SCIENCE-RELIGION QUESTIONS IN SCIENCE CLASSROOMS

by

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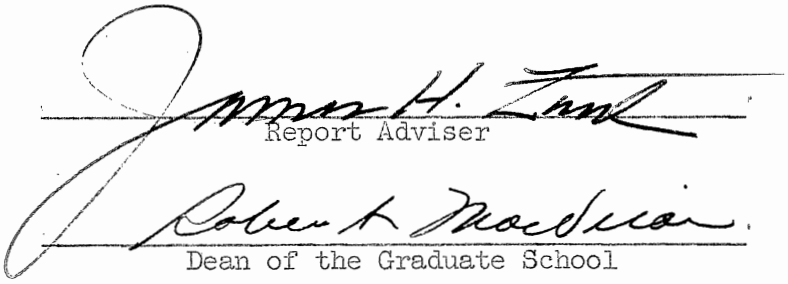

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PREFACE

As a science teacher, I have encountered students who have questions concerning the compatibility of science and religion. By means of a questionnaire sent to science teachers, I was able to find out how much of a problem the science-religion one is in some classrooms and to compile suggestions from teachers concerning this problem. I asked specifically for suggested magazine or pamphlet articles to which students and teachers could be referred as well as for descriptions of projects which students had done on subjects such as evolution, origin of the earth or science and religion. I contacted Science Fair participants to get descriptions of their projects. I compiled a list, with brief summaries, of magazine articles on science and religion, evolution, or origin of the earth. These articles were chosen from magazines published since 1951 and likely to be found in most schools. Finally, I obtained information about films and filmstrips.

Indebtedness is acknowledged to Dr. James H. Zant for his helpful guidance; to Mrs. Joan Reiff, librarian at Rio Hondo, Texas, for a list of magazines likely to be found in most high school libraries; to Science Service, 1719 N St. N.W., Washington 6, D.C., for lists of National Science Fair exhibits and other information on Science Fairs; to Wayne Taylor, Director of Texas Science Teaching Improvement Program, for information about Texas Science Fairs; to Thomas A. Bass, teacher at Port Neches, Texas, for descriptions of projects his students had done; to Pauleen Green, teacher at Dumas, Texas, for information about the

Library of Science Book Club; to Ruth Layer and Don Campbell of The Moody Bible Institute of Chicago, 820 North La Salle Street, Chicago 10, Illinois, for information about Moody films; to Edward Damon, teacher participating in the National Science Foundation program, for information about colchicine-treated and irradiated seeds; to Kenneth Fast, another National Science Foundation teacher, for the transcripts of statements by Oak Ridge scientists; to Jerry Seagle for his description of his project which won a first prize at the South Texas Science Fair; to Theo Miles and his mother for their description of Theo's National Science Fair entry; to Cleveland Boatman for his description of his National Science Fair entry; to Gene Pulley for his help in using IBM card punch and sorting machines for analyzing questionnaires; and to the many Texas and National Science Foundation teachers who took time to answer questionnaires and give suggestions.

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CHAPTER I

INTRODUCTION

The writer of this report has heard three educators, visitors to the Oklahoma A. and M. Campus during the school year 1956-57, speak on the subject of science and religion. Dr. Harold K. Schilling, Dean of the Graduate School and Professor of Physics at Pennsylvania State University, spoke during Religious Emphasis Week on "Relating Science and Religion". Dr. Schilling quoted Alfred N. Whitehead as saying that the future course of history will be determined by what view we take on science and religion and on our relating intelligently these "two strongest forces" in the world today. Schilling says there are creeds in both science and religion. (In science, Newton's Laws are creeds, for example.) Both have revelatory experiences. In science, there are experienced and theoretical explanations for phenomena such as electron flow. There is the same type of thing in religion. "There are basic facts in both which should remain, ideas in both which should go."

Later, talking to college teachers, Dr. Schilling said that he tells his students that they need both science and religion for a full life. Each has something to offer that the other cannot offer. Conflict is merely over interpretation. A sunset, for example can be studied through the eyes of a physicist, worshipped through the eyes of a peasant. Religion is more than morality. It offers people experience with God.

Dr. Edmund W. Sinnott was on the Oklahoma A. and M. campus to give a three-day lecture series. Described as "one of the nation's foremost authorities on the biological sciences", Dr. Sinnott is Director of the Sheffield Scientific School and Dean of the Graduate School of Yale University. Author of textbooks, president of the American Association for the Advancement of Science, and lecturer, he is author also of such books as The Biology of the Spirit. In one of his lectures entitled "Life and Mind", Dr. Sinnott said that a scientist's study of man as a "physical-chemical machine" tends to support materialism. Other studies of living things, however, show that all become organized, "self-regulated", so that they may reach goals. Says Dr. Sinnott, "There are now biological arguments for the existence of a soul". (His book, Biology of the Spirit, delves deeply into these arguments. This book and a pamphlet by Dr. Sinnott will be referred to in later chapters of this report.)

A fellow teacher gave the writer of this report the transcript of a speech he had heard at the Oak Ridge Institute of Nuclear Studies. Ralph T. Overman, Chairman of the Special Training Division, spoke there on "A Scientist's Faith". A scientist "is supposed to deal with the world which he can see, feel, taste, smell, or hear," he says. However, "a scientist's whole outlook starts from at least one basic faith or belief - belief in the consistency of nature." An ever increasing number of scientists, he says, are coming to realize that there can be no conflict between science and religion, and it is important that people other than scientists should also realize this. "The cornerstone of my faith is the belief that science has much to offer in one area of my experience, whereas religion has even more to offer, but in another

part of my experience."

