Elementary and Middle School Science Improvement Project
NAS8-36277

Final Report Covering the Period

May, 1986 - April, 1987

Submitted by:

Saundra Y. McGuire
Department of Chemistry
Alabama A & M Universitty
Normal, Alabama

Prepared for George C. Marshall Space Flight Center
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Elementary and Middle School Science Improvement Project

Introduction

The Alabama A & M University Elementary and Middle School Science Improvement Project (Project SIP) was instituted in response to a need to improve the ability of North Alabama teachers to teach science effectively using the experiential or "hands-on" approach. The project was operated for thirty teacher participants. The major component of the project was a two-week workshop conducted on the campus of Alabama A & M University. Follow-up visits were made to the classrooms of many of the participating teachers to obtain information on how the program was being implemented in the classroom. The material in this report addresses the administrative aspects of the program, the delivery of the services to participating teachers, and the project outcomes. These subjects will be addressed by providing answers to the questions posed by the "Guidelines for Preparation of Annual Reports" prepared for NASA Office of Equal Opportunity Programs (OEOP) Sponsored Teacher/Counselor/Administrator Training Projects.

Teacher/Counselor/Administrator Training Project Summary

I. Administrative

A. Participant Recruitment and Selection

Project SIP sought thirty teacher participants from elementary and middle school grades (targeting grades 3 - 8) for participation in the program. These grades were targeted because the science material content of the program is most congruent with material appearing in the science curriculum of those grades. However, applicants from other grades within the schools were not to be eliminated in the selection process because of the changes in grade assignments that often occur in the school system. (For example, a teacher may teach kindergarten one year and fourth grade the next year.) Also, hign school teachers who expressed a strong interest in the program would not be eliminated because much of the content is applicable to high school physical science courses.

The number of workshop participants selected and agreeing to participate was thirty. Of the thirty participants, eighteen were elementary teachers, eleven were middle school teachers, and one was a high school teacher. Twenty-seven were currently teaching science in North Alabama schools, one was teaching physical education but waiting for a science position to become available, one was taking the workshop as part of the requirements for becoming certified in science, and one was a science teacher formerly certified to teach science in the state of Mississippi and looking for a science position in North Alabama.

A number of mechanisms were used to attract teachers. Notification of the workshop was sent to all inservice-education coordinators, all principals, and selected science teachers throughout the four county,

ten school district area to be served by the project. In addition, an article about the workshop appeared in the local newspapers soliciting participants. One of the most effective recruiting techniques was the publicity provided by former participants in workshops coordinated by the Project Director. Teachers told other teachers in their schools about the workshop and encouraged them to attend. Finally, the Project Director contacted some teachers directly who had expressed an interest in and a need for participating in a science workshop. The least effective mechanism seemed to be the communications sent to principals and system inservice coordinators. There was a delay in getting the information to the teachers, and some participants reported that their principal would pass on this type of information to those teachers he or she personally wanted to participate. The newspaper article and direct contact with teachers were the most effective recruitment mechanisms.

Based on experience with this project, the preferred strategy for recruiting participants is to contact teachers directly. The timing, however, must be right. If teachers are required to commit themselves too early (more than two months in advance) to participate in such a project, a significant percentage of those who apply for participation will cancel out before the workshop begins. Additionally, the information sent to principals by in-service coordinators must be scrutinized by the Project Director before it is mailed out. In the Project SIP description that was distributed to one of the ten school systems' principals and teachers, the project was incorrectly listed as being for teachers in grades 9 - 12. Thus, many elementary and middle school teachers indicated later that they had looked for the workshop description in materials they had received, but could not find it listed.

B. Scheduling

A workshop that provides teachers with instruction in the areas of biology, physics, chemistry, and electricity and magnetism, as well as allowing them to individually participate in a variety of hands-on activities requires approximately 35 - 40 hours of on-site instruction to teachers. A two-week block with four hours of instruction provided per day was used in Project SIP because teachers had expressed the feeling that a one week block with eight hours of instruction per day forced them to cram too much information, and that committing more than two weeks of time to such a project was unfeasible for teachers who have only two months away from regular classroom duties. One common problem experienced by workshops that are longer than two to three days in length is absenteeism. However the Project SIP participants were informed that they were expected to participate <u>each day</u> unless emergencies arose that made it impossible to attend. The workshop attendance was 100% for the first four days, and then a death and illness decreased the attendance by two for three days of the final six workshop days.

Since this workshop assumes no existing science knowledge, all teachers were ready to participate. The sequencing was designed to start them off with the familiar--biology; show them how exciting physics can be while the interest level is still high; start them with

electricity experiments after they have been exposed to some physics; and finally dazzle them with chemistry activities that can be easily performed by their students. This particular sequence has worked quite well.

Since the project is designed to use readily available, low-cost materials, most of the materials were available and ordered in time to be provided to the participants when necessary. Packaging the materials in the form to be given to the teachers was the most logistically taxing part of the project, but was successfully accomplished by using assistants from the Department of Chemistry at Alabama A & M University.

C. Facilities

The workshop activities were held in one of the biology laboratories of Carter Hall, the science building at Alabama A & M. The size of the room was quite adequate as were the facilities--running water, gas and electrical outlets, and a projection screer. However, the participants complained (justifiably) that the temperature of the room was uncomfortably warm. The air conditioner did not adequately cool the area and was unbearably loud. The unit should be replaced before conducting similar workshops in this classroom. However, this particular classroom is the most suitable one currently existing on campus because it can accomodate thirty participants with comfortable desks and chairs.

The workshop accessibility to participants was excellent. There were no residential provisions made as all participants resided within commuting distance of the workshop activities. Transportation was provided by participants. No per diem or mileage allowance was provided since the participants were getting the workshop instruction and materials free of charge. The only incentive for attending the workshop was the $400.00 worth of materials that the teachers knew they would be receiving throughout the course of the two weeks.

The cooperation of the departments of chemistry, biology, physics, and electrical engineering technology of Alabama A & M University, as well as representatives from the NASA Marshall Space Flight Center and the Johnson Environmental Center at the University of Alabama at Huntsville was crucial to the success of this project. The presence of so many scientists on campus and making presentations to the participating teachers was a great advantage for the program. Additionally, the teachers were provided with resource persons whom they called upon during the school year to talk with their classes.

D. Program Staff and Administrators

The project was administered solely by the Project Director. Secretarial assistance was provided by the Department of Chemistry secretary and by secretaries in the Alabama A & M - UAH Regional Inservice Education Center. The teaching staff of the program was recruited from the science departments of Alabama A & M University, NASA Marshall Space Flight Center, and the University of Alabama, Huntsville Johnson Environmental Center. The members of the teaching staff were

from a variety of disciplines in keeping with the nature of the workshop. There were three physicists, three biologists, two chemists, two environmental scientists, one electrical engineer, and one former secondary science teacher. The number of members on the teaching staff was adequate, but additional scientists should have been included in order to provide the teachers with as large a resource group as possible. Plans for the 1987 program include involving more scientists from NASA and the Army Missile Command in Huntsville.

