half of the professors served as graduate assistants. Five of the Teachers were Teaching Assistants, and six of the Researchers were Research Assistants in graduate school. One can conclude from these data that serving as a graduate assistant is a compelling experience.

The data on professors' experiences as graduate assistants suggests a possibility for academically motivating bright high school students. Since it seems to have been the active involvement and responsibility which were important in the experiences of graduate assistants, similar experiences in lieu of straight classroom activities might attract more high school students to academic activities.

One person in each area except Medicine worked his way through undergraduate school. The GI Bill was the source of financial support which made college and graduate work possible for a significant number. Ten of the professors attended college on the GI Bill. This was a significant factor because it not only per-
mitted them to attend college, which they might have done by working their way through, but it allowed them to be free from financial concerns so that they could devote their full efforts to their studies. Although the time which they spent in the service was during World War II and the occasion of minor wounds for several professors, it was viewed as a good experience by most of the professors. In fact, all except one spoke of their military service as a time of meeting people different from those they had known at home, maturing, and reaching vocational decisions. Those who were in the service entered immediately after high school or were drafted after their first year of college. The favorable reaction of such outstanding professors to the side effects of being in the service for two years lends support to the idea of establishing some form of voluntary national service. Social, ecological, or other service, in lieu of military duty, could offer the same benefits which these professors cited. Two or three years' service in return for a modest wage and room and board would give young people a chance to expand their horizons, find themselves, and make plans for the future. If this were organized on the same principle as the GI Bill, with one month's tuition for each month's service, there would be a viable program for bringing higher education into the reach of students from all economic levels in all parts of the country. The experience would provide an opportunity for them to arrive at their own decisions away from pressures to attend college.
Social Development

Relations with Peers

More than any other group, the Zoologists reported that they were introverted and played little with other children. The Physicians reported the most childhood interaction with other children. Mathematicians and Engineers were split evenly into those who were rather withdrawn and those who were actively involved with childhood peers.

In adolescence, the Mathematicians described their friends as intellectuals, and the Engineers described their friends as the better students. The Engineers and the Physicians reported friends with a greater diversity of interests than did the Mathematicians and the Zoologists.

The field of zoology is one which requires little interaction with other people. It is also a field which allows man to establish feelings of self-importance in the mastery and dominance of his chosen environment. The study of zoology clarifies man's own position and role in the universe. Initial attraction to zoology may have provided for these professors a compensation for feelings of social inadequacy. Teachers are justifiably concerned with social development of their students; however, their efforts to "help" students in social adjustment may be misguided. Because social relations are a manifestation of personality structures which can be changed only with persisting efforts over long periods of time, teachers might better serve bright, introverted children.
by encouraging them to study areas which, like zoology, are explicit, can be mastered, and thus offer a feeling of concrete achievement and self-worth.

The Physicians reported the most childhood interaction with peers and the most dating in high school. Theirs is the field in this study which requires the most direct and intimate contact with other human beings. The contrast between Physicians' and Zoologists' reports of their social development demonstrates that personality structure is an important factor in career choices. It also shows that students with contrasting personality structures, but similar interests, in this case biology, are academically motivated in areas which accommodate their own level of social interaction.

In the Activity groups, the Researchers and Scholars were the ones who had limited interaction with their peers. The Teachers and Consultants reported that they played with neighborhood children and shared their interests more often than the other two groups did.

That Researchers and Scholars had limited interaction with their peers while the Teachers and Consultants were involved with their peers emphasizes the point made above. Personality structures which are formed in the early years of childhood have lasting effects on later patterns of behavior. Social development is a manifestation of personality structure, and as such, can be used as a key to helping students find activities which suit them. The child who is introverted should be encouraged by his teachers to turn to academic activities which will develop his sense of worth. The data from this study indicate that these will probably be solitary activi-
ties in areas with unambiguous content.

Dating

In terms of the Areas of study, it was the Physicians who did the most dating in high school. In each of the other Areas, only one of the eight dated in high school. The Zoologists reported that they did not begin to date until after the service.

An equal number of persons reported high school dating in each of the Activity groups. Two persons in each group except Consulting dated in high school. The others did not begin dating until they were in college or military service.

These data on the dating activity of the professors emphasize that their social relations varied in a way which forecast the disciplines which they would later choose. Those who were most involved with their peers also were the ones who dated earliest and who chose disciplines which offered the greatest involvement with other people.

Marriage Age

Professors in the Basic Areas married later on the average than did their corresponding Applied Areas. Zoologists as a group married later than any other. Their average age at marriage was 29.5, compared to 25.8 for Mathematicians, 23.3 for Engineers, and 27.5 for Physicians.