"Usually," continues Dr. Overman, "a scientist makes observations about an object; he then summarizes and makes a generalization of his observations, which he calls a law, and finally he tries to develop a theory which helps him to explain and predict something else about a similar object. It is important to note that theories are never proved or disproved. They are used so long as they have any value and discarded when they are no longer useful. This is equally true of the atomic theory, which has remarkably wide acceptance, and of the theory of evolution, which has some serious inadequacies even from a scientific point of view." Even if God could be proved in such an objective scientific way, "I have come to the conclusion that scientific proof of these points has not and will not give a personal experience with a personal God." Experiences other than those of our senses are just as valid and acceptable. A feeling of love is one of these.

Another scientist at Oak Ridge is the Rev. Dr. William G. Pollard, Director of Nuclear Studies, who was ordained in 1954 a priest in the Episcopal Church. Edith Johnson, in a 1956 Sunday Oklahoman newspaper, tells of some of his comments. (A clipping of this article, without the exact date, was given to the author). There is nothing evil about a hydrogen bomb, says Dr. Pollard, who adds that "the sun and stars are hydrogen bombs in themselves, and they are sources of light and life, being in a process of continuous explosion." A universe that banned these natural hydrogen bombs would be a dead universe.

Scientists did not set out to create a deadly weapon. It took physicists some time "to become fully aware of the meaning of their discoveries." No moral choice can change the fact that we now "know

atomic energy as something real in the world which at any time and at any place could be materialized into a bomb." The whole course of science has been "a sequence of unforseen turning points, full of what, when seen from the outside, apart from the experience of the living God, can only be described as chance or accident." Many people fail to realize that scientists did not set out to create an atomic bomb, and this is a pity for scientists love their work, and it is anything but a cold and calculating affair. To tell a scientist that he should pause lest he discover something having terrible potentialities is, in the eyes of Dr. Pollard, "not only presumptuous but downright blasphemous".

Man needs to learn humility and trust, says Dr. Pollard, and not try to maintain an autonomous existence in an alien universe.

CHAPTER II

A QUESTIONNAIRE AND RESULTS

A questionnaire was sent to 150 Texas science teachers and to thirty-nine of the forty-eight science teachers attending the National Science Foundation's Supplementary Training Program for High School Science Teachers at the Oklahoma Agricultural and Mechanical College in Stillwater, Oklahoma. The latter were in various high school teaching positions for at least three years before coming to Oklahoma A. and M. The Texas teachers were contacted by letters addressed to "Department Head, Science Department" and sent to high schools picked from the Texas Education Agency's 1956-57 Public School Directory.[1] Schools were chosen at random from towns having one thousand or more students in average daily attendance.

The questionnaire asked for the number of years in science teaching, subjects taught, and college major and minor. A blank was to be checked by the teachers if they had had religious training. They were asked to describe any projects their students had done, for class display, open houses or science fairs, on the subjects of evolution, origin of the earth, or science and religion. It was requested that they list any favorite magazine articles or pamphlets on science and religion, which they liked to read for their own background, liked to read to their students, or to

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[1] Public School Directory, Texas Education Agency, Bulletin 591 (Austin, Texas, 1956).

which they liked to refer their students. Finally, the following questions were asked:

1. Do you think it is important to spend class time on science-religion discussions, at least in some areas?

2. Do you encourage discussions of science and religion in your classes?

3. If you discuss science-religion questions at all, do you do so as such questions come up naturally?

4. Do you try to teach carefully the difference between fact and theory?

5. Do you present views other than your own on controversial questions?

6. Do you take special pains to be sure that information given students on controversial subjects is accurate?

7. Do you point out that Evolution is a theory?

8. Do you present more than one of the theories of the origin of the earth?

9. Do you ever show films on science and religion?

10. Do you encourage students to do projects concerning science and religion?

11. Do you refer students to articles and books when they become concerned over science-religion questions?

12. Do you refer students to qualified people such as ministers when they become concerned over science-religion questions?

13. Are you familiar with articles and books with varying points of view on science and religion?

14. Do you point out in teaching how even basic ideas in science have changed?

15. Do you show students ways in which science and religion are compatible?

16. Do students in your classes generally seem to accept the compatibility of science and religion?

17. Does your school have a Religious Emphasis Week, Bible Emphasis Week, or some way of emphasizing religion?

Questions 4, 5, 6, and 14 were included as personal inventory questions. Some of the other questions were considered by the author of the questionnaire and many of the people who took it to be leading questions. Special comments by the teachers about the individual questions will be included in the discussion of the questionnaire results.

Possible answers, indicated by starred answer blocks,were "yes", "some" and "no", without "some" as a possible answer on questions 1, 9, and 17. "When possible, depending on group" was a possible answer for questions 1, 2, and 9.

Seventy-three Texas teachers replied in time for the results of their questionnaire to be included in this report. Thirty-six National Science Foundation teachers replied. Questionnaire results can be seen in Tables I, II, III, and IV, at the end of this chapter.

Questionnaires were examined from various aspects other than those for which tables were compiled. Results were figured for the twenty-four female teachers who replied. Results, percentage-wise, very much paralleled the results for the entire group. The two teachers in the report of the total group, who said students in their classes did not generally seem to accept the compatibility of science and religion, were females.

