

THE ANTI-SCIENTIFIC ATTITUDES AMONG HIGH SCHOOL STUDENTS

by

IRMA JOY GREISEL

A THESIS

submitted to


OREGON STATE COLLEGE

in partial fulfillment of  
the requirements for the  
degree of


MASTER OF ARTS IN GENERAL STUDIES

June 1959

APPROVED:

  
Assistant Professor of Education

In Charge of Thesis

  
Chairman of General Studies Committee

  
Dean of Graduate School

Date thesis is presented August, 1958

Typed by Naomi Larsen

## TABLE OF CONTENTS

Chapter	Page
I. Introduction . . . . .	1
II. Forces Against Science . . . . .	10
III. Preliminary Investigation . . . . .	25
IV. Presentation of Data . . . . .	53
V. Interpretation of Test Data . . . . .	63
VI. Why Do Myths Persist in Twentieth Century . .	87
VII. Further Research Needed . . . . .	102
Bibliography . . . . .	110
Appendix . . . . .	114

# LIST OF TABLES

Table	Page
1. Percentage Comparison of Total Correct Responses on 1957 Belief Test of 274 Seniors and 325 Freshmen	31
2. Percentage Comparison of Incorrect Responses on 1957 Belief Test of 274 Seniors and 325 Freshmen	32
3. Item Analysis of the 1957 Belief Test	36
4. Item Analysis of the Seniors and Freshmen - 1957 Belief Test	37
5. Percentage Comparison of Incorrect Responses on the Revised Preliminary Test of 56 Third Year Science Students With the Incorrect Responses on the 1957 Belief Test of 274 Seniors and 325 Freshmen	44
6. Item Analysis of the Revised Preliminary Belief Test	47
7. Percentage Comparison of Incorrect Responses on 1957 Belief Test of 274 Seniors and 325 Freshmen with the Incorrect Responses on 1958 Belief Test of 225 Seniors and 463 Freshmen	54
8. Percentage of Incorrect Responses on 1958 Belief Test of 132 Freshmen and 64 Seniors Who Had Part of Their Grade School Education Outside of Oregon Compared with 331 Freshmen and 161 Seniors Who Had Received All of Their Education in Oregon	58
9. Percentage Comparison of Incorrect Responses on 1958 Belief Test of Students from New Hampshire, Arizona, Indiana, and Oregon	60
10. Percentage Difference Between Incorrect Responses on 1958 Belief Test of 463 Freshmen and 225 Seniors	64



LIST OF TABLES  
(continued)

Table	Page
11. Percentage Comparison of Incorrect Responses on 1958 Belief Test of 463 Freshmen, 59 Seniors Who Had Taken One Science Course, 98 Seniors with Two Science Courses, 29 Seniors with Three, and 39 Seniors with Four Science Courses	66
12. Percentage Comparison of Responses on 1958 Belief Test on Questions Pertaining to the Age of the Earth	69
13. Percentage Comparison of Combined Responses on 1958 Belief Test on Questions Pertaining to Fluoridation of Water	70
14. Percentage Comparison of Responses Pertaining to Racial Superiority on 1958 Belief Test of 463 Freshmen, 59 Seniors Who Had Taken One Science Course, 98 Seniors With Two Science Courses, 29 Seniors with Three, and 39 Seniors with Four Science Courses	73
15. Percentage Comparison of Incorrect Responses Pertaining to Students' Ideas of Scientists on 1958 Belief Test of 463 Freshmen, 59 Seniors Who Had Taken One Science Course, 98 Seniors with Two Science Courses, 29 Seniors with Three, and 39 Seniors with Four Science Courses	74

# THE ANTI-SCIENTIFIC ATTITUDES AMONG HIGH SCHOOL STUDENTS

## Chapter I INTRODUCTION

This century often has been given the label, the scientific age; and, because of the scientific race with Russia which has resulted in the deep concern of our government with science, because of the tremendously important discovery of nuclear energy second only in importance to man's discovery of fire, and because of man's beginning mastery of space, this label seems apt. However, there is a mass of evidence that shows that this emphasis on science effectively covers up a large number of anti-scientific beliefs firmly held by many people, and that this prominence of science gives a false impression of the progress made in scientific thinking by people in general. The evidence of anti-scientific beliefs is so strong that George Bernard Shaw's statement (44, p. 1027) in the Preface to Saint Joan, "I affirm that the nineteenth-century, and still more the twentieth, can knock the fifteenth into a cocked hat in the point of susceptibility to marvels and miracles and saints and prophets and magicians and monsters and fairy tales of all kinds",

is too close to the truth to be ignored.

In Portland, Oregon, in July 1957, a group of approximately three hundred adults gathered to listen to a lecturer "prove" the existence of flying saucers from outer space, to see pictures of little men from Venus, and to see samples of the strange exhaust material from these flying saucers. The meeting was reminiscent of the old medicine shows and after witnessing this show, the author must agree with La Piere (28, p. 314) who believes that "popular science education has not gained acceptance for the facts of science; it has led to the development of a new folk faith in a new form of magic." Science education has trained a few people to prefer the advice of trained technicians to that of magic men, but these people are especially susceptible to the advertised claims of chlorophyl, hormone creams, enzymes, and secret ingredients. The terminology, borrowed from science, becomes an effectual prestige symbol for unscientific doctrines.

The popularity of psuedo-scientific books is another proof that scientific thinking for most of the people is only a veneer of words. The trend toward the acceptance of psuedo-scientific books became evident with the publication of Velikovsky's books, World in



Collision and Earth in Upheaval. Even though Velikovsky's theory has been refuted by reputable scientists everywhere, the books are published as scientific facts and have been on best-seller lists. Velikovsky's theory is based on one propounded in 1726 by Scheuchzer, a professor of mathematics in Switzerland. In the book, Physica Sacra, Scheuchzer develops the theory that the "fountains of the great deep" were broken up by the direct physical action of God who gripped the axis of the earth and consequently stopped its rotation which caused the water of the oceans to produce the deluge (53, p. 228). Velikovsky's books are full of half-truths and twisted facts: for example, Velikovsky, to uphold his theory, quotes Buckman, professor of geology at the University of Oxford, 1823, and says that Buckman was one of the great authorities of the nineteenth century; but Velikovsky fails to mention that Buckman later gave up his idea of a flood covering the entire earth (53, p. 16).

Scully's Behind the Flying Saucers and Roberts' Henry Gross and His Dowsing Rod (42, 38) are two other quasi-scientific books that appeal to the fear of the unknown, suspicion of scientists, fear of conspiracy, and the tendency to perceive the world



as menacing--some of the most widely held ideas and emotions of our culture.

Bernard and Judith Mausner (32, p. 35-39) believe that we are developing an anti-intellectual and especially an anti-scientific attitude in the United States, an attitude which Senator Fulbright of Arkansas has called the "swinish blight of anti-intellectualism." The Mausners believe that the current outbreak is expressed in many ways but that there are two manifestations which can be easily recognized: "a deep distrust of intellectuals and a rejection of ideas or discoveries that conflict with entrenched beliefs". In a study concerning the fluoridation of the public water supply in Northampton, Massachusetts, the Mausners found that an attitude of suspicion prevailed among those who opposed fluoridation; that those interviewed were not only suspicious of scientific organizations but feared "eggheads." They found that the anti-fluoridation opponents used three main arguments: (1) the value of fluoridation has not been sufficiently proved; (2) that sodium fluoride is a rat poison and fluorine is one component of "nerve" gases, and this fear of poison was enlarged to include a fear of communists; (3) fluoridation is an invasion of individual rights.

The Mausners' purpose was to find to what extent the general public shared the fears and attitudes of those organizations which have campaigned against fluoridation. They found that the anti-voters overwhelmingly refused to accept scientific organizations as the best authorities on fluoridation. The anti-voters thought that the public health officials, the American Dental Association, and the chemical industries, particularly the Aluminum Company of America, were in a conspiracy to impose fluoridation on the public; and those who opposed fluoridation were suspicious of scientific organizations and of the scientists themselves.

In April, 1956, the city council of Portland, Oregon, decided to place the proposal for fluoridation of the city's water on the November ballot. The Citizens' Council against Water Fluoridation and the Pure Water Committee of Portland's Health Education League became active and a bitter battle ensued. The author and the students of a chemistry class interviewed 1231 adults in the suburban area east of Portland. These people, who were supplied with water from Portland, could not vote on this issue; but this did not hinder them from voicing their opinions and from trying to influence the outcome of the vote. There

were four main arguments from the opposition: (1) fluorides were poisonous and would harm the body. (2) they did not want medication forced upon them, (3) fluorides would make the water taste peculiar, and (4) dentists say that it is bad for the teeth. Although the unofficial results of a state-wide survey of the Oregon State Medical Society disclosed practicing physicians favored fluoridation of public water supply nine to one; a Dr. Exner, a radiologist from Seattle, Washington, who opposed fluoridation was more influential. Exner said that the evidence in support of fluoridation had been deliberately falsified and was full of contradictions. He also said that he saw cases of fluoride poisoning in his practice every day but could not prove them. The fear of a communist inspired plot did not appear in the Portland area, but otherwise the pattern was much the same as the one in Northampton, Massachusetts, and the issue was defeated. The results of the author's survey made in the suburban area east of Portland showed 65 per cent in favor of fluoridation, 21 per cent opposed and 14 per cent who had no opinion. It is doubtful, however, if a vote in this area would have favored fluoridation because the survey revealed that those who were against

fluoridation were much more emotionally interested in the outcome and much more vociferous in their stand against fluoridation than the others were in support of the issue.

When large city newspapers carry daily "Star Gazer" charts; when an announcement of a meeting of an Astrological Research club meeting is placed prominently on the page beside the announcement of a PTA meeting, when men spend fifty million dollars a year to grow hair on a bald head, it is obvious that science in this scientific age is only skin deep.

The renaissance was an age of superstition, but so is our own, under the surface. Superstition is a characteristic not only of the ignorant and non-literate, but of the educated also. Intelligent citizens accept the authority of science in most affairs but in a few personal relations listen to the lure of fortune-telling, character reading, dream dictionaries, luck pieces, charms, or old folk sayings. There are well-known educated men who are anti-scientific, perhaps unwittingly so. Harrison Brown in reviewing Velikovsky's Earth in Upheaval says that he has not ever seen a single defence of Velikovsky's theory by a competent scientist and yet the book was highly praised



by such men as Fulton Oursler, Clifton Fadiman, and Harold Ickes (9, p. 127).

Scully's Behind the Flying Saucers had this publisher's note in the preface: "We are as convinced as any thoughtful publisher can be that Mr. Scully has approached his subject with probity and has interpreted the facts and figures given him with care and caution" (42, p. vii). Hold, a reputable publishing company, made the above statement even though the book contained many paragraphs like the following: "At 186,000 miles per second, that is 11,172,000 miles per minute, or 630,320,000 miles per hour. At one time Venus is 154,000,000 miles from us; at another time 161,000,000 miles away. Taking the shorter distance; that's 308,000,000 miles for the round trip. Half of 67,320,000 is 335,160,000. In other words the round trip could be made in less than 42 minutes" (42, p. 167). He has interpreted the facts and figures with care and caution?

The above illustrations are not isolated, regional examples; they represent a common thread of thought, an anti-scientific bias. Such things, viewed together, are the basis for making this study of anti-scientific attitudes among high school students. Several elements

must be taken into consideration in any study of anti-scientific attitudes: the forces against science, the anti-scientific beliefs held, the strength of these beliefs, the functions of the beliefs, and the desirability of substituting scientific facts for anti-scientific beliefs.

## Chapter II

## FORCES AGAINST SCIENCE

The theory that superstitions and myths are originated to allay fear and anxiety and are perpetuated to control the behavior of social groups is developed later in this study. Fear is probably the basic force behind all superstitions and myths and therefore fear is one of the most powerful forces against science. If those without expert knowledge cannot understand scientific discoveries, then science is not making new knowledge available to them but is producing a new unknown which may be feared. This apprehension of the science-created unknown may lead to an opposition to science. In addition, resistance to science can come from economic institutions; from the classicists; and from religious institutions.

## Science Produces Fear

The need for security and freedom from anxiety has been present in all generations and this one is no exception. The rapid growth of scientific knowledge in this century has overwhelmed those who are not scientifically minded. Advances in scientific

knowledge not only destroy the security of the laymen's knowledge but present an almost unsurmountable problem in accumulating the knowledge to understand these advances in scientific thinking.

A long program of rigorous training is necessary to understand the new scientific discoveries. The layman must take on faith the publicized statements about relativity, quanta, the uncertainty principle, and radioactive isotopes; this results in an increasing gap between scientists and laity. Since the general public cannot understand scientific terminology, science no longer explains natural phenomena for them but produces instead another unknown to be feared. The fear that tampering with the nucleus of the atom will result in world destruction is one of these fears.

There are many people, good citizens, who are afraid of science because they are afraid of the truth; they can not face the facts of life and want to believe the promising, easy solutions offered by fortune telling, character reading, astrology, phrenology, palmistry, and numerology. Often the belief in these psuedo-sciences is just half-belief, a hope that the many people who have believed in them can not all have been wrong.



The distrust of intellectuals is due partly to fear and partly to the rejection of ideas that conflict with deeply held beliefs. Since the scientists belong with the intellectuals and because they present facts that conflict with deeply held beliefs they too are distrusted. The derogatory terms of "square" and "egghead" spring from man's hatred of mental superiority, not only because the superiority wounds their vanity but because it frightens them. Fear of superiors due to position, official status, is something that can be controlled because it is understandable; but the fear of the man who sees farther and probes deeper into the unknown than other people is a strange, unknowable mystery.

#### Opposition of Economic Institutions

The rapid development of science and related technology has resulted in an anti-scientific movement led by those representing economic institutions. Even though the scientist cannot control the use made of his discoveries, if the applications are judged socially undesirable science is charged with responsibility. Opposition to advances in technology comes from representatives of labor who fear the loss of

investment in skills or fear the replacement of workers by machines. Industrial history shows that their fear is well grounded and that technological advances can result in suffering for the laborers. Science and scientists are often charged with the responsibility for this suffering.

Many inventions are eagerly used and praised by both labor and capital but capitalists object to the premature obsolescence of their machinery--obsolescence which is due to new technological advances. The antipathy toward the technological products is often projected toward science itself.

The development of practical applications of nuclear energy may result in increased resistance to science. The use of emanations from radioactive materials to gauge thickness of materials is illustrative of a change already being made in some industries. The manufacturers of older type gauges are discommoded, workers have to learn new techniques, and owners may find it necessary to replace good equipment with the new nuclear devices. The conflict, if it arises, is actually with technology rather than with science, but if those involved in the changes do not differentiate between science and technology, there is a possibility that the resentment will be directed against science.