The training for the members who were on the teaching staff consisted of an orientation session on the nature of the program and the characteristics of the teachers who would be participating in the project. The emphasis in the orientation session was on the "hands-on" aspects of the workshop sessions. Each instructor was admonished to talk for only 15 - 20 minutes before beginning the experiential activities so as not to frustrate the teachers. Although most of the teaching staff were faculty members, most had never taught a course to elementary teachers. After the experience, however, they reported that they had enjoyed working with the teachers, and all expressed a desire to teach in the program again. The teachers rated the presenters very high on their evaluation instruments.

Collaboration

As stated earlier, the collaborative effort was primarily between Alabama A & M University, the NASA Marshall Space Flight Center, and the Johnson Environmental Center during the workshop presentation. However, the Lawrence Livermore National Laboratory, the governmental organization which developed the curriculum materials used in the program, participated in the effort by co-sponsoring the national conference held in January to publicize the workshop and project activities to faculty members from other HBCU's around the nation.

Some local organizations also participated in the collaboration. The local hospitals donated old x-rays of human chest cavities, local bottlers donated empty plastic 2-liter bottles, and the University donated bricks.

With regard to services to other educator groups, the Project Director made a presentation to participants in the University of Buffalo's Summer Training Institute for teachers of students in the minority student programs sponsored by the Center for Urban Affairs at the University of Buffalo. There were approximately 65 teachers in attendance at the session. The day after the presentation to teachers the Project Director made a presentation as part of a panel to approximately 125 minority students participating in the summer programs at the University of Buffalo. The visit was arranged by Mr. Clyde Foster, OEO director at the Marshall Space Flight Center and technical monitor of this project.

The elementary and middle schools of the participating teachers were not intimately involved in the planning of this project. However, several participating teachers were referred to the program by their principals. No facilities or personnel were provided by the schools.

The workshop activities were planned by faculty from the sponsoring institution, Alabama A & M University. The University provided the classroom facilities and some equipment (such as plant models) for use in the program.

Curriculum and Materials Planning

The curriculum for this project was taken from the Lawrence Livermore National Laboratory's Elementary Science Study of Nature Project (LESSON). The four basic science areas of physics, chemistry, biology, and electricity and magnetism were the topics of study. These topics are included in the curriculum because these are the topics that are covered in elementary and middle school texts. The materials stress the contributions of minority scientists; use low-cost, easily accessible materials; and are exciting to students and teachers. Thus, they are especially useful to this population of teachers.

Other workshop materials were taken from other sources that stress experiential science learning activities. The "Sounds of Science" materials developed by Dr. Carole Hardeman at the University of Oklahoma are particularly effective in showing successful minority, female, and handicapped scientists at work to middle school students. Some of these materials were utilized during the workshop. Additionally, books with science experiments for children were constantly used as reference materials.

Participant/Project Monitoring and Evaluation

The project activities were monitored daily by the Project Director, and informal teacher feedback sessions took place throughout the two week session. Additionally, a written evaluation form was completed by participants at the conclusion of the workshop. They indicated strengths and weaknesses of the program on the form (attached to this report). The oral and written evaluations were quite helpful in making minor modifications in the program. However, since most of the comments were overwhelmingly positive, the teachers indicated they say no need for changes.

The long-term evaluation plan for this project includes the participant and supervisor questionnaires, comparing standardized test scores of participants' students vs. a matched class of non-participants, and follow-up visits to participating teachers' classrooms. The quesionnaires have been distributed and the telephone interviews are being conducted. A complete evaluation report will be submitted on or before June 30, 1987. The pre-post test was used to determine cognitive gains as a result of the workshop. A copy of the test is attached to this report as well as the results. Since this intervention program is not directly acting upon students, a documentation that the program directly affected student performance can not be unequivocal since there are many other factors that affect student performance besides the classroom teacher. Hence, it is more

appropriate to compare the participants' performances against those of fellow teachers rather than the performance of their students against other students. However, even this type of comparison is risky because these teachers opted to participate in the workshop because of their interest in becoming excellent science teachers. They may have been better than their peers at teaching science before the workshop as well as after. Hence, the only valid comparisons must be made between the pre-workshop teaching performance and post-workshop teaching performance as reported by questionnaire responses and administrator reports.

Fiscal and Development Activities

The financial incentives for project participants were not direct in the sense that teachers did not receive a stipend or a travel allowance. However, teachers did receive approximately $400.00 worth of science equipment to use in their classrooms, and this was a great incentive for them to participate.

Activities to generate non-NASA support included a presentation to the Parent Teacher Association of one of the local schools, contacting the Army Missile Command's Office of University Relations, continuing the collaboration with the Lawrence Livermore National Laboratory, and utilizing State funds provided by the Regional Inservice Education Center located on the campus of Alabama A & M. The resources provided by these agencies included loan of personnel, financial assistance to conduct the national conference, and assistance with the publicity activities of the workshop. Additional assistance from outside sources will be sought in the future.

Service Delivery

The workshop was conducted almost entirely as planned. However, post-workshop activities deviated somewhat from the plan. First, the classroom visitations were more difficult to schedule than had been anticipated. Some teachers were hesitant to have an observer in the classroom, and the Project Director was not insistent enough that classroom visitations must be made. Second, the plans to hold the first Annual Science Day in April, 1987 were postponed. The activity was to be held in conjunction with "Scientists of Tomorrow Day" held annually at Alabama A & M. However, due to scheduling problems, this program was held on the Saturday before Easter and was inconvenient for young students to plan to attend. Plans for "Science Day" activities in 1988 will begin soon after the 1987 workshop.

Diagnostic

As for diagnostic testing of individual participants, a pre-post test of cognitive science knowledge was administered. No standardized tests were administered to the participants because it was necessary that the testing instrument reflect the special characteristics of the instruction provided by this project. There are no standardized tests at the appropriate level covering the appropriate topics for this workshop.

Instructional

The instructional process included approximately four hours of instruction each day. The four hour period was divided into three or four approximately equal blocks of time to study three or four lessons within a given subject area. (See workshop outline attached to this report.) As many as three or four different scientists would present information to the teachers on a particular day. The format was particularly effective in keeping the material interesting at all times. Most of the time was spent with the teachers actually doing science rather than listening to persons talk about science. The cooperation and comraderie that developed among the participants was excellent. They did not appear to be inhibited from fully participating in any activities and helped each other considerably. A copy of some of the lessons covered during the workshop is attached to this report.

Counseling/Advising

There was no explicit counseling component to this program. However, the participants were given information on science careers and shown resource materials ("Sounds of Science") that are designed to motivate students to pursue technical careers. They were also given information on the scientific manpower needs of this country and our inevitable inability to meet these needs by the year 2000 if we do not interest more students in pursuing science as a career. The participants were provided with resource materials that would be especially effective in getting minority, female, and physically handicapped students interested in science.

Other Service Delivery

It has been established that the project participants share the materials and philosophy with their peers in the home school. Although they do not present formal workshops (most teachers do not feel prepared to do this after a two week workshop), there is much informal assistance to other teachers in their schools.