Questionnaire results were compiled also for the twenty-seven teachers who indicated that they had had religious training. Since the request to check a blank was easily misunderstood, some teachers undoubtedly checked that they had had religious training when theirs was not religious training in college. In this group of twenty-seven, however, were nine who show films on science and religion. (Only twenty-two of the total group of 111 indicated that they showed such films.) Only one encourages students to do science-religion projects. All said students seemed generally to

accept the compatibility of science and religion, twenty-two saying "yes", five saying "some".

Another compilation of answers was made on the basis of how many years teachers had taught. Only six of the thirty-six in the group of teachers who had taught one to five years encouraged science-religion projects. This is a small per cent of "yes" and "some" answers compared to per cents of "yes" and "some" answers from the entire group. Otherwise, this group very nearly paralleled the entire group. Perhaps the less experienced teachers simply do not encourage projects at all. Of the eighteen teachers who had taught twenty years or more, all show students ways in which science and religion are compatible, and sixteen have students who generally seem to accept the compatibility of science and religion. Only three of the group encourage science religion projects, checking the block "some". Teachers who have taught six to nineteen years apparently encourage more projects among their students.

Two questionnaires of the 111 returned were returned with no answers at all, one with this comment: "Never discuss religion in my classes at all." The other had no comment. Some blocks were left unmarked on others because certain questions did not apply, but there were other unmarked blocks accompanied by statements that questions seemed biased or not clear.

Many teachers commented on individual questions. These comments will be included in a brief discussion of the questions and the replies to them.

On questions 1 and 2, four of the teachers said they thought it was important to spend class time on science-religion discussions only if a student originated the discussion. A number of general comments on the

questionnaires explained why many teachers answered "no" or "when possible depending on group".

Two teachers, teaching mostly chemistry and physics, felt that the subject of religion did not enter into their subjects enough for many of the questions to apply to them. Two other teachers, teaching all the sciences, said science-religion conflicts had never presented much of a problem.

One "no" response to the first question was explained by the statement, "I always mention the relationship in appropriate places but do not feel that a discussion by the class of a subject such as this would be profitable to them without more preparation than I can give them in class." An active church member felt that religion should be separate from academic work. A man who had travelled much and had talked to men of many different religions, felt religion should be "left to the individual student and his rabbi, priest, pastor, or other religious leader." Three mentioned that school policy did not favor religion being brought into school classrooms. One of these three said separate classes in religion were taught in her school, but school policy was to avoid religious questions in other classes. Personal opinions included the feeling that school and church should be separate, teaching of religion being left with those better qualified to do it. A statement that his community was a heterogeneous one was made by one Texan, and he had a "few science-religious discussions in private or in small groups, where these students seemed to be mature in this respect."

Questions 4, 5, 6, and 14, personal inventory questions, all had a high per cent of "yes" and "some" answers, indicating that most of the teachers contacted try to give accurate, fair information to their students.

Groups in some classes, for example, give composite reports, these reports being many-sided as is life itself.

Question 7, asking whether or not Evolution was taught as a theory, drew many comments. Two of those answering felt the question was poorly phrased. Others left the space blank since they taught chemistry, physics, and mathematics and did not discuss evolution. Of those saying "yes", one triple-checked the "yes" block, while another expanded his answer by saying that evolution is a well-substantiated theory. There was one who qualified the question, "Do you point out that Evolution is a theory?", by inserting "of a specie" after "Evolution" before checking the "yes" blank. An experiment to show mutation was described by a Texan answering "yes". (This type of experiment will be mentioned in Chapter V.) "Evolution is taught as changes in form due to mutation or other influences as evidenced today in new breeds of domestic animals," was an explanation following a negative answer. The student body of one Texas school was described as "exceptional in regard to these survey questions". Only one biology student questioned "evolution theory to such an extent that he dropped class." The teacher feels that added explanation probably would have prevented this. In a biology class in another part of Texas, "Several debates on evolution have been worked up by my students." (Recent magazine articles discussing evolution will be referred to in Chapter IV.)

An explanation following a "no" answer to question 8, which asked if teachers present more than one of the theories of the origin of the earth, was: "I stay off the subject as much as possible. Students are referred to Genesis by a teacher who explains at the same time that "scientific and religious views do not necessarily clash." A long note accompanying one questionnaire had the following statement: "I try to assure students that

the two (science and religious explanations) are in sympathy with each other and do not conflict. I avoid details of the origin of the earth as explained in the Bible, as much as possible, for there you may tread on someone's personal toes. One of the hazards of public school teaching!" This same teacher tries to emphasize that "for the earnest thinker there must be a beginning" by a "power greater than man".

Few teachers said they showed films on science and religion. Many do not know where to obtain such films. (Chapter VI will give suggestions and mention comments and suggestions by teachers.)

Some of the "no" and "some" answers to question 10 are explained by the fact that while students are encouraged to do projects, they are not encouraged along particular lines. If these students pick projects along these lines of evolution, origin of the earth, or science and religion, teachers will help them as they will in any subject field.

Seven of the blanks on questions 11 and 12 were explained by the notation that cases where concerned students needed to be referred to articles on science and religion or to ministers had not arisen. One teacher said he would refer students to ministers if spiritual problems were indicated.

Many who replied indicated that they were familiar with articles and books on science and religion. Some of these teachers, however, as well as others, expressed a desire to know of more such articles. (Chapters III and IV will discuss some.)

Most teachers show ways in which science and religion are compatible. Two said they did this only when suitable discussion subjects arose. Another, who answered "some", commented, "I teach science, not religion." An opposing view was voiced by, "Absolute necessity." Only two replies indicated

that students did not seem to accept generally the compatibility of science and religion.