## Opposition of the Classicists

One of the bitterest attacks on science comes from the classicists and the bitterness is exemplified in Coffin's review of Kenneth Roberts' book, Henry Gross and His Dowsing Rod. Coffin says:

"All my life long I have grown heartily sick of the thesis of the reliability of the so-called exact sciences and its corollary, the unreliability of folk lore; I regard folk lore as the one unchanging truth in a mutable world. Since I was in college the physicists and astronomers have flatly reversed themselves on the size, shape, and nature of the universe. ...I have had to fight for my thesis that Homer doesn't tell us such lies as astrophysicists and that ancient books that come from folk experience are still truthful, whereas all text books of science go out of date every decade." (12, p. 15-16)

Kenneth Roberts in his book, Henry Gross and His Dowsing Rod, attacked scientists in much the same manner. After Dr. Murphy of the American Society for Psychical Research watched some of Roberts' dowsers and was not sufficiently impressed, Roberts commented, "I was astounded to find scientists of standing experimenting with childish and unprofitable tests" (28, p. 79). Roberts has an antipathy for geologists and finds many occasions to attack them. His chief dowser, Henry, blames the hostility of geologists on the fact that dowsers know things that geologists can neither know nor explain, and that geologists will fight to refute

their lack of perception (38, p. 99). After dowsing for water in Bermuda, Roberts thinks that the world's geologists look silly and that at last it is proved that the geologists have misrepresented the facts and the dowsers have been right (38, p. 246-249). The book ends with the question, "How dumb can a scientist be?" (38, p. 262). Since Roberts has gained some popularity as a writer of historical novels his attitude toward scientists may be reflected by his readers.

An influential advocate of classical education as opposed to the scientific is Robert Hutchins. Hutchins' idea of a perfect university is one that teaches from the one hundred greatest books of the western world. He says (23, p. 81), "You will observe that the great books of the western world cover every department of knowledge". Hutchins states his attitude toward the scientific spirit in Higher Learning in America (23, p. 99, 101): "A similar degeneration overtakes natural science. If the world has no meaning, if it presents itself to us as a mass of equivalent data, then the pursuit of truth for its own sake consists of the indiscriminate accumulation of data... We believe that if we can gather enough information



about the world we can master it. Since we do not know precisely which facts will prove to be helpful, we gather them all and hope for the best. This is what is called the scientific spirit." His opinion of scientists is expressed thus (23, p. 104): "It has become almost a tradition in this country for a natural scientist, after he achieves eminence and leisure, to employ some of both in metaphysical, and even theological, speculations. Without any particular training in these disciplines and with a healthy contempt for those who have, he proceeds to confuse the public further about the greatest questions that have confronted the human mind."

#### Opposition from Religious Institutions

Since the opposition of organized religion to science has a long history, the strength of institutional resistance can be gauged more accurately and can be traced more completely. The struggle between intelligent people and superstitions, many of which had a religious significance, is probably as old as civilization. Lucretius (99?-55 B.C.) wrote his de Rerum Natura as a protest against the degrading superstitions of Rome and his purpose was to dispel

superstitions and to bring about freedom from the fear of punishment by the gods. One of the reasons that de Rerum Natura was neglected by scientific minds for so long is that Lucretian science conflicted with religion.

Compton (13, p. 71) relates that in the tenth and eleventh centuries in the Arab world, science was growing but that this growth suddenly stopped in the twelfth century. According to Islamic historians the reason for the decline of scientific enthusiasm was the anti-scientific attitude which Islamic religion took. This same attitude also prevailed in western civilization; astrology, physiognomy, phrenology, palmistry, numerology, necromancy, metoposcopy, and rhabdomancy flourished.

History proves that many anti-scientific beliefs lasted long after they were discarded by thinking men. Plato and Aristotle believed that the world was round as well as St. Thomas Aquinas and Dante but Martin Luther and John Calvin still believed that the world was flat. No one was to benefit from salvation if he believed that the earth was inhabited on the other side, and even though Magellan sailed around the world in 1519, the doctrine was opposed for two hundred years

longer (53, p. 100-113).

The Ptolemaic system was the triumph of Platonic metaphysics and was used for fourteen hundred years. The Ptolemaic theory, developed in the second century, was that the earth was the center and that the sun and planets revolved around the earth, an idea that came from antiquity into the Christian world. This system was developed as a sacred astronomy during the Middle Ages. In 1500 Copernicus, a professor in Rome, announced his doctrine but had to admit that it was merely a scientific curiosity. Thirty years later he wrote Revolutions of the Heavenly Bodies but, not daring to send it to Rome to be published, he gave it to a friend, Oseander, in Nuremberg. Oseander published it but with a preface saying that the doctrine of the earth's movement was not propounded as a fact but as a hypothesis. The church authorities ignored the doctrine until 1616 when Galileo upheld it as a truth and proved it by the use of the telescope. To read Copernicus was to risk damnation and all the Christian world accepted this decree--Protestants and Catholics alike. On February 26, 1616, Galileo was forced to relinquish his opinion and Pope Paul gave out a decree that to teach or read works of Copernicus was to risk persecution in this

world and damnation in the next. Galileo lived to see the truths he had established carefully weeded out from all church colleges and universities in Europe. The Index of books forbidden to Christians included a bull forbidding all writings which affirmed the motion of the earth and it was not until 1835, two hundred years after Galileo's death, that the forbidden books were taken off the list (53, p. 130).

Even as late as 1873, less than one hundred years ago, a publishing house of the Lutheran Synod of Missouri published Astronomische Unterredung and in the introduction were these words: "The entire Holy Scripture settles the question that the earth is the principal body of the universe, that it stands fixed, and that the sun and moon only serve to light it" (53, p. 150). This non-scientific idea of the earth and its position in the solar system which was, because of religion, also an anti-scientific belief, persisted then for three hundred years in the face of scientific evidence that it was false. The effect of this strong anti-scientific belief is still felt today. Remmers and Radler found that 40 per cent of the teenagers they polled believed that the earth is the center of the universe (37, p. 28).



While the idea of a literal creation by the hand of the Creator was the beginning of a powerful stream of theological thought, a lesser current, a belief in a process of evolution, was always detectable. Aristotle had some idea of the development of higher organisms from lower forms, and the fifth book of Lucretius' de Rerum Natura is a brilliant sketch of the beginnings of life upon the earth and the evolution of man. St. Augustine thought it likely that some of the very small animals may not have been created on the fifth and sixth days but may have originated later from slime or putrified matter. However, the main theological tendency was so strong that the world kept on believing in a special creation. At the end of the seventeenth century Leibnitz suggested the mutability of species; but in 1712 the Jesuits defeated an attempt of Leibnitz to found an Academy of Science at Vienna (53, p. 57). Church authorities were shocked by Linnaeus' proof of a sexual system in plants and his writings were banned in the Papal States until 1773 (53, p. 60). By the end of the eighteenth century evolutionary ideas were developing in England, France, Switzerland, and Germany.

Cuvier, who was the acknowledged leader of natural

science and who was afraid that opposition to the church was detrimental to science, threw the whole weight of his authority in favor of the old theory. However, this was not enough to stop the tide of evolutionary thought which culminated in Darwin's The Origin of Species. Darwin's theory came into the theological world like a plow into an ant hill. Protestants as well as Catholics gathered their forces to fight in the last open conflict with science. Professors were fired from universities for teaching the new theory of evolution, the idea was bitterly attacked in church pulpits and college rostrums, in religious and secular newspapers, in books and pamphlets, and by sacro-scientific organizations formed to combat the acceptance of evolution.<sup>1</sup> In the United States the bitterness flared again in the famous Stokes trial at Nashville, Tennessee in 1925. This bitter struggle between religion and science seems so far in the past now that there is an inclination to overlook the effect it still has in 1958. Even now, nearly a hundred years after

---

<sup>1</sup>The Academia, a Catholic organization, and the Victoria Institute in London.

Darwin published The Origin of Species the belief in a six day creation is still strong and a law forbidding the teaching of evolution is still in effect in Tennessee. Many high school students can not accept the idea of evolution, and cognizance of this rejection is evident in many high school biology texts since the books avoid the use of the word, evolution, and do not include man in the discussion of the relations of animals.

After these bitter conflicts between religion and science, the opponents have signed a truce. There is not much evidence that religious thinking recognizes scientific progress but rather there is more evidence that religion ignores science. The church today is interested mainly in man as a social being, in welfare, and social reform.

Since the second World War, two nineteenth-century revival type organizations in modern dress have gained some prominence. One is Billy Graham's organization which has attracted an accumulative audience of over 500,000 people during his 1957 summer crusade in Madison Square Garden, and, according to the television ratings, Graham has a television audience of six million. Billy Graham is anti-scientific as is evident

by his reference to scriptural warnings that the efforts of writers, scientists, and philosophers would be used to undermine the gospel truths. He said: "We see what our scientific achievements do for use. We have a lot of gadgets to save time and now nobody has any time. We build Frankenstein monsters and hydrogen bombs and the whole world lives in fear of them." (8, p. 1).

Another group closely related to Graham's is the Youth for Christ movement which has made an amazing progress. The movement began in Chicago in 1944 and by early 1945 the Youth for Christ International was formed. According to information from the organization, the movement has spread to seventy-eight countries and the ninth World Congress was held in Copenhagen in 1957. There is no membership in the organization so it is difficult to assess the actual strength of the group; however, the Bible clubs which are sponsored by Youth for Christ are also international and are active in forty-one states, four provinces in Canada, and seven foreign countries and over 100,000 high school students in the United States belong to these clubs. In Portland, Oregon, the average weekly attendance is two thousand, and thirty-four high school



Bible clubs operate in the metropolitan area. The object of Youth for Christ is evangelism for the purpose of channeling youth into a Bible-teaching church. A Bible-teaching church is one that accepts the Bible literally and the Youth for Christ rallies are simply nineteenth century evangelism in a modern setting of radio, microphones, and television.

Even though the influence of organized religion has become less significant as the center of social control has shifted to economic and political institutions, these newly developed groups can not be ignored as forces against science. Any time that a scientific discovery conflicts with beliefs or threatens the power by which institutions control their members then new conflicts will arise. As long as scientific theory proceeds beyond the understanding of the non-scientific mind, then science and scientists will be feared.

The general anti-scientific attitudes and the forces working against the acceptance of scientific facts revealed in this resume indicated that an investigation of the anti-scientific attitudes held by high school students would be a fruitful study.

### Chapter III

#### PRELIMINARY INVESTIGATION

##### The Experimental Design

The students selected for investigation of anti-scientific attitudes were freshmen and seniors in a high school having approximately 1500 students. The school is located in the metropolitan area but outside the city of Portland, Oregon. The school has students from both rural and suburban areas. It has very few, two or three, Negro students; very few Orientals since 1942; and there has been no evidence of racial problems in the last ten years.

The purpose of the belief test given to these students was three-fold: to find the non-scientific beliefs held by individuals who have received all of their formal education since the first use of nuclear energy; to learn which incorrect beliefs persist through the four high school years; and to get the students' opinions of scientists.

Twenty-three statements were used in the first preliminary test. Eight were asked to discover the students' idea of scientists: are scientists honest, truthful, geniuses, odder than other people, more

apt to cooperate with foreign agents, and are they more likely to become communists. Two questions were asked to discover the racial prejudices of the students: one was concerned with the mixing of Negro and Caucasian blood plasma and the other questioned racial difference in intelligence. Five questions were asked to disclose the conflict between scientific and religious beliefs and the acceptance of scientific or religious authority: two questions were asked about the age of the earth, one on the evolution of man, and in one set of two questions a statement by the American Dental Association concerning the fluoridation of water supplies was placed in juxtaposition with a statement about fluoridation by a Reverend Mr. Sheen. The other eight questions related to folk-lore and superstitions.

The students were asked to use the words "Yes" or "No" in answering all questions. The results of the test might have been more valid in some cases if the students had been permitted to indicate uncertainty or doubt. This criticism of the test is particularly pertinent in relation to the questions concerning the head-burying ostrich, the ground hog, and cloud seeding. Some valuable information can be obtained, however, by forcing the students to state a definite opinion.

For example, if a student did not know the approximate age of the earth he had an opportunity to accept the geologists statement or refuse to do so. The choice itself becomes indicative of an attitude toward scientific authority. Some students probably knew few of the arguments for and against the fluoridation of water but they had a choice between the statements of the American Dental Association and the statements of an unknown person.

To show that the results indicated a general trend rather than a localized set of beliefs the students were asked to list the states in which they had received their grade school education. No names were written on the papers and no special instructions were given other than that all questions should be answered yes or no. In May, 1957, the following belief test was given to 599 high school students, 274 seniors and 325 freshmen.

#### BELIEF TEST 1957<sup>2</sup>

1. Do you believe that there are people who can find

---

<sup>2</sup>The answers are given here; answers which, of course, were not included in the questionnaire. While there may be disagreement about the answers to some of the questions, the answers are generally accepted as correct.