Participant Outcomes

This project is designed to enable teachers to devise their own hands-on activities based on their individual curricula for use in their classrooms. To this end, the teachers are encouraged to develop one hands-on activity for demonstration to the workshop participants at the end of the workshop. This activity has been a very successful one, and it results in each participant having another 29 activities to add to his or her repertoire of activities to be used in the classroomns.

Although this project did not address the application of math and science concepts to engineering, the project did stress the importance of integrating science throughout the curriculum. Teachers were shown ways in which science activities could be incorporated into lessons in English, reading, writing, social studies, health, and writing. Thus, the instructional skills of the teachers improved in science as well as

in other areas as a result of this project.

As stated earlier, the career counseling skills of teachers was significantly enhanced by information on various science careers. Through a lesson on computers, participants were shown how a computer executes instructions in a computer program to perform a task. However, there was no explicit instruction in computer programming since there will be little or no need for these teachers to write their own programs for their students. They will use currently existing software. Access to some instructional software was made available to participants through the Johnson Environmental Center.

When the participants left the two-week workshop, they were quite eager to try out the new materials in their classrooms and appeared motivated to incorporate the workshop philosophy and instructional techniques into their classroom curricula. Follow-up visits and conversations indicated that the teachers did use the materials in their classroom to increase science interest on the part of their students. Evaulation questionnaire responses will further document this result.

Project Dissemination

Information concerning the project was disseminated via presentations to local and national groups. A detailed description of the project activities was presented at the Fourteenth Annual Meeting of the National Organization for the Professional Advancement of Black Chemists and Chemical Engineers (NOBCChE) held in San Francisco, CA. A copy of the paper presented at the meeting is attached to this report.

A manuscript for publication in the Journal of College Science Teaching is being prepared and will be submitted in the fall.

Conclusion

The Alabama A & M University Elementary and Middle School Science Improvement Project (Project SIP) successfully completed the work outlined in the "Statement of Work" as appears in attachment J-1 of NASA contract NAS8-36277. A two week workshop was held for thirty North Alabama teachers of elementary and middle school science. A variety of area scientists were involved in presenting information to the teachers and in performing activities with them. The NASA teacher astronaut finalist interacted with North Alabama elementary and middle school students to a limited extent. (The extent was limited due to the Challenger tragedy.) Science in the classrooms and schools of the participating teachers has been affected positively as a result of the project, and area teachers indicate they are looking forward to future workshop activities of this type.

Appendix 1

Project SIP Recruitment Information

Alabama A & M - UAH Regional Inservice Center Announces Summer Workshops for Area Science Teachers

Six science workshops to be held during the summer have been announced by the Regional Inservice Education Center. The workshops are designed to upgrade the skills of area teachers in the knowledge of science concepts and in the ability to teach science effectively to students in grades K - 12. The 1986 summer workshops are:

1. Physics Demonstrations for High School Teachers to be held June 11th from 8:30 a.m. until 12:30 p.m. at Huntsville High School. The workshop presenter is Ms. Dottie Dale, physics teachers at Huntsville High School. Tested demonstrations and laboratory exercises in physics will be presented.

→2. Project SIP (Formerly called Project LESSON) for teachers of grades 3 - 6 to be held June 16 - 27 from 8:30 a.m. until 12:30 p.m. on the campus of Alabama A & M University. Dr. Saundra McGuire is coordinating this workshop that provides basic instruction in the areas of biology, chemistry, physics, and simple electricity and magnetism. Teachers will receive materials to be used in their classrooms for the following year. The workshop is funded by NASA and will involve participation by NASA/MSFC personnel.

3. Hands-On Activities in Sounds of Science for middle school science teachers to be held June 25, 1986 from 1:00 - 5:00 p.m. on the campus of Alabama A & M. The workshop presenter will be Dr. Carole Hardeman of Oklahoma.

4. Activity Based Elementary Science to be held July 9th from 8:30 a.m. until 12:30 p.m. at Alabama A & M. The workshop will feature simple activities that can be used to peak student interest in science.

5. What Research Says to the Science Teacher to be held June 20th from 10:30 a.m. until 12:30 p.m. The workshop, to be conducted by Dr. Dorothy Gabel of Indiana University, will present research developments in K-12 science education, as well as show teachers what classroom techniques are effective in teaching science as demonstrated by research studies. Project SIP participants will participate in this workshop along with any other interested persons.

6. Chemistry for Elementary Students July 16, 1986 from 1:00 - 5:00 p.m. at Alabama A & M University. The presenters will be members of the Alabama A & M Chemistry Department. Topcis to be discussed will include acids and bases, atomic structure, chemical reactions, and states of matter.

Additional workshops may be planned if there is sufficient interest. Anyone interested in participating in any of the workshops listed above should contact Dr. Saundra McGuire, Department of Chemistry, Alabama A & M University at 859-7328 or 29, or The Regional Inservice Education Center at 859-7393 or 94.

Appendix 2

Roster of Project SIP Participants

WORKSHOP PARTICIPANT LIST

Inservice Activity Project SIP Date 7/31/86

Area Coordinator Saundra McGuire Workshop Presentor Saundra McGuire et al

Name of Participant	Address	County	School System	Name of School	Subject Matter	Area Positi
Geraldine Miller	654 Baltimore Hill Rd. 852-8751 Huntsville, AL 35811			Chapman Middle	Science	Teacher
Peggy McDaniel	Rt. 3 Box 222 Fyffe, AL 35971	632-2492		Fyffe School	"	"
Gwendolyn Strong	2306 Bell Avenue Huntsville, AL	534-3413		Lincoln Elementary	"	"
Gwendolyn Foster	156 Wilkerson Dr. Huntsville, AL 35811	534-7054		Rolling Hills	"	"
Geraldine Richards	2702 Sanelle Circle Huntsville, AL	881-4596		Westlawn Middle	"	"
Dollie Bradley	1812 Forney Drive Huntsville, AL 35810	837-5708		Whitesburg Middle	"	"
Dorothy Oliver	116 Robin Lane Huntsville, AL	859-9171		Oakwood Elementary	"	"
Gwendolyn Baldwin	6410 Cedar Point Dr. Huntsville, AL	8593935		Rolling Hills Elem.	"	"
Andryna Kuzimic	11008 Vivian Drive Huntsville, AL	852-1788		Davis Hills Elem.	"	"
Vicki Roth	3613 Chasewood Dr. Apt. 6 881-6963 Huntsville, AL 35805			Holy Spirit	"	"
Patty Faust	4278 Brian Green Dr. 881-0936 Huntsville, Al 35802			Holy Spirit	"	"
Paula Kephart	2005 Brookmanor Drive 353-6476 Decatur, AL 35601			Brookhaven Middle	"	"
Dorothy Upton	2010 Willis Road Huntsville, AL 35801	534-5157		Blossonwood Elem.	"	"
Joe Hinesley	2800 Poplar Avenue Huntsville, AL	615-433-2912		A A A	"	"
Myrtle Binford	3321 Tucker Drive Huntsville, AL 35810	852-1967		Madison Middle	"	"
Billy Stevenson	2815 Ready Section Rd. Tony, AL 35773	423-2525		Madison Crossroads	"	"
Terry Davis	116 Thatch Lane Toney, AL	828-4366		Madison Academy	"	"
Bob Trammell	4300 Force Drive Huntsville, AL	852-5981		Madison Academy	"	"
Ann Fults	11017 Rockcliff Drive Huntsville, AL	852-4682		Madison Academy	"	"