Of the fifty-six schools which have some way of emphasizing religion, at least nine have morning devotionals, either in classrooms or over public address systems. Assemblies begin with a prayer by a member of the Student Council. Pre-game devotionals for a football team are held, as are pre-game prayers for the spectators. Church youth groups and schools work closely with one another in some Texas towns.

Other comments were made about the questionnaire as a whole. Some of these are quoted. "I don't spend a great deal of time on origin and evolution because there are other things that are more important. Why worry about how we got here - learn something that will make our brief stay more beneficial." "One is foolish if he delves into the above," reference being made to questionnaire subject matter. "I do not commit myself as to a conflict between science and religion because I am of the opinion that high school students are not fully able to understand that all points set forward by the scientist as proofs are accepted only by the scientific method, while the religion side can always quote the Bible as proof for everything..."

"This problem shows the interrelation between science and the humanities."

"I, too, am interested in this subject. I think we need to teach more religion in schools, certainly not doctrine - but basic religious principles. If the schools minimize religion, how can young people help but get the idea that it is unimportant? I have had very satisfying and enriching discussions in my classes on the subject." "...There needs to be a method in which we teachers may discuss this subject without fear of

repercussions..."

"I still remember the first poster made for the new laboratory. It read, 'In the beginning God created the Heavens and the earth (center picture). Out of that which God created, man has made (border of latest inventions.)'"

"... I consider the opportunity of helping students reconcile science and religion, as questions do arise, as one of life's greatest tasks!"

TABLE I

QUESTIONNAIRE RESULTS FOR ENTIRE GROUP OF 109 TEACHERS

Question	Yes	Some	No	When possible depending on group	Blank
1. Science-religion discussions important?	59	--	25	24	1
2. Science-religion discussions encouraged?	13	25	59	10	1
3. Discussions arise naturally?	95	5	3	--	5
4. Difference between fact and theory taught?	96	5	6	--	2
5. Views other than own given?	94	10	0	--	3
6. Information accurate?	93	10	1	--	5
7. Evolution presented as theory?	87	5	5	--	11
8. More than one theory of origin of earth presented?	87	3	7	--	11
9. Films on science and religion shown?	11	5	82	6	4
10. Science-religion projects encouraged?	29	15	59	--	6
11. Students referred to articles and books on science and religion?	62	16	21	--	9
12. Students referred to ministers?	66	15	18	--	9
13. Familiar with articles and books?	36	52	18	--	2
14. Basic changes pointed out?	97	6	2	--	3
15. Compatibility of science and religion shown?	78	19	6	--	5
16. Compatibility of science and religion accepted by students?	81	22	2	--	2
17. Religious Emphasis Week?	56	--	49	--	1
Religious training	26				
Female	23				
Taught 20 years or more?	17				
Taught 5 years or less	35				

TABLE II

QUESTIONNAIRE RESULTS FOR 59 TEACHERS

WHO ANSWERED "YES" TO QUESTION 1

Question	Yes	Some	No	When Possible depending on group	Blank
2	12	18	23	6	0
3	54	3	--	-	2
4	51	3	5	-	1
5	54	4	--	-	1
6	52	5	1	-	2
7	50	4	3	-	2
8	50	0	4	-	4
9	10	3	42	4	-
10	6	11	39	-	3
11	45	2	10	-	2
12	39	8	10	-	2
13	20	31	7	-	1
14	52	5	1	-	1
15	52	5	2	-	0
16	41	14	2	-	1
17	32	--	26	-	-

TABLE III

QUESTIONNAIRE RESULTS FOR GROUP OF 24 TEACHERS WHO ANSWERED "WHEN POSSIBLE DEPENDING ON GROUP" TO QUESTION 1

Question	Yes	No	When Possible depending on group	Blank
2	1	5	4	1
3	23	1	-	0
4	23	1	-	0
5	20	4	-	0
6	20	4	-	0
7	20	1	-	2
8	18	2	-	3
9	1	1	2	1
10	21	3	-	0
11	8	10	-	2
12	12	6	-	3
13	6	12	-	0
14	22	11	-	1
15	13	7	-	2
16	20	4	-	0
17	11	--	-	0

TABLE IV

QUESTIONNAIRE RESULTS FOR GROUP OF 25 TEACHERS

WHO ANSWERED "NO" TO QUESTION 1

Question	Yes	Some	No	When Possible depending on group	Blank
2	0	2	23	-	-
3	18	1	3	-	-
4	22	1	1	-	1
5	20	2	0-	-	2
6	21	1	-	-	3
7	17	-	1	-	7
8	18	1	2	-	4
9	-	1	21	-	3
10	1	1	20	-	3
11	9	4	7	-	5
12	15	1	5	-	4
13	10	9	5	-	1
14	23	0	1	-	1
15	13	7	2	-	3
16	20	4	0	-	1
17	13	1	10	-	1

CHAPTER III

TEACHERS' SUGGESTED READING ON SCIENCE AND RELIGION

Teachers made many suggestions when asked to list favorite magazine articles or pamphlets on science and religion.

Several teachers mentioned Life's The World We Live In, now in book form.[1] The articles have been used to "point out and illustrate the teachings that parallel the Bible in our Zoology classes." (See Chapter IV for excerpts from The World We Live In.)

Current issues of the magazine, Bulletin of Atomic Scientists, carry the pro and con of the controversy, which the teacher labels "very good". (Some of the issues to which to refer are those of March and July, 1953; March, June and October, 1955; and December, 1956.) The National Education Association publications are good sources, according to one teacher.