- water by the use of forked sticks (divining rods)?  
(No)
2. Do you think that scientists are as honest as most other people? (Yes)
  3. Do you believe that ostriches hide their heads in the sand when they are frightened? (No)
  4. On February 2, many newspapers comment on the ground hog and his shadow saying that if he sees his shadow we will have six more weeks of winter. Do you believe this? (No)
  5. Do you think that scientists as a group are odder than other people? (No)
  6. For the last ten or fifteen years scientists have experimented with cloud seeding to produce more rainfall in drouth areas. Do you think that these experiments should be continued? (Yes)
  7. Do you think that scientists are more likely to become communists than other people are? (No)
  8. The following paragraph is taken from a pamphlet written by Reverend Lyle F. Sheen, pastor of St. Malachy's Parish, Geneseo, Illinois, concerning the addition of sodium fluoride to water to prevent tooth decay: "Sodium fluoride is a violent, metallic, inorganic poison. I wish to add my voice against the devilish and un-American plot to fluoridate water." Do you agree with Sheen? (No)
  9. The following is a paragraph taken from a pamphlet published by the American Dental Association concerning the addition of sodium fluoride to water to prevent tooth decay: "The fluoridation of public water supplies is now widely accepted as a method for reducing dental decay." Do you agree with the American Dental Association? (Yes)
  10. Archbishop Usher said that the date of creation was October 29, 4004 B.C. Do you think that this date is correct? (No)
  11. Geologists think that the earth is between two and four billion years old. Do you agree with geologists? (Yes)

12. Do you believe that scientists are the "tools" of big business? (No)
13. In some places the citizens will not permit the Red Cross to mix Negro blood plasma with white blood plasma. Do you think that there is a difference between Negro blood and the blood of white people? (No)
14. Do you think that scientists are more apt to cooperate with foreign agents than people in other professions? (No)
15. According to the evolutionary view, the life we see all about us is the product of a long series of slow changes, connecting it with an original ancestor of very primitive form, probably a single cell. Do you agree with this statement? (Yes)
16. Scientists are more likely to tell lies than other people. Do you believe this? (No)
17. Eighteen social scientists made this statement, "There are no racial differences in intelligence." Do you believe this? (Yes)
18. Do you believe that a person must be a genius to be a scientist? (No)
19. All cancer is incurable. Do you believe this to be true? (No)
20. All students have the same intelligence; it is only the difference in the amount of time spent in study that makes the difference in grades. Do you agree with this statement? (No)
21. Fat people are jolly. Do you believe this common saying? (No)
22. In a recent book, Behind the Flying Saucers, this statement is found, "Flying saucers exist. Three of them have landed in this country and have been examined by scientists." Do you believe this? (No)
23. Do you think that scientists have a normal family life? (Yes)

## Results of the Preliminary Test

Approximately 30 per cent of the students had come to Oregon from other states and had received at least part of their early training in one or more states other than Oregon.<sup>3</sup> As might be expected more students had lived in Washington or California than in any other state; fifty-seven listed Washington, forty-three came from California, and thirteen had lived in Nebraska. Twenty-eight other states and Alaska were represented.<sup>4</sup>

Of the 599 students answering the questionnaire only nine seniors and three freshmen answered all questions correctly and thirteen was the greatest number of incorrect answers for any student (Table 1). A comparison of the number of questions answered incorrectly by seniors and freshmen does not indicate much difference between the two (Table 2).

---

<sup>3</sup>The high school is located in an area of rapidly increasing population. The increase is due to migration, to the shift from urban to suburban areas, and to the increased birth rate.

<sup>4</sup>See Appendix, Table 1.

TABLE 1

Percentage Comparison  
of Total Correct Responses on 1957 Belief Test  
of 274 Seniors and 325 Freshmen

Number of Questions Answered Correctly	Percentage of Seniors	Percentage of Freshmen
23	3.3	.9
22	9.1	5.2
21	12.0	10.5
20	15.0	17.3
19	12.8	11.7
18	15.3	16.0
17	10.6	12.0
16	8.8	9.9
15	5.1	8.3
14	3.6	3.7
13	1.8	1.5
12	1.5	1.2
11	.4	1.5
10	.7	.3
Total	100.0	100.0

An analysis of the 1957 Belief Test revealed some interesting facts, particularly those relating to the students' ideas of scientists. While approximately 7 per cent of the students believe that a scientist is dishonest, 12 per cent of the seniors and 8.5 per cent of the freshmen believe that scientists are more likely to tell lies than other people. The percentage of freshmen who believe that a scientist is dishonest and lies is less than the percentage of



TABLE 2

Percentage Comparison  
of Incorrect Responses on 1957 Belief Test  
of 274 Seniors and 325 Freshmen

Questions	Percentage of Seniors Who Answered Incorrectly	Percentage of Freshmen Who Answered Incorrectly
1. forked sticks	41.6	47.7
2. honest scientists	7.3	6.1
3. ostriches	45.2	37.6
4. ground hog	13.8	11.0
5. scientists - odd	25.9	23.6
6. cloud seeding	11.6	18.3
7. communists	11.6	15.2
8. anti-fluoridation	13.8	16.5
9. fluoridation	17.9	15.8
10. Archbishop Usher	14.9	9.4
11. age of earth	21.9	25.9
12. scientists - tools	55.8	59.6
13. Negro blood plasma	10.2	13.1
14. foreign agents	29.8	28.7
15. evolution	38.9	43.1
16. scientists lie	12.0	8.5
17. race intelligence	26.3	43.1
18. genius	10.2	9.4
19. cancer incurable	4.7	4.0
20. same intelligence	27.6	22.3
21. jolly fat people	15.6	14.4
22. flying saucers	20.9	15.5
23. normal life	27.6	29.9

seniors who believe this. Twenty-nine and eight-tenths per cent of the seniors and 28.7 per cent of the freshmen believe that scientists are more apt to cooperate with foreign agents than people in other professions but only 11.6 per cent of the seniors and 15.2 per cent of the freshmen believe that scientists are more likely to become communists. Of the eight questions pertaining to scientists, six of them had a higher percentage of incorrect answers from the seniors which, perhaps, indicates that the students form a less desirable idea of a scientist as they progress through high school.

Slightly over 26 per cent of the seniors and 43 per cent of the freshmen believe that there are racial differences in intelligence. Since there is no scientific proof of equality or inequality of racial intelligence perhaps this question should have been omitted but the question was retained since the negative answers may be indicative of racial prejudice. The question has been used on surveys of attitudes toward desegregation (25, p. 35).

The two most commonly held beliefs are those concerning divining rods and the head-burying ostrich. The ostrich belief may be due to ignorance but the divining rod belief is held because the student has

"proof" that it works.

A few students wrote comments with the answers or indicated their strong belief or disbelief in some statements. In answering the question pertaining to Usher's statement that creation occurred October 29, 4004 B. C. one freshman answered, "No. It was October 28." Five freshmen answered the question about evolution in large letters followed by exclamation marks but only three seniors indicated special feeling about it; however, one senior wrote, "Heavens, no." and another senior commented, "That's crazy." One senior, evidently eager to defend scientists, wrote the following explanation under the question which asked if scientists were more likely to tell lies than other people: "It's just that scientists have more theories and when they don't work out people think they are liars." Even though this student felt that it was necessary and desirable to defend and explain scientists, he thought that scientists were more likely to become communists and this was the only incorrect answer on his paper! One of the seniors who believed in flying saucers from outer space defended his belief by saying that he had read Scully's book and he thought the man knew what he was talking about.

### Item Analysis for Discrimination

An item analysis for discrimination was made; that is, each question was analyzed to find if it distinguished between those who had a scientific attitude and those who did not. The analysis was done according to Julian Stanley's simplified item-analysis procedure. After all papers had been checked for errors the papers were arranged by score, beginning on top with the best score. Twenty-seven per cent of the total number of papers, 162, were taken from the top of the stack to make up the "high" group. A like number was taken from the bottom of the stack for the "low" group. The rest of the papers were not used in the item analysis.  $W_L$  was the number of students in the low group who answered a certain item incorrectly;  $W_H$  was the number of students in the high group who answered the item wrongly. The larger the difference was between  $W_L$  and  $W_H$  the more discriminating power the item has. In Table 3 the items are arranged from least discriminating to most discriminating. For this test sixteen was the critical value of  $W_L - W_H$  at or above which the item is considered significantly discriminating.

According to this analysis, item 19, cancer is incurable, was not sufficiently discriminating. Also



TABLE 3

## Item Analysis of the 1957 Belief Test

Item Number	Rank Order According to Discriminating Power (Poorest - 1)	$W_L$	$W_H$	$W_L - W_H^*$	$W_L + W_H$
19. cancer incurable	1	15	2	13	17
2. honest scientists	2	31	1	30	32
23. normal life	3	45	14	31	59
10. Archbishop Usher	4	34	3	31	37
21. jolly fat people	5	40	9	31	49
18. genius	6	37	4	33	41
4. ground hog	7	42	8	34	50
20. same intelligence	8	54	15	39	69
16. scientists lie	9	39	0	39	39
13. blood plasma	10	43	3	40	46
9. fluoridation	11	51	10	41	61
22. flying saucers	12	50	9	41	59
6. cloud seeding	13	49	7	42	56
15. evolution	14	85	42	43	127
7. communists	15	47	3	44	50
3. ostriches	16	82	32	50	114
8. anti-fluoridation	17	59	2	47	61
11. age of earth	18	68	10	58	78
14. foreign agents	19	83	24	59	107
12. scientists - tools	20	116	52	64	168
1. forked sticks	21	99	34	65	133
5. scientists - odd	22	78	12	66	90
17. race intelligence	23	91	22	69	113

\* $W_L - W_H$  at 16 or above 16 can be considered discriminating.

TABLE 4

Item Analysis of the Seniors and Freshmen  
1957 Belief Test

Item	Senior $W_L$	Senior $W_H$	Discrimi- nation* $W_L - W_H$	Freshman $W_L$	Freshman $W_H$	Discrimi- nation** $W_L - W_H$
1	36	15	21	63	19	54
2	12	1	11	19	0	19
3	36	20	16	46	12	34
4	22	2	20	20	6	14
5	36	9	27	42	3	39
6	17	1	16	32	6	26
7	17	1	16	30	2	28
8	23	0	23	36	2	34
9	19	5	14	32	5	27
10	15	2	13	19	1	18
11	24	4	20	44	6	38
12	51	25	21	65	27	38
13	16	1	15	27	2	25
14	32	19	13	51	23	27
15	38	19	19	47	23	24
16	21	0	21	18	0	18
17	33	7	26	58	15	43
18	15	2	13	22	2	20
19	5	0	5	10	2	8
20	16	8	8	38	7	31
21	21	4	17	19	5	14
22	30	4	26	20	5	15
23	13	8	5	32	6	26

\* $W_L - W_H$  at 11 or above 11 can be considered discriminating for seniors.

\*\* $W_L - W_H$  at or above 12 can be considered discriminating for freshmen.

when an item analysis was carried out separately for freshmen and seniors, Table 4, it was found that item 19 was not discriminating for either group. Item 20, all students have the same intelligence; and item 23, scientists lead a normal family life, were not discriminating for seniors.

The item analysis of the test, interviews with students, and comments from teachers who administered the test revealed some weaknesses. The word, creation, in question ten was apparently misleading to some students. Nineteen freshmen and eight seniors answered yes to both questions concerning the age of the earth; and, while it is certainly possible to hold two contradictory beliefs without being aware that they are contradictory, the author felt that the question should be restated in other terms.

Because of the high percentage of incorrect answers given by both seniors and freshmen to question twelve, which asked if scientists are the "tools" of big business, it seemed evident that the question had not been interpreted correctly. After discussing the question with students who had taken the test it was discovered that many students had considered the word, tool, to mean simply to work for, or to be

employed by a business or manufacturing concern in a legitimate manner. The question did not suggest any undesirable activity on the part of the scientist or business and so the question was omitted from the following tests.

Question nineteen, "All cancer is incurable," was also omitted from subsequent tests since the discrimination value was only 13 for the entire group and was not sufficiently discriminating for either seniors or freshmen.

Item 20, "Students' intelligence is all the same," was not discriminating for seniors but since it had such a high discriminating value for freshmen the question was retained. Item 23, "Scientists lead a normal family life," was not discriminating for seniors but was for freshmen; but since the question hinges on the word, normal, and since it was found that the students had difficulty in determining what a normal family life was, the question was omitted from following tests.

Since Scully's book, Behind the Flying Saucers, attempts to prove that saucers from other planets have landed on the earth, the question was reworded to make this clear.



On October 18, 1957 a revised preliminary test was administered to 56 high school juniors, students who were taking their third year of science. The group included eighteen students who were in a class for gifted science students. For reasons previously stated three questions from the first test were omitted from this revised questionnaire: cancer is incurable, scientists lead a normal family life; and scientists are the tools of big business. In addition to the two questions concerning fluoridation which quoted statements by Reverend Sheen and the American Dental Association the questions were repeated with no authority given since it seemed desirable to discover if the students were influenced by the authorities quoted. Five questions were added to the test, questions based on divinatory psuedo-sciences, such as cheiromancy (hand reading) and physiognomy (reading character by examining the face) both of which developed during the sixteenth century and are still fairly common. One question, "Do you believe that you can make a person turn around by staring at his back?," was added as representative of parapsychological beliefs.

## REVISED PRELIMINARY TEST

1. Do you believe that there are people who can find water by the use of forked sticks (divining rods)? (No)
2. The addition of sodium fluoride to water would help to control tooth decay. Do you think that this is true? (Yes)
3. Do you think that scientists are as honest as other people? (Yes)
4. Do you believe that ostriches hide their heads in the sand when they are frightened? (No)
5. Do you think that a person who does not look at you directly is dishonest? (No)
6. On February 2, many newspapers comment on the ground hog and his shadow saying that if he sees his shadow we will have six more weeks of winter. Do you believe this? (No)
7. Do you believe that you can make a person turn around by staring at his back? (No)
8. Do you think that a person with a high forehead is more intelligent than one with a low forehead? (No)
9. Do you think that scientists as a group are odder than other people? (No)
10. For the last 10 or 15 years scientists have experimented with cloud seeding to produce more rainfall in drouth areas. Do you think that these experiments should be continued? (Yes)
11. Do you think that a person with long, slender hands is more apt to be artistic than one with short, thick hands? (No)
12. The following paragraph is taken from a pamphlet written by Reverend Lyle F. Sheen, pastor of St. Malachy's Parish, Geneseo, Illinois, concerning the addition of sodium fluoride to water to prevent tooth decay: "Sodium fluoride is a violent, metallic, inorganic poison. I wish to

add my voice against the devilish and un-American plot to fluoridate water." Do you agree with the Reverend Sheen? (No)

13. The following is a paragraph taken from a pamphlet published by the American Dental Association concerning the addition of sodium fluoride to water to prevent tooth decay: "The fluoridation of public water supplies is now widely accepted as a method for reducing dental decay." Do you agree with the American Dental Association? (Yes)
14. Do you think that especially intelligent children are most often physically weak? (No)
15. A square jaw is the sign of a strong, determined person. Do you think that this is true? (No)
16. Archbishop Usher said that the earth and all life was created on October 29, 4004 years before the birth of Christ. Do you think that this date is approximately correct? (No)
17. Geologists believe that the earth is between two and four billion years old. Do you agree with the geologists? (Yes)
18. In some places the citizens will not permit the Red Cross to mix negro blood plasma with white blood plasma. Do you think that there is a difference between negro blood and the blood of white people? (No)
19. Do you think that a scientist is more apt to cooperate with foreign agents than people in other professions? (No)
20. According to the evolutionary view, the life we see all about us is the product of a long series of slow changes, connecting it with an original ancestor of very primitive form, probably a single cell. Do you believe in evolution? (Yes)
21. Scientists are more likely to tell lies than other people. Do you believe this? (No)
22. Eighteen social scientists made this statement "There are no racial differences in intelligence." Do you agree with the social scientists? (Yes)