WORKSHOP PARTICIPANT LIST

Inservice Activity Project SIP Date 7/31/86

Area Coordinator Saundra Y. M'Guire Workshop Presentor S. Y. M'Guire et al

Name of Participant	Address	County	School System	Name of School	Subject Matter	Area Posi
Jerome Foster	156 Wilkerson Dr. Huntsville, AL 3581	534-7054		Lakewood Elem.	Science	Teacher
Sandra Saunders	P.O. Box 379 Meridianville, AL 35759	828-0488		Sparkman High	"	"
Betty Vaughn	11001 Mt. Charron Dr. Huntsville, AL	852-3353		West Mastin Lake Elem.	"	"
Jan Renshaw	3315 Charleston Ave Huntsville, AL 35810	859-5893		West Mastin Lake Elem.	"	"
Joyce Tittsworth	7805 Mallard Dr. Huntsville, AL	828-0391		West Mastin Lake Elem.	"	"
Martha Mckenzie	Route 1 Box 30 Pisgah, AL 35765	228-6708		Pisgah High School	"	"
Bobby Jenkins	Route 2 Pisgah, AL 35765	451-7316		Flat Rock School	"	"
Marie Everett	Route 1, Box 208 Pisgah, AL 35765	451-3789		Pisgah High School	"	"
Betty Bailey	Route 1 Box 156 Section, AL 35771	228-6232		Macedonia School	"	"
Katie Jones	1406 Ascent Trail Apt. B Huntsville, AL 35816	830-6732			"	"
Caulyne Hayden	2525 Eton Road Huntsville, AL 35810	232-7780		Julian Newman	"	"

Appendix 3

Schedule of Project SIP Activities

Alabama A & M University Department of Chemistry

Science Improvement Project
(SIP Program)

Schedule of Activities
June 16, 1986

8:30 - 8:45	Registration
8:45 - 9:00	Welcome Dr. Bessie Jones, Dean School of Arts & Sciences
9:00 - 9:30	Overview of Workshop or *"Just What is SIP?"* Dr. Saundra McGuire, Workshop Coordinator
9:30 - 9:45	Introduction of Participants
9:45 - 10:30	Fun & Games
10:30 - 10:45	Break
10:45 - 11:30	The Scientific Method
11:30 - 12:30	Lesson 39 - Senses & Skills

Alabama A & M University Department of Chemistry

Science Improvement Project
(Project SIP)

Schedule of Activities

June 17- 27

June 17th - 18th — Biology

June 17th

Lesson 34	Characteristics of Living Things	Mr. Wiley Henderson
Lesson 37	Organs of Man	Dr. Charles McMillan
Lesson 38	Microorganisms	Dr. Rather Brown

June 18th

Lesson 35	Structure of Living Things	Mrs. Katie Jones
Lesson 40	Plants	Mr. Wiley Henderson
Lesson 36	Function of Cells	Dr. Charles McMillan
Lesson 41	Water & Life	Dr. Rather Brown

June 19th - 20th — Physics

June 19th

Lesson 2	Forces	Dr. Jeffrey Wang
Lesson 3	Moving Bodies	Dr. Jeffrey Wang
Lesson 4	Pressure	Dr. M. D. Aggarwal
Lesson 5	Surface Tension	Dr. M. D Aggarwal

June 20th

Lesson 7	Electric Force & Charge	Dr. Walter Watson
Lesson 13	Light	Dr. Saundra McGuire
Lesson 9	Temperature	Dr. Saundra McGuire
Lesson 10	Thermal Expansion	Mrs. Katie Jones

June 23rd - 24th — Electricity & Magnetism

June 23rd

Lesson 18	Electrical Circuits	Mr. J. B. Turner
Lesson 19	Magnets	Mr. J. B. Turner
Lesson 23	Computers	Dr. James Thompson

June 24th

Lesson 20	Generators & Motors	Mr. J. B. Turner
Lesson 21	Alternating Current	Mr. J. B. Turner
Lesson 22	Sending Messages	Mr. J. B. Turner

June 25th - 26th — Chemistry & Miscellaneous

June 25th

Lesson 24	Molecules	Dr. Libby Chou
Lesson 29	Compounds & Solutions	Dr. Saundra McGuire
Special Lesson	Alternate Energy Sources	Mr. Bernie Levine
Special Lesson	NASA's Teacher Center	Mr. Bill Anderson

June 26th

Lesson 30	Acids & Bases	Dr. Saundra McGuire
Lesson 31	Carbon Dioxide	Dr. Saundra McGuire
Lesson 33	Uses of Chemistry	Dr. Saundra McGuire
Special Lesson	Environmental Education	Mr. Bernie Levine

June 27th — Culminating Activities

Lesson 14	Astronomy	Dr. Saundra McGuire
Individual Presentations by Teachers		
Presentation of Certificates		Mr. Clyde Foster, NASA/MSFC

The 1986 SIP Program in Review

Appendix 4

Project SIP Workshop Evaluation Forms

A&M-UAH REGIONAL INSERVICE EDUCATION CENTER

INSERVICE ACTIVITY EVALUATION FORM

Name of Workshop SIP Workshop Presenter Dr. McGuire

Date 6-17 thru 6-27 Location Ala. A+M

1. How well did this workshop succeed in meeting the objectives set forth at the beginning of the workshop? Circle the number.

Excellent 10 9 8 7 6 5 4 3 2 1 Poor

2. Indicate the degree to which the content of this workshop is relevant to your work assignment.

Poor 1 2 3 4 5 6 7 8 9 10 Excellent

3. Handout materials were adequate and pertinent.

Excellent 10 9 8 7 6 5 4 3 2 1 Poor

4. Circle the number that represents your overall evaluation of the workshop.

Poor 1 2 3 4 5 6 7 8 9 10 Excellent

5. Briefly comment on the following:

a. What change(s) in the workshop would have made it more beneficial for you? Please explain.

none (excellent)

b. In your opinion, what are the major weaknesses of the workshop? Please explain.

air conditioning

A&M-UAH REGIONAL INSERVICE EDUCATION CENTER

INSERVICE ACTIVITY EVALUATION FORM

Name of Workshop SIP Workshop Presentor Dr. McGuire

Date June 16-17, 1986 Location Room 302 A&M Univ.

1. How well did this workshop succeed in meeting the objectives set forth at the beginning of the workshop? Circle the number.