"The Bible and Science", Science Teacher, XX (March, 1953), 69, was a suggested reference. (This volume was not available in the A. and M. Library, but many science teachers will have this issue in private collections.) An article in another issue of Science Teacher was mentioned. The reference was: Hanor A. Webb, "Science in the Bible", Science Teacher, XXX (October, 1948), p. 123, and (December, 1948), p. 175. Mr. Webb mentioned many references to plants, animals, stones and weather, and he suggested that students use a concordance to do "science searches" in the Bible.

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[1] See sixth entry of Bibliography.

Says he, do interpret findings, but interpret them as to natural history of Palestine, customs of ancient Hebrews and the moral lessons from nature, letting youngsters do most of the thinking.

Pamphlets are often sources of articles on science and religion. "Hazen pamphlets are designed to arouse and stimulate thought, discussion and action. They are addressed to educators ..." and others. Divergent points of view are presented. So says an explanation of these pamphlets inside the cover of one. An interested person can write to "Secretary, The Edward W. Hazen Foundation, 400 Prospect Street, New Haven 11, Connecticut" and ask for such pamphlets as "Science and Religion, a Necessary Partnership", by Edmund W. Sinnott. These pamphlets cost twenty-five cents. Others are entitled "Spiritual Problems of the Teacher" and "Education for Character".

Bernard Ramm, Professor of Religion at Baylor University, was on the A. and M. Campus during Religious Emphasis Week speaking on science and religion. He is the author of a book entitled The Christian View of Science and Scripture, which a National Science Foundation teacher listed.

Mankind so Far, by William W. Howells,[2] was given as a favorite reference, as was R. W. Hegner's Parade of the Animal Kingdom.[3] Mankind So Far, in the first chapter, states that evolution is fact, not theory, and explains this statement.

It was stated that adult church publications put out by the Methodist, Presbyterian and Congregational churches are generally accepted as good, unbiased, publications by most churches and contain good articles on

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[2] See tenth entry in Bibliography.
[3] See ninth entry in Bibliography.

science and religion.

The Library of Science, 59 Fourth Avenue, New York 3, has book selections such as Evolution, Genetics and Man by Theodosius Dobzhansky and Science, Philosophy, and Religion, as well as many other fine books on science and mathematics. These books are available to members of this book club only. To become a member, a person must be recommended by a present member.

Lincoln Barnett's The Universe and Dr. Einstein, a suggested reference, gives in the last chapter, some of Einstein's comments on the ultimate origins of this universe. He, Einstein, once said that the sensation of the mystical is at the center of true religiousness. Another time he declared "The cosmic religious experience is the strongest and noblest mainspring of scientific research."[4] Einstein, who has been called an atheist, has no inhibitions about using the word God. He said his religion consisted of a "humble admiration of the illimitable superior spirit who reveals himself in the slight details we are able to perceive with our frail and feeble minds. That deeply emotional conviction of the presence of a superior reasoning power, which is revealed in the incomprehensible universe, forms my idea of God."[5]

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[4] Lincoln Barnett, The Universe and Dr. Einstein (New York, 1948), p. 105.

[5] Ibid., p. 106.

CHAPTER IV

MAGAZINE ARTICLES ON SCIENCE AND RELIGION

Upon contacting a librarian in a small Texas high school, the writer of this report found that the following magazines would probably be found in most high schools, the first six likely in even the smallest schools: Reader's Digest, Saturday Evening Post, Life, Time, Popular Science, National Geographic, Science News Letter, Ladies' Home Journal, Seventeen, Today's Health, Field and Stream, Newsweek, Science Digest, Popular Mechanics and Coronet. The writer used this list in looking through Reader's Guide to Periodical Literature for articles on science and religion. Only articles found in these magazines were used in order that students in most high schools could be referred to the articles. The writer found all articles in these magazines concerned with science and religion, evolution, or origin of the earth by looking under the topics, "religion and science", "earth", "biology (life)", and "evolution". All such articles from 1951 to the present (1957) found are summarized and/or listed in this chapter. Varying points of view are represented. The only magazines in the list above which had articles on the above subjects were Time, Life, Reader's Digest, Science News Letter, and Science Digest.

Articles on scientists' comments on religion are listed and summarized below:

"Deus ex Laboratorio." Time, LVIII (August 13, 1951), p. 64.

"Most scientists believe in God," concludes Reporter Howard Whitman in Colliers. His comments were made after a cross-country tour of the

nation's laboratories. "The majority of scientists consider themselves children playing on the seashore while the ocean of truth lies undiscovered in the distance."

"What we know is just the tiniest fragment. For the whole we depend on faith," said a Wayne University professor.

"Even the 'law of chance' presupposes a law. Whose law? For me, I prefer the belief in a creator, divine, supernatural. I cannot accept chaos." An anthropologist said this.

Scientists and engineers see mass become energy and conclude that "there must be a 'Higher Power' who can make it."

Older scientists have the deepest spiritual awareness. Said an elderly genetecist: "When we think we know a lot we're agnostic. When we learn how insignificant our knowledge is, we return to God."

"Behind Every Door: God", Time, LVIII (December 3, 1951), pp. 75-77.

Pope Pius XII says there is not an unbridgeable gulf between modern science and revealed religion. In the latest physics and astronomy, said the Pope, true science discovers God in an ever-increasing degree - "as though God were waiting behind every door."