23. Do you believe that a person must be a genius to be a scientist? (No)
24. Do you believe that the explosions of atomic bombs have caused changes in the weather, that is, extremely hot weather, very cold weather, cloud-bursts, or other changes? (No)
25. Sodium fluoride is a poison and this should not be added to drinking water. Do you agree with this? (No)
26. All students have the same intelligence; it is only the difference in the amount of time spent in study that makes the difference in grades. Do you agree? (No)
27. Fat people are jolly. Do you believe this common saying? (No)
28. In a recent book, Behind the Flying Saucers, this statement is found: "Flying saucers exist. Three of them from another planet have landed in this country and have been examined by scientists. Do you believe this? (No)

It might be expected that these students would rate higher in the test than the larger group tested earlier since they were all third year science students. The mean average wrongs score for this group was 4.03 and for the 599 seniors and freshmen it was 5.1. All of these third year science students thought that scientists were honest, believed that there was no racial difference in blood plasma, and did not believe that scientists were more likely to tell lies than other people (Table 5). One surprising result was that on the test given to the third year science students



TABLE 5

Percentage Comparison of Incorrect Responses  
on the Revised Preliminary Test  
of 56 Third Year Science Students  
With the Incorrect Responses on the 1957 Belief Test  
of 274 Seniors and 325 Freshmen

Questions	Percentage of Third Year Science Students Who Answered Incorrectly	Percentage of Seniors Who Answered Incorrectly	Percentage of Freshmen Who Answered Incorrectly
1. forked stick	33.9	41.6	47.7
2. sodium fluoride	10.7	-----	-----
3. honest scientists	0.0	7.3	6.1
4. ostriches	25.0	45.2	37.6
5. dishonest look	1.8	-----	-----
6. ground hog	1.8	13.8	11.0
7. turn by staring	26.8	-----	-----
8. intelligent head	0.0	-----	-----
9. scientists - odd	19.6	25.9	23.6
10. cloud seeding	8.9	11.6	18.3
11. artistic hands	42.9	-----	-----
12. Sheen	5.4	13.8	16.5
13. ADA	12.5	17.9	15.8
14. intelligent, weak	10.7	-----	-----
15. square jaw	8.9	-----	-----
16. Archbishop Usher	8.9	14.9	9.4
17. age of earth	8.9	21.9	25.9
18. negro blood plasma	0.0	10.2	13.1
19. foreign agents	16.1	29.8	23.7
20. evolution	30.4	38.9	43.1
21. scientists lie	0.0	12.0	8.5
22. race intelligence	23.2	26.3	43.1
23. genius	3.6	10.2	9.4
24. atomic bombs	30.4	-----	-----
25. No sodium fluoride	8.9	-----	-----
26. same intelligence	16.1	27.6	22.3
27. jolly fat people	14.3	15.6	14.4
28. flying saucers	19.6	20.9	15.5

the question pertaining to flying saucers was answered incorrectly by almost the same percentage of students as on the earlier test. Definite conclusions can not be drawn from this test since the sample was too small, but the test does show that information about the number of science courses is important to this study.

An examination of the results of this test showed that nine students of the fifty-six made errors on one or more of the questions pertaining to fluoridation. Three of the nine thought that sodium fluoride should not be added to the water since they thought that it was a poison, but they agreed with the statement made by the American Dental Association that the fluoridation of public water supplies is widely accepted as a method for reducing dental decay. Two students thought that sodium fluoride was not a poison and should be added to the water but they did not agree with either Sheen or the American Dental Association. Two students believed that sodium fluoride should be added to the water even though it was a poison but they agreed with Sheen's statement. Two students thought that sodium fluoride was not a poison but should not be added to water and they accepted Sheen's statement. Part of the conflict about fluoridation beliefs may be due to

careless reading of the four questions but some is no doubt due to the fact that the students were influenced by the names, Reverend Sheen and the American Dental Association. These four questions relating to fluoridation were retained on the final test.

The discrimination value ( $W_L - W_H$ ) for this test was six and only six items were discriminatory for this group: belief in flying saucers, head-burying ostriches, scientists are odd, belief that evolution is not true, artists have slender hands (Table 6). All of these were included in the final test.

Of the five questions based on divinatory psuedo-sciences only one, the belief that artistic people have long, slender hands, was discriminating. This one was retained as representative of this kind of belief, and the other four were discarded. The belief in staring to make a person turn around was retained as a representative parapsychological belief even though it was not discriminating for this particular group. While the belief, atomic bombs are responsible for adverse weather conditions, was not discriminating for this group, the question was retained on the final test since the discriminatinating value of four indicated that it would be discriminatory for students with

TABLE 6

Item Analysis of the Revised Preliminary Belief Test  
Given to 56 Students

Item Number	Rank Order of Item According to Discriminating Power (Poorest - 1)	$W_L$	$W_H$	$W_L - W_H$	$W_L + W_H$
3. honest scientists	1	0	0	0	0
5. dishonest look	2	0	0	0	0
8. intelligent head	3	0	0	0	0
18. negro blood plasma	4	0	0	0	0
21. scientists lie	5	0	0	0	0
23. genius	6	1	0	1	1
15. square jaw	7	1	0	1	1
6. ground hog	8	1	0	1	1
26. same intelligence	9	3	1	2	4
14. intelligent, weak	10	2	0	2	2
12. Sheen	11	3	0	3	3
17. age of earth	12	3	0	3	3
2. sodium fluoride	13	4	0	4	4
7. turn by staring	14	4	0	4	4
10. cloud seeding	15	4	0	4	4
16. Archbishop Usher	16	4	0	4	4
19. foreign agents	17	4	0	4	4
24. atomic bombs	18	7	3	4	11
25. no sodium fluoride	19	4	0	4	4
27. jolly fat people	20	4	0	4	4
13. ADA	21	5	0	5	5
22. race intelligence	22	7	2	5	9
28. flying saucers	23	6	0	6	6
4. ostriches	24	7	1	6	8
9. scientist - odd	25	7	7	7	7
20. evolution	26	9	2	7	11
1. forked stick	27	9	1	8	10
11. artistic hands	28	10	1	9	11



fewer science courses. The question on evolution was revised to make it clear that the evolution of man from lower animals was included.

The final form of the test was arranged according to the discriminating values found from the two preliminary tests except that the two questions on fluoridation were separated from the two on fluoridation which had authorities stated. After a comparison of the two preliminary tests it seemed desirable to know if the number of science courses taken made a difference; consequently, the 1958 test included an information sheet on which the students were asked to list the number of science courses that they had taken.

The test in the following form was given to 688 high school freshmen and seniors on April 2, 1958:

#### INFORMATION PAGE

CLASS (Freshmen or senior) \_\_\_\_\_

STATES in which you received your grade school  
education \_\_\_\_\_

SENIORS -- check science courses that you have taken

_____	General Science
_____	Biology
_____	Advanced biology
_____	Physics
_____	Chemistry

DIRECTIONS: Answer YES or NO to the following:

1. Do you think that scientists are as honest as most other people?
2. Do you think that the addition of sodium fluoride to water would help to prevent tooth decay?
3. Archbishop Usher by using dates and events listed in the Bible to prove his point, said that the date of creation of the world and everything in it was October 29, 4004 B.C. Do you think that this date is approximately correct?
4. Are scientists more likely to tell lies than other people?
5. Do you believe that you can make a person turn around by staring at his back?
6. In some places the citizens will not permit the Red Cross to mix negro blood plasma with white blood plasma. Do you think that there is a difference between negro blood and the blood of white people?
7. Do you believe that a person must be a genius to be a scientist?
8. Fat people are jolly. Do you believe this common saying?
9. Do you think that scientists are more likely to

become communists than other people?

10. On February 2, many newspapers comment on the ground hog and his shadow saying that if he sees his shadow we will have six weeks more of winter.

Do you believe this?

11. For the last 10 or 15 years scientists have experimented with cloud seeding to produce more rainfall in drouth areas. Do you think that these experiments should be continued?

12. In a recent book, Behind the Flying Saucers, this statement is found, "Flying saucers exist. Three of them from another planet have landed in this country and have been examined by scientists."

Do you believe this?

13. The following paragraph is taken from a pamphlet written by Reverend Lyle Sheen, pastor of St. Malachy's Parish, Geneseo, Illinois, concerning the addition of sodium fluoride to water to prevent tooth decay: "Sodium fluoride is a violent, metallic, inorganic poison. I wish to add my voice against the devilish and un-American plot to fluoridate water." Do you agree with Reverend Sheen?

14. The following is a paragraph taken from a pamphlet

published by the American Dental Association concerning the addition of sodium fluoride to water to prevent tooth decay: "The fluoridation of public water supplies is now widely accepted as a method for reducing dental decay." Do you agree with the American Dental Association?

15. All students have the same intelligence; it is only the difference in the amount of time spent in study that makes the difference in grades. Do you agree?
16. Geologists believe that the earth is between two and four billion years old. Do you agree with the geologists?
17. Do you think that scientists as a group are odder than other people?
18. Do you think that a scientist is more apt to cooperate with foreign agents than people in other professions are?
19. Eighteen social scientists made this statement, "There is no racial difference in intelligence." Do you agree with the social scientists?
20. Do you believe that the explosions of atomic bombs have caused changes in the weather, that is, that they have caused extremely hot weather,



very cold weather, cloudbursts, or blizzards?

21. Do you think that a person with slender, long hands is more apt to be artistic than one with short, thick hands?
22. Do you believe that ostriches hide their heads in the sand when they are frightened?
23. Sodium fluoride is a poison and should not be added to drinking water. Do you agree with this?
24. According to the evolutionary view, the life we see all about us is the product of a long series of slow changes, connecting it with an original ancestor of very primitive form, probably a single cell. Do you believe in man's evolution from lower animal forms?
25. Do you believe that there are people who can find water by the use of forked sticks (divining rods)?

## Chapter IV

## PRESENTATION OF TEST DATA

## Comparison of Results of 1957 and 1958 Tests

The final belief test was given to 688 high school students, of which 463 were freshmen and 225 seniors, on April 2, 1958. The test was mimeographed and the instructions to be given to the students by the administrators were: (1) We have been asked to take this test; (2) Answer each question to the best of your ability; (3) Do not omit any question.

The results of the 1957 and the 1958 questionnaires were generally similar; however, there were a few striking differences as shown in Table 7. More students believed that the date of creation was 4004 B.C., more freshmen believed that fat people are jolly, more freshmen but fewer seniors believed that the groundhog can predict weather, more students did not accept the American Dental Association as an authority, twenty per cent fewer seniors believed that the intelligence of everyone is the same, twelve per cent fewer seniors thought the ostrich buries his head in the sand, and more students did not believe in evolution but more students believed in the efficacy of water witching.

TABLE 7

Percentage Comparison of  
 Incorrect Responses of 274 Seniors and 325 Freshmen  
 on 1957 Belief Test  
 with Incorrect Responses on 1958 Belief Test  
 of 225 Seniors and 463 Freshmen

Item	Freshmen		Difference	Seniors		Difference
	1957	1958		1957	1958	
1.	6.1	6.1	0.0	7.3	2.3	-5.0
2.	-----	24.4	-----	-----	23.1	-----
3.	9.4	18.6	9.2	14.9	23.1	8.2
4.	8.5	15.3	6.8	12.0	6.2	-5.8
5.	-----	31.5	-----	-----	33.6	-----
6.	13.1	21.6	8.5	10.2	8.9	-1.3
7.	9.4	13.4	4.0	10.2	10.2	0.0
8.	14.4	23.8	9.4	15.6	16.4	0.8
9.	15.2	18.6	3.4	11.6	9.8	-1.8
10.	11.0	14.0	3.0	13.8	8.0	-5.8
11.	18.3	11.0	-7.3	11.6	6.2	-5.4
12.	15.5	15.6	-0.1	20.9	16.9	-4.0
13.	16.5	20.1	3.6	13.8	12.4	-1.4
14.	15.8	21.8	6.0	17.9	23.1	5.2
15.	22.3	24.8	2.5	27.6	7.5	-20.1
16.	25.9	22.0	-3.9	21.9	22.2	0.3
17.	23.6	20.3	-3.3	25.9	21.8	-4.1
18.	28.7	28.1	-0.6	29.8	20.0	-9.8
19.	43.1	33.7	-9.4	26.3	28.4	2.1
20.	-----	46.1	-----	-----	48.0	-----
21.	-----	30.2	-----	-----	29.7	-----
22.	37.6	36.5	-1.1	45.3	33.3	-12.0
23.	-----	15.8	-----	-----	12.0	-----
24.	43.1	52.5	9.4	38.9	52.4	13.5
25.	47.7	50.7	3.0	41.6	52.6	11.0

Since the survey showed an increase in the number of 1958 seniors who believed that a scientist is honest, does not lie, is not more likely to become a communist, and is not more likely to cooperate with foreign agents, one might conjecture that the increased favorable publicity given to science following the launching of the first Russian satellite had an effect upon attitudes toward scientists. Five per cent more of the 1958 seniors believed that scientists are honest; 5.8 per cent more believed that scientists are not more likely to lie than other people; 1.8 per cent more believed that scientists are not more likely to become communists; and 9.8 per cent believed that scientists are not apt to become foreign agents. It would be unwise, however, to attribute the increase in a favorable attitude toward scientists to this factor without further study. This change in attitude did not occur among the freshmen, in fact, the reverse is true in some cases. Six and eight tenths per cent more 1958 freshmen believed that scientists are likely to tell lies, 4.0 per cent more believed that only geniuses can be scientists, and 3.5 per cent more believed that scientists are likely to become communists. Fewer 1958 freshmen believed that scientists were odd and



nearly the same percentage believed that scientists are apt to cooperate with foreign agents.

To find the validity of various factors which might have contributed to the differences in the results of the two tests would involve studying the effect of mass media communications, religious affiliations, the relation of the questions to one another, the effect of proximity of questions, the alteration of emphasis of some questions, and many other factors which are not within the scope of this paper.<sup>5</sup>

The only difference that is large enough to make the validity of the results questionable is the difference between the results of the two years of question fifteen. In 1957, 27.6 per cent of the seniors believed that everyone has the same intelligence and in 1958 only 7.5 per cent of the seniors believed this. However, the freshmen results were approximately the same for the two years. In 1957, 22.3 per cent of the freshmen believed that everyone has the same intelligence and in 1958, 24.8 per cent believed this.

---

<sup>5</sup>Since the relationship to this test of any of these is questionable no attempt has been made to list all factors which might have contributed to the difference between the two years.