Excellent									Poor
(10)	9	8	7	6	5	4	3	2	1

2. Indicate the degree to which the content of this workshop is relevant to your work assignment.

Poor									Excellent
1	2	3	4	5	6	7	8	(9)	10

3. Handout materials were adequate and pertinent.

Excellent									Poor
(10)	9	8	7	6	5	4	3	2	1

4. Circle the number that represents your overall evaluation of the workshop.

Poor									Excellent
1	2	3	4	5	6	7	8	9	(10)

5. Briefly comment on the following:

a. What change(s) in the workshop would have made it more beneficial for you? Please explain.

None

b. In your opinion, what are the major weaknesses of the workshop? Please explain.

Air conditioning needs to be fixed.

A&M-UAH REGIONAL INSERVICE EDUCATION CENTER

INSERVICE ACTIVITY EVALUATION FORM

Name of Workshop Sci Improvement Projects Workshop Presentor Dr. McGuire

Date 6-27-86 Location Ala. A. & M. Univ.

1. How well did this workshop succeed in meeting the objectives set forth at the beginning of the workshop? Circle the number.

Excellent
(10) 9 8 7 6 5 4 3 2 1 Poor

2. Indicate the degree to which the content of this workshop is relevant to your work assignment.

Poor
1 2 3 4 5 6 7 8 9 (10) Excellent

3. Handout materials were adequate and pertinent.

Excellent
(10) 9 8 7 6 5 4 3 2 1 Poor

4. Circle the number that represents your overall evaluation of the workshop.

Poor
1 2 3 4 5 6 7 8 9 (10) Excellent

5. Briefly comment on the following:

a. What change(s) in the workshop would have made it more beneficial for you? Please explain.

None

b. In your opinion, what are the major weaknesses of the workshop? Please explain.

Needed more air conditioning - no weaknesses, otherwise.

Was a great workshop - fun, informative, and useful

A&M-UAH REGIONAL INSERVICE EDUCATION CENTER

ORIGINAL PAGE IS OF POOR QUALITY

INSERVICE ACTIVITY EVALUATION FORM

Name of Workshop Science Improvement Project Workshop Presentor U Sandra McGuire

Date June 16-27 Location AL A & M

1. How well did this workshop succeed in meeting the objectives set forth at the beginning of the workshop? Circle the number.

Excellent (10) 9 8 7 6 5 4 3 2 1 Poor

2. Indicate the degree to which the content of this workshop is relevant to your work assignment.

Poor 1 2 3 4 5 6 7 8 (9) 10 Excellent

3. Handout materials were adequate and pertinent.

Excellent (10) 9 8 7 6 5 4 3 2 1 Poor

4. Circle the number that represents your overall evaluation of the workshop.

Poor 1 2 3 4 5 6 7 8 9 (10) Excellent

5. Briefly comment on the following:

a. What change(s) in the workshop would have made it more beneficial for you? Please explain.

The hands-on activities were great. The outside speakers could have involved the class better.

b. In your opinion, what are the major weaknesses of the workshop? Please explain.

The two speakers from Johnson were boring. It was beneficial for us as teachers to see how students drift away when they aren't involved.

Dr. McGuire did such a good job on the part she presented in keeping everyone involved, so it may be [illegible]

A&M-UAH REGIONAL INSERVICE EDUCATION CENTER

INSERVICE ACTIVITY EVALUATION FORM

Name of Workshop SIP Service Workshop Workshop Presentor Sandra McGuire

Date June 16-27 Location A&M University

1. How well did this workshop succeed in meeting the objectives set forth at the beginning of the workshop? Circle the number.

Excellent
(10) 9 8 7 6 5 4 3 2 1 Poor

2. Indicate the degree to which the content of this workshop is relevant to your work assignment.

Poor
1 2 3 4 5 6 7 (8) 9 10 Excellent

3. Handout materials were adequate and pertinent.

Excellent
(10) 9 8 7 6 5 4 3 2 1 Poor

4. Circle the number that represents your overall evaluation of the workshop.

Poor
1 2 3 4 5 6 7 8 9 (10) Excellent

5. Briefly comment on the following:

a. What change(s) in the workshop would have made it more beneficial for you? Please explain.

b. In your opinion, what are the major weaknesses of the workshop? Please explain.

This was a great workshop. It really makes me want to be more with my students and to make science more interesting. You did a fantastic job.

A&M-UAH REGIONAL INSERVICE EDUCATION CENTER

INSERVICE ACTIVITY EVALUATION FORM

Name of Workshop Science Improv. Workshop (PROJECT) Workshop Presentor Dr M. McGuire

Date June 16 - 27 Location A&M

1. How well did this workshop succeed in meeting the objectives set forth at the beginning of the workshop? Circle the number.

Excellent									Poor
(10)	9	8	7	6	5	4	3	2	1

2. Indicate the degree to which the content of this workshop is relevant to your work assignment.

Poor									Excellent
1	2	3	4	5	6	7	8	9	(10)

3. Handout materials were adequate and pertinent.

Excellent									Poor
(10)	9	8	7	6	5	4	3	2	1

4. Circle the number that represents your overall evaluation of the workshop.

Poor									Excellent
1	2	3	4	5	6	7	8	9	(10)

5. Briefly comment on the following:

a. What change(s) in the workshop would have made it more beneficial for you? Please explain.

Beef up the physics portion - everything else was super.

b. In your opinion, what are the major weaknesses of the workshop? Please explain.

Physics portion

A&M-UAH REGIONAL INSERVICE EDUCATION CENTER

INSERVICE ACTIVITY EVALUATION FORM

Name of Workshop Science Improvement Program Workshop Presentor McGuire

Date 6-16-86 — 6-27-86 Location Ala. A+M University

1. How well did this workshop succeed in meeting the objectives set forth at the beginning of the workshop? Circle the number.

Excellent 10 9 (8) 7 6 5 4 3 2 1 Poor

2. Indicate the degree to which the content of this workshop is relevant to your work assignment.

Poor 1 2 3 4 5 6 7 (8) 9 10 Excellent

3. Handout materials were adequate and pertinent.

Excellent (10) 9 8 7 6 5 4 3 2 1 Poor

4. Circle the number that represents your overall evaluation of the workshop.

Poor 1 2 3 4 5 6 7 8 (9) 10 Excellent

5. Briefly comment on the following:

a. What change(s) in the workshop would have made it more beneficial for you? Please explain. More experiments related to lower elementary level

b. In your opinion, what are the major weaknesses of the workshop? Please explain. Some lecturers were not interesting
Some areas were covered to quickly

I enjoyed the workshop. Mrs. McGuire did an excellent job!

A&M-UAH REGIONAL INSERVICE EDUCATION CENTER

INSERVICE ACTIVITY EVALUATION FORM

Name of Workshop Science Improvement Project Workshop Presentor Dr. McGuire

Date July 16 – July 27 Location Alabama A & M University

1. How well did this workshop succeed in meeting the objectives set forth at the beginning of the workshop? Circle the number.