St. Thomas Aquinas' thirteenth century proofs of the existence of God are constantly being buttressed by scientific discoveries, the Pope said. Discoveries of changes in the nuclei of atoms backs up St. Thomas' first proofs of God's existence, change in all matter which leads to the postulation of one unchanging agency at the source, ... God.

Astronomer Edwin P. Hubble of California's Mt. Wilson Observatory has said that galaxies tend to double distance between themselves every 1300 years. This, the age of meteorities, the calculable age of the earth's

crust, oscillations of star systems and other ways of tracing earth back to a beginning in time simply repeat the first verse of Genesis. And what preceded time? The Creator! Science, concludes the Pope, simply helps make people more conscious that God is the "Exalted Maker".

"The Side of the Serpent." Time, LXIII (May 31, 1954), p. 58.

Australia's top atomic physicist, Marcus Oliphant, attacked recent statements by Pope Pius XII and Labor Leader Clement R. Atlee citing the misuse of science as a menace to the world. Oliphant said the world's sorry state is the fault of the churches for not doing their job better.

In the Garden of Eden incident, Professor Oliphant gladly put himself on the side of the Serpent, saying that Adam and Eve eating of the fruit of the tree of knowledge signified "probably the greatest step [man] ever took."

"Scientist on Miracles." Time, LXVI (July 4, 1955), p. 42.

Dr. John R. Brobeck, Professor of Physics at the University of Pennsylvania spoke to physicians at a breakfast session of the joint annual meeting of the British and Canadian Medical Associations in Toronto.

Dr. Brobeck said that "many scientists have become a lot less positive about the prerogative of science and the scientific method. But "... many fields of human experience are not susceptivle to scientific analysis." Modern science hesitates to use the word "law" any longer but speaks of "high probability", since science cannot predict what an individual molecule in a given population is likely to do.

One thing which needs to be added to translate miracles into something possible to account for is a "source of energy unknown to us in our biological and physiological sciences. In our Scriptures this source of energy

is identified as the Power of God.

Both Christians and scientists think miracles improbable and impossible to explain in terms of our present understanding. This doesn't mean miracles are impossible, and the Christian accepts them by faith. The attitude to science of the scientist who is not a Christain is rapidly approaching that of the scientist who is a Christian.

"Most scientists are not Christians, but not because they are scientists." Most people in any walk of life are not Christians.

As a scientist, Grobeck cannot believe the miracles of the past which he could not see, but he can believe the miracles which happened to him, the creation within him by no biological or psychological force, of the will to believe. This is an application of God's Power.

"An Attribute of God." Time, LXVI (October 10, 1955), p. 95.

(This article is a review of Biology of the Spirit by E. W. Sinnott, Dean of the Graduate School, Yale University).

"Many people suspect that scientists, riding high in the modern world, are uninterested in man's spiritual qualities, which cannot be subjected to microscopic analysis." Sinnot is interested in the analysis of the spirit.

There are two parts to man - are they both real or is one an illusion? Sinnott says biologists have learned much about protoplasm but have not explained its purposefulness. It knows what it wants to do in even simple organisms. A fertilized egg becomes a frog, pine tree, or man - alive.

There exist two opposing streams. The organic world moves upward. The Second Law of Thermodynamics, stating that heat flows from higher to lower levels, indicates that lifeless matter tends to decrease in degree of its organization.

A "Principle of Organization" provides three great essentials for this religion: order out of randomness, spirit out of matter, and personality from impersonal stuff. This "Principle of Organization" is thought of as an "attribute of God".

Weaver, Warren. "Can A Scientist Believe in God?" Reader's Digest, LXVII (July, 1955), pp. 55-57.

(For twenty years, Dr. Warren Weaver, a vice-president of the Rockefeller Foundation, has been responsible for a world-wide program in the natural sciences. He is also chairman of the Board of the American Association for the Advancement of Science.)

"Science is the activity whereby man attempts to gain understanding and control of nature, while religion is a personal affair: "a guide to conduct, and the theory of the moral meaning of our existence."

"Electron" is really only the name behind a set of phenomena. Scientists have never seen an electron. Similarly they have not seen God but can accept the abstract and intellectual ideas of God. To a scientist, the real is what is universally experienced.

God has revealed himself and continues to do so in every new discovery of science, which is a further "revelation" of the order which God has built into His universe.

"I believe that the Bible is the purest revelation we have of the nature and goodness of God. It seems to me inevitable that the human record of devine truth should exhibit a little human frailty along with much devine truth. It seems to me quite unnecessary to be distrubed over minor eccentricites in the record.

Most references on evolution and origin of the earth were found to be short articles telling of ways in which the age of the earth is

estimated today and of modern theories as to how life began or how life evolved. These articles were in Science Digest, Science News Letter, and Time, and are good references for students to read to know how scientists theorize.

The following is a summary of one article on evolution: "According to Adler". Time, LVII (June 4, 1951), pp. 65-67.

At the University of Chicago, Dr. Mortimer J. Adler spoke, to a crowd which overflowed Kent Hall, rejecting Darwin's hypothesis in Origin of Species, saying the hypothesis was all right for plants and animals but didn't apply to man.

Man and apes differ "essentially in kind, not degree." Since no intermediate forms (no missing link) has been found, there is no common ancestor.

Adler's two alternatives are: the theory of "emergent evolution" in which a higher species "evolves" from a lower with no intermediate forms, and the possibility of man's special creation by God in His own image.