## Do these Results Indicate General Attitudes or Attitudes of One Community?

To find if the results indicated general population attitudes or the attitudes of one community the students were asked to list the states in which they had received their grade school education. Of the total 688 students taking the test, 28.5 per cent of the freshmen and 28.4 per cent of the seniors, had received part of their grade school education outside the state. While California and Washington were listed more often than any other state, thirty-two states and Washington D.C. were named, also Alaska, Canada, England, Finland, Hawaii, Japan, Panama, and Guam were each named once.<sup>6</sup> This indicated that the attitudes expressed are not the result of an ingrown, compact, wholly integrated community. Table 8 shows the comparison of Oregon students with students who received at least part of their grade school education in other states.

In addition fifty tests were sent to a high school in New Hampshire, one in Indiana, and a set to a high school in Arizona. A fifty-student sample from each of these areas is too small a sample to have much

---

<sup>6</sup>See Appendix, Table 2.

TABLE 8

Percentage of Incorrect Responses on 1958 Belief Test  
of 132 Freshmen and 64 Seniors who had  
Part of their Grade School Education Outside of Oregon  
Compared with 331 Freshmen and 161 Seniors  
Who had Received All of their Education in Oregon

Item	Out of State	Freshmen Oregon	Total	Out of State	Seniors Oregon	Total
1.	4.5%	6.6%	6.1%	1.6%	1.9%	1.8%
2.	23.5	24.8	24.4	23.4	23.0	23.1
3.	18.2	18.7	18.6	25.0	22.4	23.1
4.	14.4	15.7	15.3	3.1	7.5	6.2
5.	28.8	32.6	31.5	37.5	39.1	38.6
6.	26.5	19.6	21.6	6.2	9.9	8.9
7.	9.1	15.1	13.4	6.2	11.8	10.2
8.	21.2	24.8	23.8	15.6	16.8	16.4
9.	18.2	18.7	18.6	6.2	11.2	9.8
10.	17.4	12.7	14.0	9.4	7.5	8.0
11.	9.1	11.8	11.0	0.0	8.7	6.2
12.	10.6	17.5	15.6	14.1	18.0	16.9
13.	16.7	21.4	20.1	12.5	12.4	12.4
14.	22.7	21.4	21.8	21.7	23.6	23.1
15.	31.0	22.4	24.8	1.6	9.9	7.6
16.	22.0	22.0	22.0	15.6	24.8	22.2
17.	22.0	19.6	20.3	25.0	20.5	21.2
18.	28.8	27.8	28.1	25.0	18.0	20.0
19.	29.5	35.3	33.7	17.2	32.9	28.4
20.	42.4	48.9	46.1	51.6	46.6	48.0
21.	28.8	30.8	30.2	28.2	30.4	29.8
22.	39.4	35.3	36.5	32.8	33.5	33.3
23.	17.4	15.1	15.8	15.6	10.5	12.0
24.	53.0	52.3	52.5	56.3	50.9	52.4
25.	51.5	50.1	50.5	51.6	53.4	52.8

significance, yet a comparison of the results shown in Table 9 denotes that the attitudes of the students from different sections of the country do not vary much.

Forty-two per cent of the New Hampshire students do not believe that sodium fluoride helps the teeth which is 18 per cent more than the Oregon group. However the city council of the New Hampshire community was discussing the fluoridation issue but had not taken any action. Concord, New Hampshire, fired their city manager and then promptly terminated their fluoridation program.<sup>7</sup> If the fluoridation discussion followed the trend of that in Northampton, Massachusetts (33, p. 35-39), then the students are reflecting a polarization of attitude brought about by the conflict between those in favor of fluoridation and those opposed to it. The administrator of the test in Indiana reports that fluoridation is not an issue in the community.

An interesting pattern of trends becomes evident upon study of Table 9. Arizona, which generally has the highest opinion of the scientist, has the least respect

---

<sup>7</sup>Guy Burrill, personal communication, 1958.



TABLE 9

Percentage Comparison of Incorrect Responses  
on 1958 Belief Test of Students  
from New Hampshire, Arizona, Indiana, and Oregon

Items	Students: 50 New Hampshire	49 Arizona	51 Indiana	688 Gresham
1. honest scientists	4.0	2.0	7.7	4.9
2. sodium fluoride	42.0	36.7	31.3	24.0
3. Archbishop Usher	16.0	16.3	16.4	20.0
4. scientists lie	8.0	6.1	7.7	12.4
5. turn by staring	28.0	32.6	41.4	33.9
6. negro blood plasma	16.0	0.0	21.5	17.4
7. genius	8.0	0.0	16.4	12.4
8. jolly fat people	30.0	6.1	19.6	21.4
9. communists	6.0	10.2	19.6	15.7
10. ground hog	12.0	4.1	19.6	12.1
11. cloud seeding	2.0	20.4	13.7	9.4
12. flying saucers	28.0	14.3	21.5	16.0
13. Sheen	24.0	8.2	22.4	17.6
14. ADA	32.0	44.9	11.7	22.2
15. same intelligence	16.0	4.1	31.3	19.2
16. age of earth	16.0	34.7	25.5	22.1
17. scientists - odd	22.0	14.3	29.4	20.4
18. foreign agents	20.0	14.3	39.3	25.4
19. race intelligence	36.0	22.4	27.4	32.0
20. atomic bombs	50.0	16.3	62.7	47.4
21. artistic hands	26.0	12.3	35.2	30.1
22. ostriches	50.0	30.6	47.0	35.5
23. no sodium fluoride	26.0	12.3	19.6	14.5
24. evolution	32.0	61.2	39.3	52.5
25. forked sticks	56.0	18.4	45.1	51.3

for scientific authority. Arizona also has fewer students who believe that the atomic bomb has changed the weather and more students who do not think that cloud seeding experiments should continue. Arizona also has the fewest who believe in the efficacy of the forked stick and least who believe in evolution.

It is not necessary here to consider the various reasons why the results vary. Many factors would have to be considered and evaluated, such as: the administration of the test, the small sample tested, proximity to large scale scientific experiments, and a comparison of the religious and racial groups represented. The value of the comparison lies in showing that the attitudes held by the Oregon students are general attitudes held also by students outside of Oregon.

A study made by Remmers and Radler (37, p. 25-29) during the past seventeen years showed similar results: 25 per cent of the teenagers polled believed that scientists are more than a little odd; 35 per cent believed that it takes a genius to be a really good scientist; and 27 per cent agree that scientists are willing to sacrifice the welfare of others to further their own interest. They found that 40 per cent do not believe that man has evolved from lower forms of

animals, 35 per cent do believe this, 24 per cent do not know and one per cent gave no response. Their research was concerned not only with teenagers' attitudes toward science but with the problems and desires of teenagers. Remmers and Radler came to this conclusion: "A need and craving to be liked, drifting with the crowd, conformity, a kind of passive anti-intellectualism, these seem to be outstanding characteristics of the present-day younger generation as it has expressed itself in our polls."

## Chapter V

## INTERPRETATION OF TEST DATA

## What Effect Does a High School Education, Especially Additional Science Courses, Have On Attitudes?

That a high school education did not have much effect on the beliefs of these students is shown in Table 10. This is not an unusual result and changes in deeply held beliefs are not to be expected. The problem of changing beliefs is more fully studied later in the discussion of why myths persist in the twentieth century. One rather encouraging result, however, is that the seniors have a better attitude toward scientists, with the exception that more of them believe that scientists are odd. However, they do not accept scientific authority with any more readiness than freshmen.

There are four results which need special comment. More seniors believe (38.6 per cent) than freshmen (31.5 per cent) that a person can be made to turn around by staring at his back. One reason for this difference may be that one of the biology teachers includes a unit of psychology in the year's work and he stresses parapsychology, clairvoyance, and telepathy.



TABLE 10

Percentage Difference Between Incorrect Responses  
on 1958 Belief Test  
of 463 Freshmen and 225 Seniors

Item	Freshmen	Seniors	Difference
1. honest scientists	6.1	2.7	3.4
2. sodium fluoride	24.4	23.1	1.3
3. Archbishop Usher	18.6	23.1	-4.5
4. scientists lie	15.3	6.2	9.1
5. turn by staring	31.5	38.6	-7.1
6. negro blood plasma	21.6	8.9	12.7
7. genius	13.4	10.2	3.2
8. jolly fat people	23.8	16.4	7.4
9. communists	18.6	9.8	8.8
10. ground hog	14.0	8.0	6.0
11. cloud seeding	11.0	6.2	4.8
12. flying saucers	15.6	16.9	-1.3
13. Sheen	20.1	12.4	7.7
14. ADA	21.8	23.1	1.3
15. same intelligence	24.8	7.5	17.3
16. age of earth	22.0	22.2	-0.2
17. scientists odd	20.3	21.8	-1.5
18. foreign agents	28.1	20.0	8.1
19. race intelligence	33.7	28.4	5.3
20. atomic bombs	46.1	48.0	-1.9
21. artistic hands	30.2	29.7	0.5
22. ostriches	36.5	33.3	3.2
23. no sodium fluoride	15.8	12.0	3.8
24. evolution	52.5	52.4	0.1
25. forked sticks	50.5	52.8	-2.3

The most noticeable difference in percentage is the one related to the question, "All students have the same intelligence; it is only the difference in the amount of time spent in study that makes the different grades." The difference between the percentage of seniors who believe this and the percentage of freshmen who do may be due to the fact that high school grades are numerical and are given for actual work done, not for effort, or for effort related to ability as many grades in grade schools are. The study of heredity in sophomore biology classes may also help to change this belief. Since the function of this belief is not of great importance, it is more easily changed.

Only two items show an increase in anti-scientific attitudes as more science courses are taken (Table 11). More seniors who have taken three or four science courses believe in the efficacy of the forked stick and the percentage of seniors with three or four courses of science who do not agree with the statement made by the American Dental Association is higher than the seniors who have only one or two science courses. This difference was noted previously in the comparison between the results of the seniors and freshmen.

TABLE 11

Percentage Comparison of Incorrect Responses  
on 1958 Belief Test of 463 Freshmen,  
59 Seniors Who Had Taken One Science Course,  
98 Seniors with Two Science Courses,  
29 Seniors with Three,  
and 39 Seniors with Four Science Courses

Item	Freshmen Total	Senior Percentage				Total
		1 Course	2 Courses	3 Courses	4 Courses	
1.	6.1	5.1	2.0	3.4	0.0	2.7
2.	24.4	28.3	23.5	24.1	12.8	23.1
3.	18.6	35.6	25.5	17.2	2.5	23.1
4.	15.3	10.2	6.1	3.4	2.5	6.2
5.	31.5	39.0	44.9	41.3	20.5	38.6
6.	21.6	18.6	8.2	3.4	0.0	8.9
7.	13.4	13.5	12.2	10.3	0.0	10.2
8.	23.8	27.1	15.3	6.9	10.2	16.4
9.	18.6	11.9	12.2	3.4	5.1	9.8
10.	14.0	16.9	7.1	3.4	0.0	8.0
11.	11.0	5.1	11.2	0.0	0.0	6.2
12.	15.6	25.4	17.2	6.9	10.2	16.9
13.	20.1	22.0	10.2	17.2	0.0	12.4
14.	21.8	27.1	17.2	27.5	23.2	23.1
15.	24.8	10.2	8.2	6.9	2.5	7.5
16.	22.0	22.0	30.6	20.6	2.5	22.2
17.	20.3	20.4	26.5	20.6	12.8	21.8
18.	28.1	25.4	20.4	24.1	7.6	20.0
19.	33.7	30.5	32.7	24.1	17.9	28.4
20.	46.1	50.8	60.2	37.9	20.5	48.0
21.	30.2	30.5	32.7	27.5	23.0	29.7
22.	36.5	42.4	29.6	41.3	23.0	33.3
23.	15.8	13.5	13.3	17.2	2.5	12.0
24.	52.5	59.3	54.1	62.0	30.7	52.4
25.	50.5	55.9	43.9	72.4	56.4	52.8

The evidence seems to indicate that the more science a student has the better is his opinion of scientists but the less likely he is to accept statements from scientific authority. This may occur because the students feel more capable of judging for themselves.

In most cases the decrease in incorrect answers is a steady one from the seniors with one science course to those with four or five. One factor must not be overlooked in drawing conclusions from the number of science courses taken: 157 seniors had one or two science courses and only 68 had more than two. Also before definite conclusions could be made such factors as intelligence and other courses taken would have to be investigated. After comparing the results of all students, a tentative conclusion that there is not much evidence of change in beliefs during the four high school years could be made.

#### Effect of Stated Authority

The test attempted to find the influence which authoritative statement, that is, a statement of belief bolstered by a recognized authority, had upon the acceptance of the belief.

Two questions were asked about the age of the



earth: the third question stated that Archbishop Usher said that the earth was formed in 4004 B.C.; and the sixteenth question stated that geologists believe that the earth is approximately four billion years old. Some students would remember that they had been taught that the approximate age of the earth was four billion years and they probably paid little attention to the authorities mentioned.

The results in Table 12 show that 7.6 per cent of the seniors and only 2.2 per cent of the freshmen were influenced by the Archbishop. The percentage of seniors with less than four years of science who accept Usher as the proper authority seems large when compared with the freshmen results.

The percentage of both freshmen and seniors who agree with neither of the authorities or agree with both may indicate that the questions need to be reworded and that their placement on the test should be changed. Perhaps these results would have been different if the term, archbishop, had been identified with religious authority and if the questions had been in proximity so that the choice between the two was obvious.