Excellent
10 (9) 8 7 6 5 4 3 2 1 Poor

2. Indicate the degree to which the content of this workshop is relevant to your work assignment.

Poor
1 2 3 4 5 6 (7) 8 9 10 Excellent

3. Handout materials were adequate and pertinent.

Excellent
10 (9) 8 7 6 5 4 3 2 1 Poor

4. Circle the number that represents your overall evaluation of the workshop.

Poor
1 2 3 4 5 6 7 8 9 (10) Excellent

5. Briefly comment on the following:

a. What change(s) in the workshop would have made it more beneficial for you? Please explain. More experiments and demonstrations for Biological science

b. In your opinion, what are the major weaknesses of the workshop? Please explain.
Cooler classroom temperature

I enjoyed it very much !!

A&M-UAH REGIONAL INSERVICE EDUCATION CENTER

INSERVICE ACTIVITY EVALUATION FORM

Name of Workshop Science Improvement Project Workshop Presentor Saundra McGuire

Date 6/27/86 Location A & M. University

1. How well did this workshop succeed in meeting the objectives set forth at the beginning of the workshop? Circle the number.

Excellent									Poor
(10)	9	8	7	6	5	4	3	2	1

2. Indicate the degree to which the content of this workshop is relevant to your work assignment.

Poor									Excellent
1	2	3	4	5	6	(7)	8	9	10

3. Handout materials were adequate and pertinent.

Excellent									Poor
(10)	9	8	7	6	5	4	3	2	1

4. Circle the number that represents your overall evaluation of the workshop.

Poor									Excellent
1	2	3	4	5	6	7	8	9	(10)

5. Briefly comment on the following:

a. What change(s) in the workshop would have made it more beneficial for you? Please explain.

I could not understand some of the speakers. AC noise was a problem, as well as their not cooling adequately.

b. In your opinion, what are the major weaknesses of the workshop? Please explain.

A&M-UAH REGIONAL INSERVICE EDUCATION CENTER

INSERVICE ACTIVITY EVALUATION FORM

Name of Workshop Science Improvement Workshop Presenter Dr. ~~Saunders~~ Saandra McQuire

Date June 27, 1986 Location A & M University

1. How well did this workshop succeed in meeting the objectives set forth at the beginning of the workshop? Circle the number.

Excellent									Poor
(10)	9	8	7	6	5	4	3	2	1

2. Indicate the degree to which the content of this workshop is relevant to your work assignment.

Poor									Excellent
1	2	3	4	5	6	7	(8)	9	10

3. Handout materials were adequate and pertinent.

Excellent									Poor
10	9	(8)	7	6	5	4	3	2	1

4. Circle the number that represents your overall evaluation of the workshop.

Poor									Excellent
1	2	3	4	5	6	7	(8)	9	10

5. Briefly comment on the following:

a. What change(s) in the workshop would have made it more beneficial for you? Please explain.

- Kits should be more accurately prepared
- Room temperature uncomfortable
- Several speakers were difficult to understand

b. In your opinion, what are the major weaknesses of the workshop? Please explain.

[redacted]

ORIGINAL PAGE IS
OF POOR QUALITY

Strengths - Will be able to use materials in class this 1986-87 year. At least 1/2 the lessons are relevant to Units taught.

* Resource people available will be great & vital part of Science Program for next [illegible]

A&M-UAH REGIONAL INSERVICE EDUCATION CENTER

INSERVICE ACTIVITY EVALUATION FORM

Name of Workshop Science Improvement Project Workshop Presentor Dr. McLaurin

Date 6/17 - 6/27 Location A&M

1. How well did this workshop succeed in meeting the objectives set forth at the beginning of the workshop? Circle the number.

Excellent 10 9 8 7 6 5 4 3 2 1 Poor

2. Indicate the degree to which the content of this workshop is relevant to your work assignment.

Poor 1 2 3 4 5 6 7 8 9 10 Excellent

3. Handout materials were adequate and pertinent.

Excellent 10 9 8 7 6 5 4 3 2 1 Poor

4. Circle the number that represents your overall evaluation of the workshop.

Poor 1 2 3 4 5 6 7 8 9 10 Excellent

5. Briefly comment on the following:

a. What change(s) in the workshop would have made it more beneficial for you? Please explain.

b. In your opinion, what are the major weaknesses of the workshop? Please explain.

A&M-UAH REGIONAL INSERVICE EDUCATION CENTER

INSERVICE ACTIVITY EVALUATION FORM

Name of Workshop Science Improvement Project SIP Workshop Presentor Dr. McGuire

Date June 27, 1986 Location A & M University

1. How well did this workshop succeed in meeting the objectives set forth at the beginning of the workshop? Circle the number.

Excellent
(10) 9 8 7 6 5 4 3 2 1 Poor

2. Indicate the degree to which the content of this workshop is relevant to your work assignment.

Poor
1 2 3 4 5 6 7 (8) 9 10 Excellent

3. Handout materials were adequate and pertinent.

Excellent
(10) 9 8 7 6 5 4 3 2 1 Poor

4. Circle the number that represents your overall evaluation of the workshop.

Poor
1 2 3 4 5 6 7 8 (9) 10 Excellent

5. Briefly comment on the following:

a. What change(s) in the workshop would have made it more beneficial for you? Please explain.

Dr. McGuire gave the most beneficial lessons. She was more interesting in presenting the lessons. She was very energetic!

b. In your opinion, what are the major weaknesses of the workshop? Please explain.

A&M-UAH REGIONAL INSERVICE EDUCATION CENTER

INSERVICE ACTIVITY EVALUATION FORM

Name of Workshop S. I. P Workshop Presentor Dr. McGuire

Date 6-27-86 Location A+M University

1. How well did this workshop succeed in meeting the objectives set forth at the beginning of the workshop? Circle the number.

Excellent — Poor

(10) 9 8 7 6 5 4 3 2 1

2. Indicate the degree to which the content of this workshop is relevant to your work assignment.

Poor — Excellent

1 2 3 4 5 6 (7) 8 9 10

3. Handout materials were adequate and pertinent.

Excellent — Poor

(10) 9 8 7 6 5 4 3 2 1

4. Circle the number that represents your overall evaluation of the workshop.

Poor — Excellent

1 2 3 4 5 6 7 8 9 (10)

5. Briefly comment on the following:

a. What change(s) in the workshop would have made it more beneficial for you? Please explain.

All area were not relevant to my teaching assignment, but the workshop served the purpose set forth- I think the workshop is excellent with the plan now being used.

b. In your opinion, what are the major weaknesses of the workshop? Please explain.

None

A&M-UAH REGIONAL INSERVICE EDUCATION CENTER

INSERVICE ACTIVITY EVALUATION FORM

Name of Workshop Science Imp. Proj. Workshop Presentor Dr. S. McGuire

Date 6-16 - 6-27 Location Okla. A&M U.

1. How well did this workshop succeed in meeting the objectives set forth at the beginning of the workshop? Circle the number.