The average ages at marriage of the Researchers, Scholars, Teachers, and Consultants were not strikingly different. The Con-
sultants were the oldest at marriage, 27.0, but the other groups were not far ahead of them. Researchers' average age at marriage was 26.4; Scholars' was 24.4; and Teachers' was 26.1.

Career History

Aspirations

In the Applied Areas, over half of the professors had made their career choices by the time they were high school seniors, and many of them decided in junior high school. This is a striking contrast to the professors in the Basic Areas who were undecided or unconcerned about what occupation they would pursue. Only two in each of the groups, Mathematics and Zoology, knew from an early age their occupational goals. They did not know what road they would follow, but their love of the subject kept them on the track.

All of the professors of the Basic Areas continued straight through school to obtain their doctorates and began teaching immediately upon graduation. For most, the "decision" to become a professor was never made; it evolved as they went through their programs. The decision to enter academic life on a university campus was a real one for professors in the Applied Areas because all of them had intended to become engineers or physicians when they entered college. It was recognition of the possibility for a greater variety of tasks and more freedom in the university setting which caused them to modify their original intentions. Interest in research, stimulated by work they did in industry, as research associates, or
in their residencies, was also an important attraction.

These data show a clear contrast between the styles of career decision of men in the Basic and those in the Applied Areas. In the Basic Areas were men devoted to subjects which had an early and persistent fascination for them. They did not actually make career choices, but followed their interests which culminated in the role of university professor. This suggests that high school students need a greater variety of experiences in school to allow them to form images of more academic occupations. The Engineers and Physicians made career plans on the basis of popular images of physicians and engineers and their work. It was when they became actively involved in research and teaching in graduate school or internships that they began to consider alternatives to plans for private practice or working in industry. The pursuit of knowledge for its own sake became attractive to them then. This argues for allowing students in secondary school, especially the very bright ones, to engage in both teaching and research activities. The idea is not a new one, but it is a too-often overlooked one.

Several of the Mathematicians thought that they wanted to be engineers, but they disliked laboratory work so much that they changed to mathematics. It is possible that their aspirations to be engineers were based upon the generally well-known image of engineers as bright, constructive people who are recognized and esteemed. If they had had an image of a mathematician and his job, however, they might have known much earlier what they wanted to do with their lives. A more clear-cut image of academicians in the
eyes of youth might stimulate more young people to achieve academically. Students are not enough exposed to mathematicians and zoologists, or to historians and philologists, for that matter. Bringing academicians into the view of students to demonstrate what their activities are is an important task for the schools. Especially with ever-increasing leisure time and the imminent advent of a negative income tax, intellectual pursuits should be carefully cultivated both as occupations and as avocations.

The Researchers all had inclinations toward their fields during or before high school. Three of the Scholars, three of the Teachers and six of the Consultants also decided at an early age on their fields. Two of the Consultants, half of the Teachers, and half of the Scholars changed their aspirations during college. The single-mindedness of the Researchers was outstanding.

Work Experiences

The data on work experiences were not widely different among the groups either by Areas or by Activities. Among the Areas, the one noticeable difference was that fewer Mathematicians had jobs before they entered college. Over half of the professors in each of the other areas reported that they worked before they entered college. Their jobs, however, did not relate to their future professions in most cases. Jobs during college were not common among the professors in any Area. However, in graduate school there were seven graduate assistants or instructors in Mathematics, four in Zoology, and seven in Engineering. The Physicians did not report
working during medical school.

In the Applied Areas two physicians and four engineers worked outside the university before they became professors. The engineers did so before they earned their doctorates. The physicians were both in private practice before they returned to the university. In the Basic Areas, only one professor worked outside the university before he became a professor, and he did so only because there were no teaching appointments available in universities at that time. All of the other professors in the Basic Areas became professors immediately after receiving their doctorates.

Among the Activities, the Consultants were the ones who did not report holding jobs before college as often as the professors in other Activities. Only three of them worked while over half of the professors in each of the other Activities did hold some kind of job before entering college. With the exception of one who attended a European university, all of the Researchers were research assistants during their graduate study. In no other Activity was the number that high although five of the Teachers were teaching associates. Considering that the Physicians were eliminated automatically from teaching, the figure for Teachers is also very high.

Autonomous Activities

Reading was characteristic of the independent activity reported by at least half of the professors in each Area. The Mathematicians and the Physicians were the groups who were the most enthusiastic readers and the most academically oriented readers.
The Zoologists and the Engineers read more for entertainment than did the Mathematicians and the Physicians. The reading done by the Mathematicians and Physicians was purposeful, aimed toward elucidating an area of interest like photography, chemistry, evolution, astronomy, or rocketry. The Zoologists were early collectors and categorizers. The Engineers spent their free time in construction projects. Radios, model airplanes, and wood work were the products of the Engineers' autonomous activities.