The four questions (2, 13, 14, and 23) about the

TABLE 12

Percentage Comparison of Responses  
on 1958 Belief Test  
on Questions Pertaining to the Age of Earth

	SENIORS					
	59	98	29	39	225	463
	1 year	2 years	3 years	4 years	senior	Fresh-
	science	science	science	science	total	men
agree with						
Usher	11.8	8.2	6.9	0.0	7.6	2.2
agree with						
neither	10.1	22.4	13.8	2.5	14.7	19.8
agree with						
both	23.7	17.3	10.4	2.5	15.4	16.4
agree with						
geologists	54.4	52.0	69.0	94.8	62.2	61.6

fluoridation of water were asked to find if the authorities, Bishop Sheen and the American Dental Association had an effect upon the decisions made by the students (Table 13). Sixty and one-half per cent of the freshmen and 67.5 per cent of the seniors believe that fluoridation is desirable and agree with the American Dental Association. A much smaller percentage, 6.1 per cent of the freshmen and 4.9 per cent of the seniors, are against fluoridation and accept Sheen's statement about it. Approximately 7 per cent of the freshmen and 5 per cent of the seniors did not want

TABLE 13

Percentage Comparison of Combined Responses  
on 1958 Belief Test  
on Questions Pertaining to Fluoridation of Water

Combined Responses	SENIORS					225 Total
	463 Fresh- men	59 1 year science	98 2 years science	29 3 years science	38 4 years science	
Believe that fluoridation is desirable and agree with A.D.A.	60.5	62.5	71.4	62.1	69.1	67.5
Against fluoridation and agree with Sheen	6.1	5.0	5.1	10.3	0.0	4.9
Against fluoridation but agree with A.D.A.	7.1	5.0	6.1	3.5	2.6	4.9
Against fluoridation, do not agree with A.D.A., do not believe sodium fluoride is a poison, but do agree with Sheen	3.2	6.8	1.0	0.0	0.0	2.2
Believe that fluoridation is desirable but do not agree with A.D.A.	3.5	3.4	2.0	13.8	18.0	6.7
Against fluoridation, do not believe sodium fluoride is poison, but agrees with both authorities	0.9	3.4	1.0	0.0	0.0	1.3

TABLE 13 (continued)

Combined Responses	463 Fresh- men	SENIORS				225 Total
		59 1 year science	98 2 years science	29 3 years science	38 4 years science	
Believe that fluoridation is desirable, do not believe that sodium fluoride is a poison, but agree with both authorities	3.9	1.7	0.0	0.0	0.0	0.4
Other combin- ations of responses	14.8	12.2	13.4	10.3	10.3	12.1

Fluoridation but were influenced by the American Dental Association. A smaller percentage agreed to nothing except Sheen's statement. Eighteen per cent of the seniors with three or four science courses agree to the fluoridation of water but are against the American Dental Association as an authority. A much smaller percentage are influenced by both authorities, that is, they do not think that sodium fluoride should be used nor do they think that it is a poison but they agree with both Sheen and the American Dental Association. A few freshmen and seniors with one year of science think that sodium



fluoride is not a poison and that it should be used but they also agree with Sheen. Most of the other combinations of answers, and perhaps some of those mentioned above, show careless reading of the questions or the inability to read intelligently.

#### Evidence of Race Prejudice

Racial problems have never been evident in this particular high school and there has been no outward show of discrimination toward the few Negroes and Orientals who attend the school.

A comparison of the freshman with the senior answers indicates that race prejudice decreases with education, and that there is a relationship between the number of science courses and the decrease in race prejudice. Other factors which might contribute to these results are discussed in Chapter 6. The students seem to accept the idea of a lack of blood differences more readily than of intellectual differences.

In only two incidences do the seniors have a higher indication of race prejudice. The percentage of seniors with only one year of science who believe in both a difference in blood and intelligence is higher than the percentage of freshmen who believe in white

TABLE 14

Percentage Comparison of Responses  
 Pertaining to Racial Superiority on 1958 Belief Test  
 of 463 Freshmen, 59 Seniors Who Had Taken One Science Course,  
 98 Seniors With Two Science Courses, 29 Seniors With Three  
 39 Seniors With Four Science Courses

	Freshman	Seniors				Total
		1 yr.	2 yrs.	3 yrs.	4 yrs.	
difference in blood	14.0	10.2	4.1	3.4	0.0	4.9
difference in intelligence	26.1	22.1	28.6	24.2	17.9	24.4
difference in both	7.6	8.4	4.1	0.0	0.0	4.0
no difference	52.3	59.2	63.2	72.3	82.0	66.7

superiority. The seniors with two years of science have the largest percentage who believe that Negroes have less intelligence.

#### Students' Ideas of Scientists

Suspicion of scientists has a long history. Alchemy, based on the pretended art of changing the baser metals into gold, suggested quackery; and while not all alchemists were fakes, the secrecy which enshrouded their efforts made them suspicious characters.

TABLE 15

Percentage Comparison of Incorrect Responses  
 Pertaining to Students' Ideas of Scientists  
 on 1958 Belief Test of 463 Freshmen,  
 59 Seniors Who Had Taken One Science Course,  
 98 Seniors With Two Science Courses,  
 29 Seniors With Three,  
 and 39 Seniors with Four Science Courses

	Fresh- men	1 yr.	2 yrs.	Seniors 3 yrs.	4 yrs.	Senior Total
dishonest	1.8	0.0	0.0	0.0	0.0	0.0
lies	8.2	1.7	2.0	0.0	0.0	1.3
genius	6.6	1.7	3.1	6.9	0.0	2.7
communist	5.4	0.0	1.0	0.0	2.6	0.8
odd	10.6	5.1	11.2	13.8	7.7	8.0
foreign agents	13.6	8.5	5.1	13.8	2.6	6.7
communists, foreign agents	5.7	1.7	2.0	0.0	2.6	1.8
lie, odd, foreign agents	1.5	0.0	0.0	0.0	0.0	0.0
genius, foreign agents	3.6	3.4	1.0	3.5	0.0	1.8
lie, communist, odd	1.5	0.0	0.0	0.0	0.0	0.0
odd, foreign agents	3.0	5.1	4.1	3.5	2.6	4.0
genius, communists, foreign agents	0.9	0.0	2.0	0.0	0.0	0.3
lie, foreign agents	1.2	1.7	1.7	0.0	0.0	0.4
communist, odd, foreign agent	3.0	0.0	4.1	0.0	0.0	1.8
communist, odd	0.9	0.0	1.0	0.0	0.0	0.4
genius, communist	1.5	0.0	0.0	0.0	0.0	0.0
lie, odd	1.2	0.0	1.0	0.0	2.6	0.8
lie, communist	1.5	0.0	0.0	0.0	0.0	0.0
genius, odd	1.5	3.4	3.1	0.0	0.0	2.2
genius, communist, odd	0.2	3.4	1.0	0.0	0.0	1.3
other combinations	10.3	6.8	4.1	6.9	0.0	4.4
All correct	16.3	57.5	54.2	51.6	79.3	62.4



After the fifteenth century, as chemistry became gradually more scientific, alchemy became less respectable and ended in ill repute. Later, scientists came to be looked upon as enemies of the church and many scientific theories were suppressed and scientists were tried for heresy. A common belief of the eighteenth and nineteenth century was that too much prying into the secrets of nature was dangerous; a belief reiterated in the twentieth century by many after scientists had learned to release energy from the nucleus of the atom.

The senior group with the largest percentage who believe that scientists are more likely to be communists, and communists and foreign agents, and lie and are odd, is the one with four years of science. Interviews with some of these students revealed the reasoning which caused them to answer as they did. Many of them thought that scientists were more likely to become communists or foreign agents because more pressure was put on them than on those in other professions, and that if the same pressure were applied to others, they, too, might become communists. Some seniors thought that scientists were more likely to tell lies because they needed to keep secrets essential to security.



The difference between the percentage of freshmen (16.3 per cent) who answered all questions about the scientists correctly and the percentage of seniors with only freshman general science (62.4 per cent) who answered them correctly suggests that many factors have an influence on the formation of this attitude.

The results of this section of the test are encouraging because they indicate a tendency to think of scientists as ordinary people.

#### The Most Commonly Held Belief: The Forked Stick Can Find Water

Since the belief most commonly held in error by the seniors is the belief in the divining rod and also the belief without religious connotation held by the freshmen, a special study of this belief was made.

The belief in the divining rod reaches back into antiquity. The reference by Saint Paul to Moses and his miraculous rod, the use of the scepter as a symbol of power, the staff of the bishop, and the wand of the magician indicate this. From the sixteenth century the divining rod has been used to prospect for metals and to find water. Just when the forked stick first came into general use to indicate the presence of

metal or water is unknown, but Georg Agricola's De Re Metallica, published first in 1564, has a picture of the exploration for a mine with the forked stick playing a most important part.

There is little doubt that the forked stick was used often in prospecting for German mines in the sixteenth century. In Munster's book (18, p. 312) there is a wood cut showing the divining rod in use to find metal in 1544. The stick was made of hazel wood, was about eighteen inches long and was held horizontally with the palms up and the point foremost.

It was not until 1692 that there is evidence of the use of the divining rod in France. In that year, Jacques Aymar, used the forked stick to find not only metal and water but also to trace robbers and murderers (18, p. 314).

The shape of the stick and its function is practically the same in 1958. There are some minor variations among water witchers; some prefer a longer stick, some use any wood, while others prefer hazel, willow, or peach. Roberts, the historical novelist, has been one of the most vociferous twentieth-century champions of water witchers. His favorite witcher, Henry Cross, a Maine game warden, can distinguish bourbon from

Scotch, classify canned goods, and determine the Rh negative factor in blood (38, p. 64-67). The most unusual innovation mentioned by Roberts is the use of a forked stick over a map instead of land (38, p. 291). Roberts says that Henry Gross can dowse for water by holding the stick over a map or even a rough sketch of an area, and find the exact spot on which to drill a well. Shepard (45, p. 69-75) relates the story that after he had had several unsuccessful witchers on his place, he wrote to Roberts and Gross who were both in Bermuda and asked them to locate a spring on his farm in Maine. Neither Roberts nor Gross had ever seen the farm nor did they have a map of the area, but they sent the following information to Shepard:

"From the center of your kitchen it is 132 feet to place where veins come together. 430 ft. from kitchen the veins originate in a dome. Five veins flow out of this dome. Water is very good to drink."

Gross visited Shepard's farm in 1950 and after asking mentally several questions of his sugar maple forked stick, he told Shepard that he had found a vein eleven and one-half feet wide, seven feet down to water and that the bottom of the water was eleven and one-half feet from the surface of the ground. Shepard dug and found that Henry was correct to the inch!



With few variations and modifications the theory of the sixteenth century which explained the working of the forked stick still satisfies believers today. Givry (18, p. 317) quotes the explanation of Pierre Garnier, 1700, for the phenomenon of Aymar's tracking down murderers with a forked stick:

"In every spot where the murderers passed a very great quantity of corpuscles were left which issued, by transpiration, from the bodies of those murderers. As a murderer never acts in cold blood, these corpuscles were otherwise ordered than they were before the murder, and they operated very strongly on Aymar's body, especially upon his skin."

Givry quotes another author, Abbé de Vallemont (1725):  
(18, p. 317-318)

"He must not tread roughly, or he will disperse the cloud of vapours and exhalations which rise from the spot where these things are and which impregnate the rod and cause it to slant. I say that the corpuscles - as well as those which transpire from the hands of the man into the rod, as those which rise in vapour above springs of water, in exhalations above minerals, or in columns of corpuscles from the insensible transpiration over the footsteps of fugitive criminals - are the immediate effective cause of the movement and bending of the divining rod."

This pseudo-scientific theory of corpuscles emanating from a source must have been bolstered by several discoveries made in the nineteenth century: Crookes' experiments with cathode rays, Roetgen's X-rays, the discovery and identification of the proton, and the discovery of radioactivity. Also, Gilbert's



experiments in 1600 to show that the earth was a huge magnet, Oersted's proof of the relation between magnetism and electricity in 1819, and the discovery of the earth's magnetic pole in 1831 could have been instrumental in connecting the corpuscle theory of water witching with the magnetic theory of water witching. For those with little or no science training the belief that "something" emanates from the water to the rod is as logical as the belief that "something" emanates from radium; or the association between the attraction of water for the stick is as logical as the attraction of a magnet for iron.

In 1884 the W. Manfield Company of Birkenhead, England, took advantage of the new scientific discoveries in magnetism and electricity to explain in psuedo-scientific terms the workings of a new water finding device. They began to manufacture a magnetic gadget which they say finds water on a magnetic, electrical, vertical air current theory. The instrument is quite simple looking and is about the size of a microscope case. About half way between the top and bottom is a scale with a small piece of metal which is used to seat the compass needle. Different needles are used to find soft water, hard water, and salt water. The swing

of the needle indicates how much water and how deep down the water is. This gadget is quite different from a forked stick but there is a relation between the theories which explain how they work and also a similarity between the movement of the needle and the stick and the questions which they answer.

The instruction book which comes with the Mansfield instrument has this explanation of its working:

"Observations should be taken between the hours of eight and twelve in the morning and two and five in the afternoon, these being the hours of greatest activity of the vertical air currents on which the working of the machine depends. These currents naturally seek the path of greatest conductivity, and are therefore strongest in the immediate vicinity of subterranean flowing waters. This instrument is constructed to indicate only those subterranean waters with a total hardness of under twenty degrees. The softer the water the livelier the movement of the needle. The apparatus indicates subterranean water flowing in a natural state and not water pipes or sources that have sprung up to day-light. Borings should be made on any site where total movement of the needle is ten degrees or more."

On the bottom of the instrument is this warning:

"The seal of this instrument must on no account be tampered with. The instrument seldom needs repair and such repairs can only be carried out by the manufacturer. To open the bottom compartment simply means the total destruction of the instrument." The owner of one of these instruments is not likely to investigate the workings since the "machine" costs eighteen hundred

dollars!

Roy Hamilton, owner of one of the boxes, explains its workings thus: "Air moves in waves vertically, little waves and big waves. This enters the ground and goes where it can be conducted best--water. This current effects the water and the needle, one end of which is charged thirty degrees and the other end forty degrees. I think the bottom of the instrument has a coil which works against fields." When he was questioned about the meaning of "this current," he used the terms air current, earth's magnetic field, and electricity as if they were all the same thing. He had no idea how the needle could be charged thirty degrees on one end and forty degrees on the other. However, Hamilton has been quite successful, financially, with this gadget and has witched for many wells in the Portland, Oregon, area and also he has worked for the Summit Water and Supply Company of Tacoma, Washington with his gadget. A feature article in the Oregon Journal (34, p. 7) has this to say about him:

"Lance Strayer, veteran Portland well driller, is completely sold on Hamilton's results with the Mansfield finder. In recent months the water seeking pair has located a number of wells in spots where earlier drillings produced only "dry holes" after expensive failures. William Stinnett, Oregon City driller, has had equally good success in the Silverton Hills area by



following Hamilton's findings. This area is noted as a risky one by the well-drilling fraternity.

The instrument has been used for many years in England, Europe, Africa, South America, and Canada. The British army used it during World War II to locate water in arid spots of North Africa."

For those who believe in water witching the explanation of how it works is unimportant. An answer which was written on one of the test papers sums up the reasoning which results in a continuance of this belief: "My scientific answer to this question is 'No' but it works."