Excellent
(10) 9 8 7 6 5 4 3 2 1 Poor

2. Indicate the degree to which the content of this workshop is relevant to your work assignment.

Poor
1 2 3 4 5 6 7 8 9 (10) Excellent

3. Handout materials were adequate and pertinent.

Excellent
(10) 9 8 7 6 5 4 3 2 1 Poor

4. Circle the number that represents your overall evaluation of the workshop.

Poor
1 2 3 4 5 6 7 8 (9) 10 Excellent

5. Briefly comment on the following:

a. What change(s) in the workshop would have made it more beneficial for you? Please explain. Some of the presenters were a little more technical that they should have been. Presenters (Professors) should introduce the lessons as a model for how we will present them to our students.

b. In your opinion, what are the major weaknesses of the workshop? Please explain.

STATED ABOVE

Appendix 5

Project SIP Pre-Post Test Results

1987 Project SIP Pre and Post Test Scores

Teacher Number	Pre-Test	Post Test	Difference
1	11	28	+17
2	24	29	+5
3	25	20	-5
4	32	35	+3
5	18	32	+14
6	17	22	+5
7	25	25	0
8	20	29	+9
9	22	24	+2
10	23	38	+15
11	22	25	+3
12	26	31	+5
13	23	32	+9
14	13	28	+15
15	15	26	+11
16	24	32	+8
17	19	25	+6
18	23	32	+9
19	25	34	+9
20	20	29	+9
21	26	33	+7
22	31	36	+5
23	16	39	+23
24	12	26	+14
25	25	37	+12
26	20	30	+10
27	16	33	+17
28	31	37	+6
29		35	--
Average scores:	21.57	30.25	+8.86

After a t-test for significance of differences between related scores to determine whether the cognitive gains were significant, the t value obtained was 7.74. This figure is significant at the 0.001 level of significance for 27 degrees of freedom. Hence, the odds that the cognitive gains were due to chance rather than the workshop are less than one in 1000.

Appendix 6

Representative Lessons Presented in Project SIP

Lesson 39
Discovering Our Senses and Skills

PURPOSE

To help the students learn how their senses operate to gather information from the world around them, which senses they rely upon the most, and how sensitive their senses are.

SUGGESTED PRIOR STUDY

Some knowledge of the nervous system as presented in Lesson 37 is required. Also useful but not essential background study is the material on sound in Lesson 12 and light in Lesson 13.

SAFETY

Point out to the students that the scissors can be dangerous and should be used carefully.

BACKGROUND

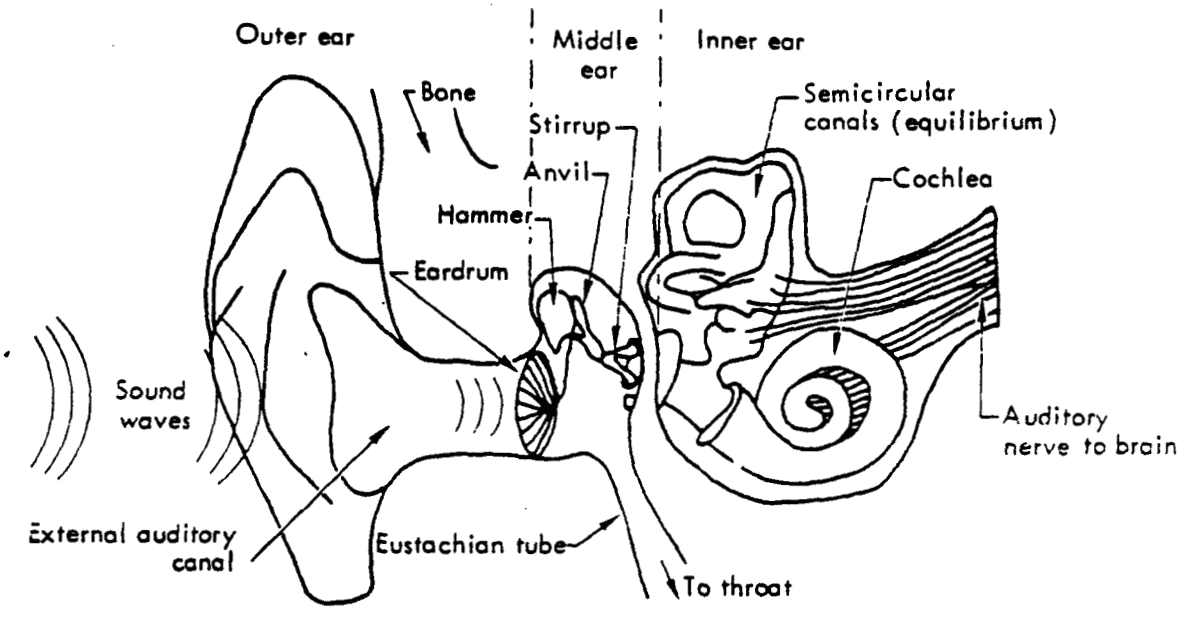
We become aware of our immediate environment and function within it through the use of our senses. The five basic senses are listed below with percentage figures showing what proportion of our total perceptions comes to us through each sense:

Sight (visual)	87%
Hearing (auditory)	7%
Smell (olfactory)	3.5%
Touch (cutaneous)	1.5%
Taste	1%

There are other senses that we depend on, such as equilibrium, which tells us what position we are in, and kinesthesia, which tells us where the various parts of our body are in space. Thus we are able to remain upright and move properly.

Hearing

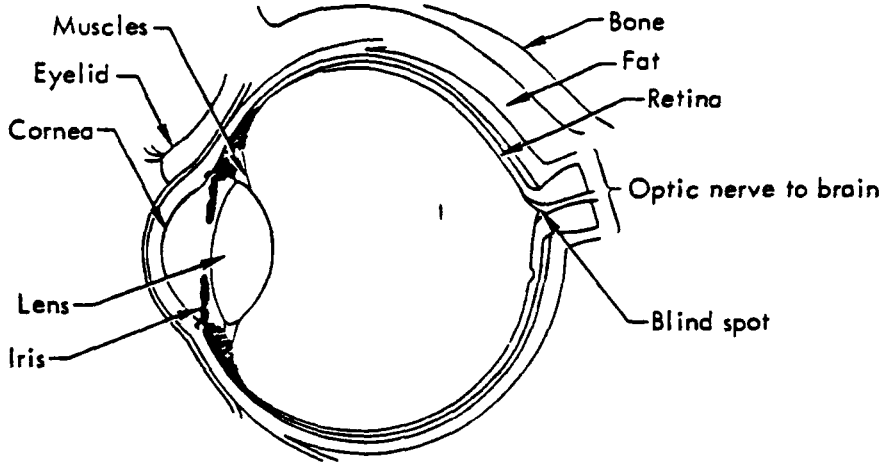
The ear is constructed in such a way as to receive sound waves sent out by a vibrating body and convert them into sensations we identify as sound. The outer ear is



shaped to catch the sound waves and direct them down a funnel-shaped canal (external auditory canal) to the eardrum, which vibrates in time with the sound waves. These vibrations are carried across the middle ear by a chain of small bones (hammer, anvil, and stirrup) which are attached to a membrane that communicates with the inner ear. The inner ear contains the essential organ of hearing within the cochlea. The fluid in the inner ear is set into motion by this membrane. The motion of the fluid is detected by the nerve endings of the auditory nerve, which then transmits the sensation to the brain. We can only hear sounds having frequencies from 16 to 30,000 Hz (vibrations per second); we can detect differences in pitch (high, low), quality (music, harsh sounds), and intensity (loudness) of various sounds.