The question and answer session following the speech was a heated one. Comments were drawn from people all over the country. At Fordham, an anthropologist said that the "old story about man being nothing better than an ape is completely false."

Adler commented further that "... today scientific hypotheses have the status of religious dogmas."

The Life magazine series, The World We Live In, now also in book form, had two articles especially applicable to this report. These articles weave into the text Bible verses and sayings of philosophers. Excerpts from these articles follow.

Barnett, Lincoln. The Earth is Born." Life XXXIII (December 8, 1952), pp. 85-101.

"Man has always postulated a creation, and Genesis speaks with universal accents in its mighty opening phrases: 'In the beginning God created the heaven and earth, and the earth was without form, and void, and darkness was upon the face of the deep...' In its assault on these uttermost questions, modern cosmogony impinges on the ancient realm of religion. The striking fact is that today their stories seem increasingly to converge and every mystery that science resolves points to a larger mystery beyond itself."

Men used to think stars would fade and chill. Today, more is known about the stars. As our sun grows old, it will first get hotter, science indicates, and earth's oceans will boil away. Perhaps the sun will increase in size to become a red giant and engulf the planets. An alternative is the exploding of the sun as it becomes a super nova, with one big explosion, like the Star of Bethlehem, or a nova with a series of lesser expolosions. From this sun will come first deadly radiation and then melting rocks and burning air.

"The end is best pictured in Revelation in another of the striking parallels between Biblical and modern scientific prophecy. 'And the fourth angel poured out his vial upon the sun ... and the mean were scorched with great heat ... and the cities of the nations fell ... and every island fled away, and the mountains were not found ..."

Barnett, Lincoln. "Pageant of Life". Life, XXXV (September 7, 1953), pp. 54-71.

It was first thought that there was a special creation of each kind of living thing. Then the idea of change was seen as paleontology developed. Many puzzles and gaps needed to be filled.

In 1859, Darwin's Origin of Species outlined his classic theory of evolution. Animals, he said, could change so much as to bear little resemblance to their ancestors. There is, he said, a struggle for existence, and the fittest survive. Competition is fiercest within a particular species rather than between species.

All substantial opposition to the theory vanished among scientists in a generation. "The theological implications led to longer disputes", though Darwin himself was a religious man and his followers, not he, wished to dispense with God. Today, though fundamentalists of all faiths believe in Genesis as a literal document open to no interpretation, the mainstream of thought in Western theology has embraced evolution as the scientific account of creation. Nor is this interpretive tradition new. Long ago, St. Augustine discussed various ways in which the work of the Six Days might be understood, and St. Thomas Aquinas distinquished between the initial creation of matter and the establishment of laws that have continued to affect change in the physical world. In Darwin's mind the miracle of creation lay in the infusion of those wondrous laws of nature, that, unfolding, called forth the great pageant of life on earth. "There is grandeur," he wrote, "in this view of life, having been originally breathed by the creator into a few forms or into one; and that whilst this planet has gone a cycling on, ... from so simple a beginning, endless forms most beautiful and most wonderful have been, and are being, evolved."

If other magazines are available in some high schools, teachers can refer to Reader's Guide to find still more references.

CHAPTER V

STUDENTS' PROJECTS

Science Service, 1719 North Street, N.W., Washington 6, D.C. provided the writer of this report with lists of National Science Fair exhibits for 1953, 1954, 1955 and 1956. None of the exhibits listed appeared to be concerned directly with science and religion. Four 1956 exhibitors with exhibits on the solar system, evolution, and archeology were contacted by letter. Two replies were received and will be reported on in this chapter.

The Director of the Texas Science Teaching Improvement Program was contacted for information about Texas Science Fairs. He said there were no exhibits entered in the Austin Science Fair in 1956 on evolution, origin of the earth, or science and religion, nor were there any entries on these topics in the State Science Talent Search for 1957, which had approximately 130 entries.

Jerry Seagle, a student at Hamlin Junior High School in Corpus Christi, had an exhibit on science and religion which won a first prize in Junior Division, Physical Sciences, in the First Annual South Texas Science Fair. (The writer of this report is familiar with this particular Science Fair, since she had students enter exhibits in it.) His exhibit had a series of paintings depicting the creation of the earth, these paintings showing the creation as science pictures it while carrying captions which were quotations from the Bible.

Jerry told about his project in a letter to the author. His teacher had heard of his art talent and thought he would enjoy doing paintings of the Creation. Using her notes and suggestions, Life's "The Earth is Born", library books, and his imagination, Jerry worked on the paintings to satisfy requirements for a class science project. The cost was between six and ten dollars. Jerry had twelve paintings, each illustrating quotations from the first chapter of Genesis. One painting, for example, was of sharp mountains with water pouring down them into the sea. This picture had under it the verse, "and God called the dry land Earth; and the gathering together of the waters he called the Seas; and God saw that it was good." A lake surrounded by vegetation which may have existed long ago was pictured to illustrate the following verse: "And God said, Let the Earth bring forth grass, the herb yeilding see, and the fruit tree yielding fruit after his kind, whose seed is in itself, upon the earth: and it was so." Creation of life was pictured by one painting of sea creatures of years ago, another of a prehistoric bird, a third of a mammoth, and the last of man, as scientists think early man must have appeared.

Several teachers answering questionnaires described projects their students had done for class, open house display or Science Fairs. One teacher said, "One of my biology students, for a Science Fair Project, made a revolving diorama which portrayed the creation of the earth, the age of Reptiles, The Modern Age of Man, and the Future (2000 A.D.)."