An experiment was conducted to watch students' reactions to a diviner and his rod. A freshman general science class observed a witcher work on the school grounds. After he had found a spot where the rod dipped consistently the students each tried. One found that the rod dipped for him at the proper spot. The witcher was then blindfolded and after devious windings was returned to the first location but the rod failed to dip. However he did find two other spots which formed an isosceles triangle with the first location. When his blindfold



was removed, he immediately interpreted the results as two water pipes running into the main one which was his first discovery.<sup>8</sup> The fact that he had missed his first location bothered neither him nor the students, nor did the fact that he had not been able to prove that there was water. After the witcher had departed, the boy who had just discovered that he could witch was taken to an area in which there were water pipes. He failed to locate these but this did not discourage him. He insisted that he could feel a pull which he could not control. One of the more skeptical students demonstrated that the stick could be made to turn down without obviously moving the hands and suggested that the witcher subconsciously turned the stick down. The new witcher became less certain that he was governed by an unseen power but he was not convinced. At the beginning of the discussion period which followed, about half of the students were firmly convinced that water witching was efficacious, but as the discussion progressed, they became less sure. It was difficult to determine if the believers had actually

---

<sup>8</sup>There were no water pipes in this area but neither the witcher nor the students knew this.

changed their minds or if they were merely becoming cautious about expressing their views. They did not find it necessary to explain why the rod dipped nor even to know that a water supply was below the surface; their belief seemed to be based on the fact that they had seen the stick dip.

Hyman and Cohen (26, p. 719-724) have estimated that there are between 15,000 and 35,000 diviners practicing today in this country. In general they found that the regions having a high concentration of diviners tend to have a low population, low precipitation, many wells dug or drilled each year, high cost of wells, poor quality of water, and difficulty in finding water in convenient places. They also found that there are more diviners in areas which showed a decrease in population in the last census, a range in depth of drilled wells, and inadequate ground water information. According to their findings, diviners practice in all forty-eight states. Hyman and Cohen came to the conclusion that witching persists where the water supply is attended by anxiety and uncertainty. They agree with Malinowski's functional theory of belief, that is, that beliefs such as witching are rituals that function to reduce anxiety in a manner

similar to that of magic in non-literate societies. When human beings are confronted with situations beyond their control and that are, therefore, anxiety-producing both in terms of emotional involvement and a sense of frustration, they respond by developing an elaborate ritual that has the function of relieving the emotional anxiety.<sup>9</sup>

Most believers in witching do not regard it as a supernatural phenomena but explain it in scientific terms. Many say that the witcher is sensitive to "something" that comes from the water to the branch, or that the branch "seeks" water, or they accept a psuedo-magnetic electrical theory. These explanations seem to the believers no less scientific than the effect of emanation from uranium on the geiger counter.

A strong, non-scientific belief such as this belief in water witching, leads to an anti-scientific attitude if it becomes necessary to defend the belief. The individuals who believe firmly in water witching defend their belief by saying that geologists are stupid, or that scientists have been wrong in the past.

---

<sup>9</sup>Malinowski's theory of belief is discussed more fully in the next section.

## Chapter VI

## WHY DO MYTHS PERSIST IN THE TWENTIETH CENTURY?

## Beliefs and Myths

Man through all time, everywhere, has been a myth-maker. Through slow, unplanned development of thoughts, feelings, and actions he has evolved his myths and has believed them. The proof of a belief is immaterial and a belief is usually accepted as being beyond the need of proof. Bidney (7, p. 293) says of belief: "Belief is an epistemically neutral term in the sense of being beyond truth and falsity -- to say that one believes a given statement tells us nothing of its scientific or objective validity."

Belief can be separated into three categories: (1) scientific belief which can be verified, at least in terms of knowledge available at any one period of time; (2) magical or mythical belief which refers to belief incompatible with scientific fact; (3) religious beliefs which can not be empirically verified since there is nothing in scientific knowledge to either prove or disprove them.

This study is concerned with the persistence of mythical beliefs in the twentieth century in the United States; myths which include magic, superstitions,



religious beliefs which have been disproved by science, and prejudice which is closely related to certain myths. Why do myths persist within a culture that prides itself on its technological and scientific progress?

### Theories of Belief

The theory that belief, especially a magical or religious belief, is the most powerful influence on humanity is one of the oldest forms of social theory. There have been many theories concerning beliefs, and the theory of magic has been the subject of a controversy between two eminent twentieth-century anthropologists, Malinowski and Radcliffe-Brown. Malinowski, after a study of the primitives of the Trobriand Islands, came to the conclusion that the primitives used magic to extend their knowledge into the realm of the unknown, and he maintains that the natives know the difference between science and magic. In his lectures, The Foundations of Faith and Morals, (7, p. 159) he states: "Primitive Man has his science as well as his religion; a myth does not serve to explain natural phenomena but rather to regulate human actions." Malinowski does not believe that magic is a substitute

for science nor in opposition to science but that it is the extension of scientific knowledge. The native's knowledge of nature (science) is for his intellect and magic is for his heart, and consequently they do not conflict and can exist at the same time. Malinowski goes on to say that the magical rites develop into a group norm and that the rites have the function of giving the natives confidence and determination. Malinowski believes that myths serve to provide control of behavior in both non-literate and literate societies. The myths of civilized society are religious beliefs, scientific knowledge, or rationalistic philosophy, which are as mythological to those who do not accept these beliefs as the non-literate's magic is to us.

Malinowski's theory has been criticized on two counts. First, Charles Singer and Levy-Bruhl (7, p. 161) do not think that the natives can differentiate between science and magic. Bidney (7, p. 161) thinks that if the natives could distinguish between science and magic, they could not possibly retain belief in magic, and he draws the conclusion that men of sophisticated cultures gave up belief in magic when they became aware of the scientific method and of the laws governing

natural phenomena. Tyler in Primitive Culture (4, p. 286) agrees with Bidney that the growth of myths has been checked by science and that myths are primitive. Malinowski's theory is also criticized by Ackerknecht (48, p. 122) because Malinowski has drawn conclusions from a non-literate society and then has applied these conclusions to all societies. Ackerknecht denounces Malinowski in somewhat bitter terms: "Malinowski felt able to tell us about the crime, sex life, myth, trade, and magic of savages on the basis of 'functional observations of one single tribe'!"

Also in opposition to Malinowski is Radcliffe-Brown, a follower of Durkheim and the social mold theory. Radcliffe-Brown says that the magical rites of non-literates are for the purpose of producing the appearance of certain feelings which the group norms indicate as appropriate. Radcliffe-Brown believes that the function of the rite is to contribute to the survival of a society by creating anxiety to emphasize the importance of vital activities of the group (22, p. 323-326). Malinowski believes that the function of magical rites is to allay anxiety and to give confidence.

Out of these conflicting theories and disagreement



it is possible to develop a theory which will explain how beliefs began and why they persist even after science has proved them to be false. Homans (22, p. 329) suggests the combination of the two theories into one:

"We may feel that a society is healthy when the impulses of individuals and the expectations of the group coincide. Both are always present and related mutually to one another." The relation between the individual and the group is in equilibrium, or if not, then the group makes a positive effort toward regaining the equilibrium. Homans (22, p. 330) reconciles Malinowski's theory and the Radcliffe-Brown theory into one:

"Magic is an expression of the emotions of individuals in the face of danger and uncertainty, it is also performed as a matter of obedience to social norms."

Homans lists seven elements that must be taken into consideration in any study of rituals or magic (21, p. 171-172): (1) the primary anxiety which is caused by the desire for certain results that are beyond the techniques of the person to produce; (2) primary ritual begins by the performance of actions which have no practical value and, since the individual is a member of a group, these actions may be taken by the group and made into a set form; (3) secondary



anxiety is caused if one of the traditional rites is neglected; (4) secondary rituals are those of atonement which have the function of dispelling the secondary anxiety; (5) statements which rationalize the performance of the ritual; (6) symbolic references to the fundamental myths evolve since the ritual action does not in itself bring practical results and the rites can be determined by other factors; and (7) the functions of the rites are not to produce the desired object but to give the members confidence by dispelling anxiety and secondly to discipline the social group.

The social-contract-Malinowski theory and the social-mold-Radcliffe-Brown theory are both necessary to explain why beliefs begin and why they persist. The beliefs are originated in an attempt to conquer fear or inadequacy and then, if the beliefs are accepted as group beliefs, the individual uses these to pattern his behavior. If he does not accept the group's beliefs, then the group tries to bring his behavior in line with the established beliefs.

#### Persistence of Myths

If, as Malinowski believes, the non-literate can distinguish between science and myth and use the myth

to extend his knowledge, why do myths persist after they have been discredited by scientists? Part of the answer is that groups use the rituals developed to control the behavior of the group. In addition to this, some of the scientific discoveries have created a fear as great as the fear of the unknown and this apprehension creates a need for anxiety-allaying myths.

In the United States the system of cultural values sets up anxiety and, as a result, is, in part, responsible for the continuation of myths. In our society where a system of cultural values praises financial success for all people while the social structure prevents much of the population from reaching this goal, one can expect to find many people who attribute their difficulties to supernatural powers such as the stars, bad luck, or a black cat.

Merton quotes Gilbert Murray in this connection (32, p. 147): "The best seed-ground for superstition is in a society in which the fortunes of men seem to bear practically no relation to their merits and efforts. A stable and well-governed society does tend to ensure that the Virtuous and Industrious Apprentice shall succeed in life, while the Wicked and Idle Apprentice fails. And in such a society

people tend to lay stress on the reasonable or visible chain of causation." If the social system does not aid most of the members in reaching the goals, then that society will tend to put stress on mysticism. When hard work and following the rules do not lead to success, then many people use magic as a supplementary technique for reaching the goal; or to explain their bad luck; that is, they use it to save face.

Once ritual patterns are developed, they are elaborated and extended in terms of certain value-orientations of a given culture and become a part of the "rational" environmental control. Once the ritual pattern of water witching is accepted, it becomes part of the process of farming along with plowing and planting. A ritual pattern fills the gap between sound rational technological techniques for coping with the water problem and the type of control which farmers feel the need to achieve. The adherents of any ritual of magic generally view the ritual as a rational technological procedure.

Experiments have been carried out to study the functional purpose of beliefs, the function of group conformity. According to Festinger, Schacter, and Back (11, p. 204) there is no longer any doubt about

the influence of the group toward the formation of uniform opinions and behavior patterns. It has also been shown that the behavior of individuals is strongly influenced by the group to conform to the behavior of the group. The more stable the group to which the individual belongs the more firmly entrenched do the beliefs become. Some groups openly and deliberately exert pressures for uniformity of behavior and attitudes but all groups exert some kind of pressure upon the individual, pressures which may be difficult to locate since they may be the weight of other peoples' opinion and the desire to do as everyone else does. Asch states this conclusion succinctly (2, p. 31-35):

"That social influences shape every person's practices, judgments, and beliefs is a truism to which any one will readily assent, a child masters his 'native' dialect down to the finest nuances." Asch conducted an experiment among college students to investigate the effects of group pressure on the individual. The group was to match lines with a standard line and when the majority of the group chose the wrong line the minority changed their opinion, even though it was correct, thirty-seven per cent of the time. Asch concludes: "That we have found the tendency to



conformity in our society so strong that reasonably intelligent and well-meaning young people are willing to call white black is a matter of concern. It raises questions about our ways of education and about the values that guide our conduct." The function of the belief, conformity, is more important and more forceful than the validity of the belief.

Prejudice is the result of certain beliefs or myths which have been used to control groups and to maintain group solidarity. Prejudice is a difficult attitude to analyze since psychologists do not know if prejudice is a single thing or many. While few psychologists think that prejudice is caused by suppressed hostility, most psychologists agree that prejudice stems from early upbringing and the attitudes of the parents.

Frenkel-Brunswick (49, p. 532) claims that prejudice is a personality trait and is closely connected to the kind of home life the child had during his early years. Other investigators have not always found that intolerance toward one group indicates intolerance toward others. Some studies have shown that some phases of prejudice are related to nationalism, some to puritanism, and others to a

fear of socialism and communism. Frenkel-Brunswick has findings which suggests that a prejudiced person has a strong urge to follow the approved way of doing things, is puritanical, has great respect and admiration for strength, and has contempt for intellectuals since he considers them weak. This study of prejudice has been correlated with the child's family and it was found that the parents were greatly concerned with social status, were unduly restrictive, and punished the child for any hostility shown toward the parents.

In general, psychologists agree that many of the specific attitudes of children closely reflect the prevailing attitudes in the home and the socio-economic-religious group with which the parents are identified. In many cases it has been found that those in a lower socio-economic group have more prejudices toward minority groups. In a study made by Bettelheim and Janowitz (5, p. 11-13) of racial discrimination it was found that hostility is a consequence of insecurity. The samples studied were one hundred fifty former G.I.'s who lived in Chicago and represented all economic classes. They found that intolerance is related first to a lowering of social status, to feelings of frustration, and insecurity. The degree to which this hostility

finds open expression depends on the degree to which society approves or disapproves of this expression.

The National Opinion Research Center has been making a study of the attitudes toward desegregation since 1942 (25, p. 35-39). From 1942 to 1956 there was a steady decrease in the prejudice against the Negro. In the North the support for school integration rose from forty per cent in 1942 to sixty-one per cent in 1956; in the South the percentage has risen from two per cent to fourteen per cent in the same time. This study suggests that one of the reasons for the shift in attitude toward desegregation comes from a fundamental change in people's belief about racial questions. The study found that beliefs about Negroes' intelligence has changed drastically. In 1942, fifty per cent of the Northerners said that the Negro was not as intelligent and today only fourteen per cent say that he is not.<sup>10</sup> There is some suggestion that people with more education are less prejudiced, but

---

<sup>10</sup>This percentage is considerably less than that found in this study among high school students. The combined percentage of freshmen and seniors who believe that there is a racial difference in intelligence is 28.4 per cent.



many college students still keep the attitudes formed during childhood. There is no proof that knowledge of other groups, or close contact with minority groups acts as an antidote for prejudice.

### Summary

The same forces, fear and anxiety, that make it necessary for non-literates to originate beliefs in magic are still in effect for twentieth-century literate man plus some additional forces created by science itself and by American culture. To summarize briefly: (1) beliefs are developed to mitigate anxiety caused by the fear that a desired result will not occur; (2) beliefs are developed to explain the unknown, strange natural phenomena; (3) beliefs are originated to relieve the anxiety because certain rites were neglected; (4) science in its search into the unknown creates a fear of unleashed, uncontrollable forces and these fears are alleviated by the application of new myths or of the old myths and magic applied to the new fears; (5) the non-scientific create myths about scientific facts because they do not understand science; and (6) the strange vocabulary of science makes it possible to develop new myths using scientific jargon -- science becomes magic.