The autonomous activities of the Researchers were characterized by their use of libraries and museums. Four of them read to educate themselves beyond what they were learning in school. Their interests were not confined to their main area of expertise. For example, one mathematician wrote a historical document when he was in secondary school.

The only other Activity group which clearly exhibited a trend was the Consultants. They were the creative ones among the four Activities. Radios, a telescope, a camera, fishing tackle, and a boat were some of their products.

One suggestion that can be drawn from this part of the experiences of university professors is that children should be encouraged to improvise with available materials to produce things that they want. Something old which can be torn down and rebuilt, remodeled, or improved is more educational than a new, ready-made object. Learning comes from both disassembly and reassembly, and there is a definite satisfaction which accompanies completion of a project. The product-orientation of many of the professors seemed
to reflect this motivational principle: there is satisfaction in creating things and then stepping back to see what has been accomplished.

Summary

The theories which were reviewed in Chapter II did not suggest specific factors that influence academic motivation. This study was an effort to identify, on the basis of interview data from thirty-two university professors, factors which contributed to their academic motivation. The raw data of the interviews were reduced to sixteen variables which bore intuitive relationships to academic motivation. Data for each of the sixteen variables were scrutinized to determine the nature of their relationship, if any, to the development of academic motivation. Analysis of the data revealed that three of the variables were essentially unrelated to academic motivation; that six of the variables differed among the Areas and Activities of the professors in ways which suggested a relationship to academic motivation; and that seven of the variables characterized the total sample and could be labeled antecedents of academic motivation for this group.

The three variables which were not apparently related to development of academic motivation were parents' birthplaces, professors' birthplace, and age of marriage. These variables did help to describe the sample, however. The sample included professors whose parents had varied origins. About one-third of the parents were of European birth; half of those born on foreign soil immigrated
to the United States where they reared their families. Birthplaces of professors who were born in the United States clustered around Ohio and did not represent other regions such as the South, the West, and the Northwest. Although average age at marriage did not vary systematically among either the Area or the Activity groups, it was considerably higher for each group except the Engineers than the national average for males.

The six variables whose variation among the groups were suggestive of relationships to academic motivation were childhood environment, parents' education and occupation, outstanding teachers, important school experiences, relations with peers, and aspirations. It was the Researchers who availed themselves of academically stimulating aspects of their environments more than any other group. Derived from this finding was the tentative conclusion that childhood interaction with one's environment fosters independence of thought and a questioning posture which are prerequisites to research activities. Those activities during their childhood provided the foundation for their continuing academic motivation.

Education of parents was related to the degree of abstraction in the professors' Areas. Parents of the Mathematicians were the best educated group, and parents of the Zoologists had the least education. Among the Activity groups, the Researchers' parents were best educated. It was inferred that sons of better educated parents were more likely to choose abstract disciplines while sons of parents with less education would be attracted to more concrete disciplines. The degree of parental education was related to the disci-
pline in which professors were initially academically motivated. That the Researchers' parents were the best educated among the Activity groups supported this inference.

Few of the professors had working mothers, and only among the Engineers did fathers' occupations seem to relate to their sons' interests and motivation. Seven of the eight fathers of Engineers had mechanically oriented occupations. This was viewed as establishing the sons' predilections for engineering.

Among the Areas, the Mathematicians were more grateful to teachers than any other group. Based on those data, it seems that good teachers were more important to the academic motivation of potential mathematicians than of students in the other disciplines. Among the Activities, Teachers and Consultants outnumbered Researchers and Scholars two to one in recall of outstanding teachers. These data implied that teachers were influential in the Activities, if not the Areas, which their students pursued. For the total sample, one-third of the professors said that none of their teachers were influential in the development of their academic motivation and their later careers.

Important school experiences of the professors revealed that competitive academic situations were positive influences in the school careers of Mathematicians, Engineers, Researchers, and Scholars, but not for the other groups. Almost one-half of the professors in the total sample reported that none of their school experiences were significant or memorable.

Data on relationships with peers formed a contrast between
the Zoologists, Researchers, and Scholars, most of whom had little interaction with peers, and the Physicians, Teachers, and Consultants, who had extensive interaction with peers. These data were interpreted as evidence that individuals will become interested in disciplines and activities which are suited to their mode of social interaction.