Another teacher answered a second letter of inquiry with descriptions and newspaper pictures of two projects students of his had done for the Sabine Area Science Fair. One was on the evolution of aortic arches and was of clay mounted on plywood. The models and labels were made from

drawings in various texts. Various colored clay denoted four stages of oxygenation. The chart demonstrated the evolution of the arches in the arterial circulation from fish to mammal. Cost of the chart was about ten dollars, and it got an honorable mention.

A second project was a Geological Time Survey. Work done by three girls on this included research on geology and what life forms were characteristic of the eras in the age of the earth, collection of fossil specimens, and charting and painting. The project consisted of a large central pole, ribbons in matching color extended to placards on the left and right which denoted the various time eras in the age of the earth, showing drawings of the kinds of animals appearing in each era. Fossils shown on the placards were displayed in front. The placard demonstrated evolution, such as that of the brachiopods, reports the teacher. A typed pamphlet gave explanations about each of the eras depicted. This project cost about five dollars and won an honorable mention.

A teacher mentioned fossil studies by students, while another said that one of her students "used fin, wing, leg and arm bones of various animals and showed how the same bones were present but how they had been modified." A student of one of the National Science Foundation teachers made an evolution family tree poster. In a Texas classroom, students had done no projects but had written term papers on evolution, origin of the earth and science and religion.

Experiments with colchicine-treated animals and plants can demonstrate chromosome changes and a form of evolution. (Tips of coleoptiles of seeds which have been germinated on wet filter paper can be treated with 0.5 per cent colchicine in lanolin, then the seeds grown in soil and compared with controls. Experiments with planaria are possible. Colchicine can be

ordered from chemical and biological supply houses, but it is poisonous and should be studied in books on the subject before being used.

Seeds can be treated with atomic radiation. Information about irradiated seeds can be obtained from some colleges or from Brookhaven National Laboratories, Upton, Long Island, New York. Experiments with these seeds are not dangerous and show mutation affects.

Cleveland Boatman, Beutonville, Arkansas had a project in the National Science Fair in 1956. His was "Solar System" and used old pin ball machine parts to construct search plates (circular boards with contacts on them), one for each of the planets. The planets' orbits were represented by different numbers of lights, each representing a certain number of day's movement for the planet. Cleveland did not include anything about the origin of the earth. Says Cleveland in his letter, "My opinion of the evolution of the world would be in the Bible."

Theo Miles, an entry in the 1956 National Science Fair had an exhibit entitled "Archaelogy of Northeast Louisiana". His project was centered around a plywood backdrop, with a colored string running from the name and description of culture group to a site on a map, to a geological time era of those on a list, to a relic group, to pottery, and finally to a picture or field trip record. A through notebook accompanied the exhibit. Nothing on evolution was included in the project, but Theo became aware of how important a part religion apparently played in the lives of the people he studied. A comment by Theo's mother is of interest. "I think the best way, and perhaps the easiest, to encourage a student in extra curricular activity is to know his individual interest. Then you can, if necessary, show him the scientific approach, and a science project develops from a hobby; for the child a feeling of being appreciated; for you, the teacher,

a variety of fields represented in your Fair." Theo's parents are both very interested in Science Fairs.

CHAPTER VI

FILMS AND FILM STRIPS

As mentioned in Chapter II, most teachers did not show films on science and religion, one reason being that they knew of no such films.

One source of movies on science and religion is the Moody Bible Institute of Chicago, 820 North La Salle Street, Chicago 10, Illinois. The Moody Institute is an interdenominational organization and has a series of educational science films for classroom use. A letter from the Moody Institute explained, "The aim of these classroom films is to direct the student to a thoughtful exploration of the world around him -- to indicate design in nature and the harmony of natural laws. In this respect the Institute films are unique. They reinforce the moral and spiritual values of the student's science and education." These films can be rented or purchased. Subjects of these films include stars, the human body, birds, insects, crystals, light, and various aspects of plant and animal life. The writer of this report has seen "How Many Stars" and found it a film very suitable for showing to junior high and senior high school groups.

Films from Moody's "Sermons in Science" series could be shown on Sundays, either for church groups or in a central location in town with students invited to come voluntarily. The latter suggestion was made by a teacher who commented that some schools do not approve of discussions of religion in classrooms.

Film strips of the Life series, The World We Live In, have commentaries which weave in Bible quotations and philosophical sayings. These excellent

film strips should be in school film libraries, anyway, if the budget permits. The thirteen film strips are six dollars each or five dollars when four or more of the color filmstrips are ordered. The cost for all thirteen is sixty-five dollars. Films strips range in length from sixty-two to eighty-four frames. Information about these film strips or the film strips themselves can be obtained from Life Filmstrips, 9 Rockefeller Plaza, New York 20, New York.

No science-religion films are used in one teacher's school, but he comments that many films commonly shown in his school include suggestions that science and religion are compatible.

Showing of films on science and religion, comments a chemistry and physics teacher, is a "good idea but should be jointly approved by school officials and community pastors."

CHAPTER VII

CONCLUSIONS

Teachers vary widely in their opinions of how science-religion discussions should be handled in science classes, and they offer many comments and suggestions. Magazine articles, books, and pamphlets dealing with science and religion offer divergent views for teachers and students who read them. The suggestions and summaries in this report are good background builders.

Films and film strips on science, with at least some emphasis on its relation to religion, can be purchased or rented for classroom use.

Students have done classroom and Science Fair projects which relate science to religion. Students and teachers can get ideas from reports in this paper of projects which have been done.

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