Beliefs persist long after they have become myths for the same reasons that they persist in non-literate societies -- for group conformity to an accepted behavior pattern. The belief establishes norms of behavior and the function of the belief is to control behavior. Since the validity of the belief is of little importance to this function of control the validity is not questioned. Another function of belief is not to extend knowledge but to give members of a group confidence and determination. Magical rites which began as a result of a desire for a certain goal are transferred to another desire. The conflict of cultural values with social structure, an obvious conflict in this century in the United States, necessitates the continuation of myths. When all known ways to reach a goal have been tried and the goal is unobtainable then some educated men, like the non-literate, rely on myths or magic to help them. The myths become part of the norms of the group and are taught to the children. Since the individual who does not believe or does not participate in a magical rite is punished by the group, the forces which hold the belief are more powerful than any force which questions the belief and so the beliefs continue long after they

are myths. To reiterate, the function of the belief, conformity, is more important and more forceful than the validity of the belief.

## Chapter VII

## FURTHER RESEARCH NEEDED

## Can Attitudes Be Changed?

A question which naturally arises at the conclusion of a study of anti-scientific attitudes is: Can anything be done to change these attitudes?

Some work has been done in an attempt to answer this question but the results are not conclusive, neither are they encouraging. Little investigation has been made of attempts to change strongly held beliefs, for example, the non-belief in evolution.

Jarrett and Sherriffs (27, p. 33-41) carried on an experiment to determine which of the three devices, propaganda, debate, or impartial presentation were most effective in changing attitudes. They chose as their problem the relative value of men and women in our culture. The propaganda method changed the group in the direction of the propaganda; the debate caused pre-existing bias to become more evident -- the amount of this change depended upon the degree of emotional involvement in the attitude; and the impartial presentation made the group more moderate in their attitudinal position.

Lichtenstein, after a study of the class room, concludes; "Schools seem able to increase the resistance to superstitions by stressing open-mindedness but they do not seem able to effectively decrease prejudice or to increase scientificness by the same means." (30, p. 75)

Stephens (49, p. 672-673), in a discussion of techniques of persuasion, thinks that an appeal to emotions, prestige, loyalty, or prejudice is more effective than the logical appeal of arguments to lead individuals to accept beliefs. An authority with prestige and an apparent freedom from bias is also instrumental in belief change. Stephens also says, "One way to persuade a student is to assign him the task of trying to persuade others. Whenever a student is required to repeat, or act out, or present an argument that he has heard, he is more likely to be affected by the argument. As might be expected, many students may resist having to expound a view that is not their own. And those who resent it the most, change the least. But they all change to some extent."

Gorden (11, p. 175) finds that in general, individuals tend to conform to their conception of group norms when giving their opinion in public. Cartwright and



Zander (11, p. 141-142) conclude that the strength of force to conform is determined by the strength of attraction which the group has for the member, the importance of the issue discussed, the number in the group who supported the issue, the size of the group, and the strength of the threat of punishment for non-conformity. The status of the individual in the group also has an effect upon the pressure toward conformity. A well-liked person is more likely to be subjected to pressure to conform and a person with high prestige is less likely to be aware of group pressure. Levine and Butler (11, p. 301) found that group decision proved superior to lecturing and individual treatment as a means of changing certain attitudes.

These experiments leave many important questions unanswered, questions that will have to be answered before much can be done about changing attitudes. Are these changes permanent? Will the changes hold in the individual's own group or are they merely reflections of the norms of the particular group which was gotten together for experimental purposes? Does an individual express one opinion publicly and hold the opposite privately?

Little is known concerning the conditions which

may cause one group norm to override all others, nor is much known about how contradictions resulting from multiple group membership are resolved. Killian (11, p. 255) has found some evidence that suggests loyalty to primary groups (family and close friends) but he also found some exceptions which indicate that such factors as training and feelings of responsibility may result in the adherence to the beliefs of other groups.

All of this evidence leads to the conclusion that an impartial presentation by a group centered leader is partially effective if the group is attractive to the members. If, as Remmers and Radler (37, p. 28) believe, conformity and drifting with the crowd are outstanding characteristics of present day teenagers, then some anti-scientific attitudes may be fairly easy to overcome. However, there is no assurance that an attempt to change strongly held beliefs such as a belief in water witchers, the disbelief in evolution, the belief that atomic bombs are responsible for adverse weather conditions, and the belief that a person can be made to turn around by staring at his back, will be successful.

## Should An Attempt be Made to Change Anti-scientific Attitudes?

For those who believe that one of the main purposes of education is to advance knowledge, the answer must be in the affirmative. If this view ignores all other considerations, ignores the social results of such an attempt, then the consequences may be a further revolt against science. The attempt to change anti-scientific attitudes can not overlook the three functions of magic, superstition, or myths: the use to allay anxiety about reaching a goal, the use as a supplementary technique for reaching a goal, and the function of controlling the behavior of social groups.

Beliefs can not be changed without a deliberate cultivation of doubt, and doubt is a painful condition. There are several steps which must be taken before a belief can be changed. First the individual must discover what he really believes; he must be shown inconsistencies between his beliefs and accepted facts; and, most important of all, he must be helped to gain a resolution of his inconsistencies.

Any time a non-scientific belief is questioned, the non-scientific attitude can easily change into an anti-scientific attitude. There is a direct relationship

between the importance of the function of the non-scientific belief and the strength of the antagonism toward science.

### Recommendations

As a result of this study which has found that high school students do hold anti-scientific beliefs, and that they continue to believe these in opposition to the facts they have been taught, the following recommendations are made.

An exhaustive survey of the non-scientific beliefs which high school students hold should be made. Once this information is accumulated the beliefs should be divided into those that are the result of ignorance and have little or no function, and those that do have a function. Those beliefs that have little function such as a belief in the head burying ostrich and the ground hog should be eradicated.

More research must be done to find the relation between anti-scientific beliefs and intelligence, the relation of beliefs to the functions of religious and other institutionalized groups, and the relation of anti-scientific beliefs to cultural goals. More must be known about the functions of anti-scientific beliefs, and ways to substitute scientific beliefs so that they can fulfill the functions which the



anti-scientific beliefs had. An answer to the question, why do high school students with three years of science have the highest percentage who believe that sodium fluoride should not be added to water because it is a poison, who believe that ostriches hide their heads in the sand, who do not believe in evolution, and who do believe in the use of forked sticks to find water, is needed. The preliminary survey showed that these four beliefs were the most discriminating; consequently, a study of the reasons why students with three years of science have these beliefs might indicate defects or weaknesses in science instruction.

This study has found some anti-scientific beliefs which high school students hold and which persist through the four years. The most discouraging evidence from the standpoint of science instruction is the high percentage of those who blame weather conditions on the atomic bomb, the number who believe that there are racial differences in intelligence, the few who accept evolution, and the many who believe in the value of the forked stick. The ideas which these students have of scientists seems encouraging when compared with other surveys made.

While the eradication of anti-scientific attitudes

is neither easy nor simple, an understanding of these attitudes and the motives and thought processes which support them should make the acceptance of the scientific attitude easier to accomplish.

## BIBLIOGRAPHY

1. Abrams, Ray H. (ed.) Organized religion in the United States. Vol. 256. Philadelphia, The American Academy of Political and Social Science, 1948. 252p.
2. Asch, Solomon E. Opinions and social pressure. Scientific American 193:31-35. November 1955.
3. Bain, Read. Man the myth-maker. Scientific Monthly 65:61-69. 1947.
4. Barnett, H. G. Innovation, the basis of cultural change. New York, McGraw-Hill, 1953. 462p.
5. Bettelheim, Bruno and Morris Janowitz. Prejudice. Scientific American 183:11-13. October 1950.
6. Bergel, Egon Ernest. Urban sociology. New York, McGraw-Hill, 1955. 523p.
7. Bidney, David. Theoretical anthropology. New York, Columbia University Press, 1953. 506p.
8. Bible texts said proof. Oregonian (Portland, Oregon) Section one, p. 1 col. 7-8. June 12, 1957.
9. Brown, Harrison. Books. Scientific American 194:127. March 1956.
10. Burrige, Gaston. Water from a forked stick. American Mercury 84:128-131. May 1957.
11. Cartwright, Dorwin and Albin Zander. (eds.) Group dynamics. White Plains, New York, Row, Peterson Company, 1953. 642p.
12. Coffin, P. Tristram. Homer didn't tell lies. Saturday Review of Literature 34:15-16. January 1951.
13. Compton, Arthur. Science and man's freedom. The Atlantic 200:71-74. October 1957.

14. Emmart, Barney D. All purpose dowsing. The Atlantic 190:90-92. July 1952.
15. Feibleman, James. The theory of human culture. New York, Duell Sloan and Pearce, 1946. 354p.
16. France, Anatole. The revolt of the angels. New York, Heritage Press, 1953. 282p.
17. Gardner, Martin. That dowsing hokum. Science Digest 33:30-36. March 1953.
18. Givry, Grillot. Witchcraft magic and alchemy. Tr. by J. Courtenay Locke. New York, Frederick Publications, 1954. 384p.
19. Hare, A. Paul. Small group discussion with participatory and supervisory leadership. Journal of Abnormal and Social Psychology 48:273-275. 1953.
20. Hartley, Eugene L., Herbert G. Birch, and Ruth E. Hartley. Outside readings in psychology. New York, Crowell, 1955. 865p.
21. Homans, George Caspar. Anxiety and ritual: The theories of Malinowski and Radcliffe-Brown. American Anthropologist 63:164-172. 1941.
22. Homans, George Caspar. The human group. New York, Harcourt-Brace, 1950. 484p.
23. Hutchins, Robert Maynard. The higher learning in America. New Haven, Yale University Press, 1936. 119p.
24. Hutchins, Robert Maynard. The University of Utopia. Chicago, University of Chicago Press, 1953. 103p.
25. Hyman, Herbert H. and Paul B. Sheatsley. Attitudes toward desegregation. Scientific American 195:35-39. December 1956.
26. Hyman, Ray and Elizabeth G. Cohen. Water witching in the United States. American Sociological Review 22:719-724. 1957.



27. Jarrett, R. F. and Alex C. Sherriffs. Propaganda, debate, and impartial presentation as determiners of attitude changes. *Journal of Abnormal and Social Psychology* 48:33-41. 1953.
28. LaPiere, Richard T. *Sociology*. New York, McGraw-Hill, 1946. 540p.
29. LaPiere, Richard T. *Theory of social control*. New York, McGraw-Hill, 1954. 522p.
30. Lichtenstein, Arthur. *Can attitudes be taught?* Baltimore, Johns Hopkins Press, 1934. 89p.
31. Manske, Arthur J. *The reflection of teachers' attitudes in the attitudes of their pupils*. New York, Teachers College, Columbia University, 1936. 67p.
32. Mausner, Bernard and Judith Mausner. A study of the anti-scientific attitude. *Scientific American* 192:35-39. February 1955.
33. Merton, Robert K. *Social theory and social structure*. Glencoe, Illinois, The Free Press, 1957. 640p.
34. Oregon's water detective. *Oregon Journal* (Portland, Oregon) Magazine section, p. 7, col. 1-3. September 25, 1955.
35. Pachter, Henry M. *Magic into science*. New York, Henry Schuman, 1951. 350p.
36. Parsons, Talcott. *The social system*. Glencoe, Illinois, The Free Press, 1951. 573p.
37. Remmers, H. H. and D. H. Radler. Teenage attitudes. *Scientific American* 198:25-29. June 1958.
38. Roberts, Kenneth. *Henry Gross and his dowsing rod*. Garden City, New York, Doubleday, 1951. 303p.
39. Roberts, Kenneth. *Water-finding wizard*. *Oregonian* (Portland, Oregon) Magazine section, p. 24-25. February 23, 1958.

40. Ross, C. C. Measurements in today's schools. Rev. ed. by Julian C. Stanley. New York, Prentice Hall, 1955. 459p.
41. Sarton, George. Six wings. Indianapolis, Indiana University Press, 1955. 318p.
42. Scully, Frank. Behind the flying saucers. New York, Henry Holt, 1950. 230p.
43. Sedgewick, W. T. and H. W. Tyler. A short history of science. Rev. ed. New York, Macmillan, 1946. 486p.
44. Shaw, George Bernard. Nine plays. New York, Dodd, Mead, 1935. 1147p.
45. Shepard, Brooks. First hand report on dowsing. Harper's Magazine 203:69-75. September 1951.
46. Shorr, Philip. Science and superstition in the 18th century. New York, Columbia University Press, 1932. 77p.
47. Sorokin, Pitirim. Contemporary sociological theories. New York, Harpers, 1927. 785p.
48. Spencer, Robert F. (ed.) Method and perspective in anthropology. Minneapolis, University of Minnesota Press, 1954. 323p.
49. Stephens, J. M. Educational psychology. New York, Henry Holt, 1956. 717p.
50. Terman, Lewis M. Are scientists different? Scientific American 192:25-29. January 1955.
51. Velikovsky, Immanuel. Earth in upheaval. Garden City, New York, Doubleday, 1955. 303p.
52. Vogt, Evon Z. Water witching: an interpretation of ritual pattern in a rural American community. Scientific Monthly 75:175-186. 1952.
53. White, Andrew D. A history of the warfare of science with theology in Christendom. New York, George Brazeller, 1955. 2 vols.

APPENDIX

100% COTTON FIBER

## APPENDIX

TABLE 1

States Represented\*

STATE	NUMBER OF STUDENTS	STATE	NUMBER OF STUDENTS
Washington	57	Colorado	5
California	43	Wyoming	5
Nebraska	13	Illinois	5
Wisconsin	10	Texas	5
Montana	9	Iowa	4
Oklahoma	9	Ohio	4
Missouri	8	Massachusetts	3
Idaho	8	Arizona	3
Minnesota	7	New York	3
Kansas	6	Pennsylvania	3
North Dakota	6	Florida	2

One each from South Dakota, Utah, Indiana,  
Michigan, Tennessee, Arkansas, West Virginia.

\*Many students had lived in more than one other state.



TABLE 2

## States Represented\*

STATE	NUMBER OF STUDENTS	STATE	NUMBER OF STUDENTS
California	43	Wisconsin	4
Washington	42	Arkansas	3
Minnesota	10	Colorado	3
Nebraska	8	Michigan	3
Kansas	7	Oklahoma	3
Idaho	6	Wyoming	3
Texas	6	Illinois	2
Arizona	5	Missouri	2
Iowa	4	Montana	2
Nevada	4	North Carolina	2
South Dakota	4	North Dakota	2
Utah	4	Ohio	2

One each from Alaska, Canada, Connecticut, England, Finland, Florida, Hawaii, Indiana, Japan, Kentucky, Maryland, Massachusetts, New Jersey, Panama, Guam, South Carolina, Virginia, Washington D.C.

\*Many students had lived in more than one other state.