Aspirations of professors in the Basic Areas of Mathematics and Zoology were different from those of professors in the Applied Areas of Engineering and Medicine. In the Applied Areas, career decisions were made by most before entering college. However, in the Basic Areas, professors never really committed themselves to a career goal but rather followed the unfolding path through Academe. The Researchers' aspirations toward their present careers were formed during or before high school whereas one-half of the Teachers and Scholars changed their aspirations during college.

The seven variables which characterized the total sample were birth order, relationships with parents, general attitude toward school, higher education, dating, work experiences, and autonomous activities. On those seven variables the data were similar for at least one-half of the total sample.

Over four-fifths of the professors in this study were the first-born sons in their families. This finding was considered evidence that child-rearing techniques which are used with first-born sons differ from those used with later-born children in ways which promote academic motivation.

Data on relationships with parents revealed that the fami-
lies of seven-eighths of the professors were not close ones which functioned as units with parents acting as teams to give affection and guidance to their sons. Two-thirds of the sample were close to neither their fathers nor their mothers. It was concluded from these data that warm, close family relationships were not prerequisites for the development of academic motivation.

The general attitude toward school of over one-half of the professors was one of boredom. Of those who were bored in school, two-thirds were good students in spite of their attitude. It was concluded from these data that greater efforts should be made by schools to accommodate students who can progress faster than the average.

The most significant factor of higher education for professors in all Areas except Medicine was experience as graduate assistants. Working either in research or teaching, they made their decisions to become professors as a result of those experiences. Physicians also decided to become professors as a result of their internship or residency programs which bear an essential similarity to graduate assistantships. It was tentatively concluded that the active experiences of graduate assistants are effective in influencing individuals to choose academic careers. It was also suggested that activities similar to graduate assistantships would be effective in stimulating academic motivation among bright high school students.

Dating in high school was almost unknown by three-quarters of the professors in this study. Although this finding was not
causally related by this study to academic motivation, it was significant by virtue of the number of professors who had similar experiences.

Work experiences of the professors were limited. Few had jobs prior to college which were forerunners of their later careers. Almost none of the professors held jobs other than graduate assistantships during their higher education. The opportunity to devote full attention to studies seemed related to the continuing academic motivation of the professors.

Extensive independent reading as an autonomous activity was characteristic of the professors from childhood. Many professors were also inventive and ingenious in producing tools which they needed for activities of interest.

Concluding Remarks

The research reported in this study demonstrated the importance which clinical studies producing "soft" data can have to educators. In addition to describing university professors, it suggested relationships between several variables and academic motivation. These relationships warrant specific study to clarify their nature and implications.

The sample in this study was limited to men who were engaged in science-oriented activities. Similar studies of professors in the humanities would give a broader perspective to these findings. Studies of women engaged as professors would also provide valuable complementary data.
May 4, 1970

Dear ____________,

You will probably agree that motivation to learn is a crucial variable in the educational process. Surprisingly, so little is known about its nature and development that educators are limited in their efforts to capitalize upon their students' motivations.

To shed light on this problem, the Kettering Foundation has funded a project at The Ohio State University to study human motivation. One phase of this project is an investigation of the motivation of university professors in a variety of areas. The Faculty of ____________ is one of several chosen for inclusion in the study.

A sample of professors from the Faculty of ____________ is needed. Those professors who are most active in conducting research, producing literature (textbooks, essays, reviews), motivating students, and/or contributing time to academic organizations are the ones who would offer the most valuable data for this study.

As a teaching associate who is familiar with the activities of the ____________ Faculty, you are in a position to help identify professors who are outstanding in the activities listed above. Would you take a few minutes to think about those professors with whom you have studied and worked and then list the names of the eight (8) outstanding, most active ones who come to your mind? An indication of the professors' predominant activities would also be helpful. Enclosed is a self-addressed envelope for return through Campus Mall.

Your assistance in this project is a necessary preliminary step which will provide a guide for the selection of professors for the study. Your individual response will, of course, be kept in strictest confidence.

Thank you for your cooperation.

Sincerely,

Sara C. West, Research Associate
Faculty of Curriculum and Foundations
The Ohio State University

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ACTIVE PROFESSORS OF

Please list below the names of the eight (8) most active professors (assistant, associate, or full professors) in your department.

Beside each name indicate the professor's outstanding activity by writing in a number from the following key:

1. conducting research
2. producing literature
3. motivating students
4. contributing to academic organizations
5. other (PLEASE SPECIFY BELOW.)

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Enclose the completed form in the self-addressed envelope and return through Campus Mail. Thank you.

Sara C. West, Research Associate
Curriculum and Foundations Faculty
A. BOOKS


B. PERIODICALS