Sight

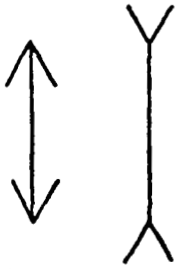
Perhaps the most important sense is sight. The eyes have developed from hollow outgrowths of the forepart of the brain. The eye is like a simple box camera. (See Lesson 15, "Photography.") In a camera, light reflected by an object is refracted by the lens and focused onto light-sensitive film. So it is with the eye – the light-sensitive film being the retina, which is the essential organ of sight. The light is controlled by the iris. The eye accommodates for distance not by moving the lens as in a camera but rather by changing the shape of the lens. The image is generally focused on one central spot of the retina, which is most capable of acute vision.



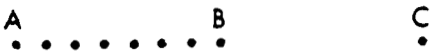
Your eyes are incessantly making fine movements to focus objects on this sensitive spot. If you look at an object that is clearly in focus, all else in your field of vision is blurred. The image is transmitted to the brain by the optic nerve to be interpreted. Myopia or nearsightedness is a result of the eyeball being longer (front to back) than it is wide. Hyperopia or farsightedness is a result of the eyeball being shorter than it is wide. Astigmatism results if the cornea which covers the lens, or the lens itself, or both, are distorted.

The brain does much of our visual work. Our vision is stereoscopic. Two slightly different images are transmitted to the brain, fused, and interpreted so that the result we see is objects that stand out from the background. We do not get this sense of depth when we look at a photograph because both eyes see the same image. Our judgment of the size of an object depends upon the size of the image produced and also its distance from our eyes. For instance, a church steeple a mile away looks no bigger than a needle a foot away. But the brain takes into account the different distances and concludes that the steeple is bigger.

The brain can be deceived by optical illusions with which we are all familiar. Optical illusions are created by imitating certain effects upon which the brain bases its judgment of size, shape, and color of objects.



The vertical lines are the same length.



The distance from A to B is the same as from B to C.

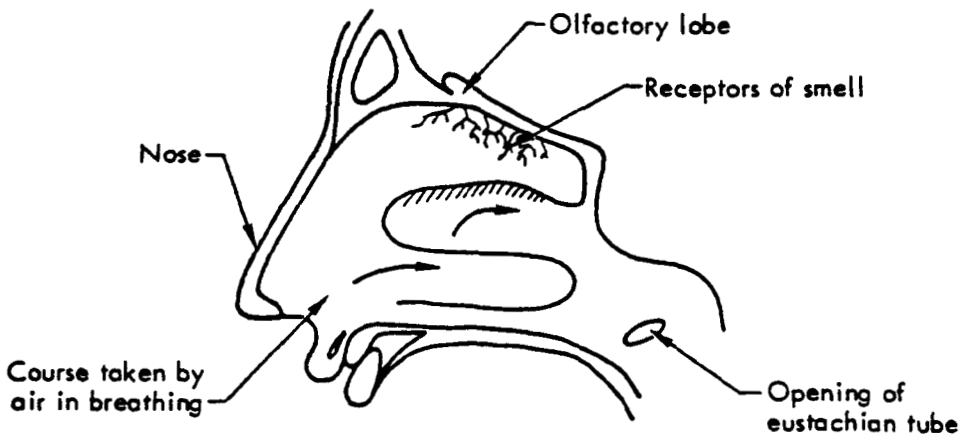
Color Vision

It is believed that a portion of the retina has three kinds of cells called cones that are sensitive to the primary colors red, green, and violet. All colors or absence of color are a combination of these. People who are colorblind are usually blind to red or green but rarely to blue.

Taste and Smell

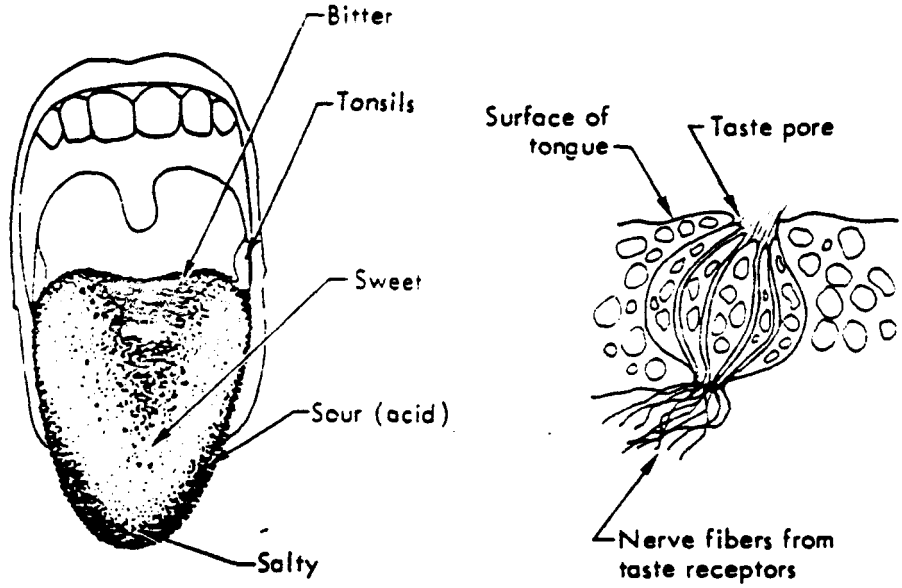
Taste and smell are alike in that both are chemical senses – that is, the stimulus that excites both is chemical. Salt has a different taste than sugar, a rose smells different than a violet. The stimuli are chemically different. The two senses are different in that the nose need not come in direct contact with the substance it smells, whereas the substance to be tasted must touch the tongue.

The sense of smell is quite rudimentary in man. The inside of each half of the nose is divided into four incomplete chambers placed one above the other running from front to back. Inhaled air flows through the lower three passages. Odors which are



gaseous must be carried by eddies from lower air currents upward to the top passage, which contains the receptors for smell. To get a better smell we purposely take short breaths or whiffs to increase the number and force of the upward currents.

The sense of taste is stimulated only by dissolved substances. The organs of taste, called taste buds, are located chiefly on the upper surface of the tongue. The



cells that make up the taste buds are supplied with fine branches of the taste nerves. There are five fundamental sensations of taste – sweet, bitter, sour, alkaline, and salty (although bitter and alkaline seem the same). Other tastes are a combination of these or a combination of taste with other sensations. Pepper produces a burning sensation, oils are often unpleasant because of how they feel, soda water "nips" the tongue, etc. Some tastes are combined with smell through the communication that exists between the mouth and the back of the nose. Note how different everything tastes when you have a cold. The fundamental taste sensations are not felt equally over all regions of the tongue, but are concentrated as follows:

Sweet – tip and front
Salt – tip
Sour – sides
Bitter – back

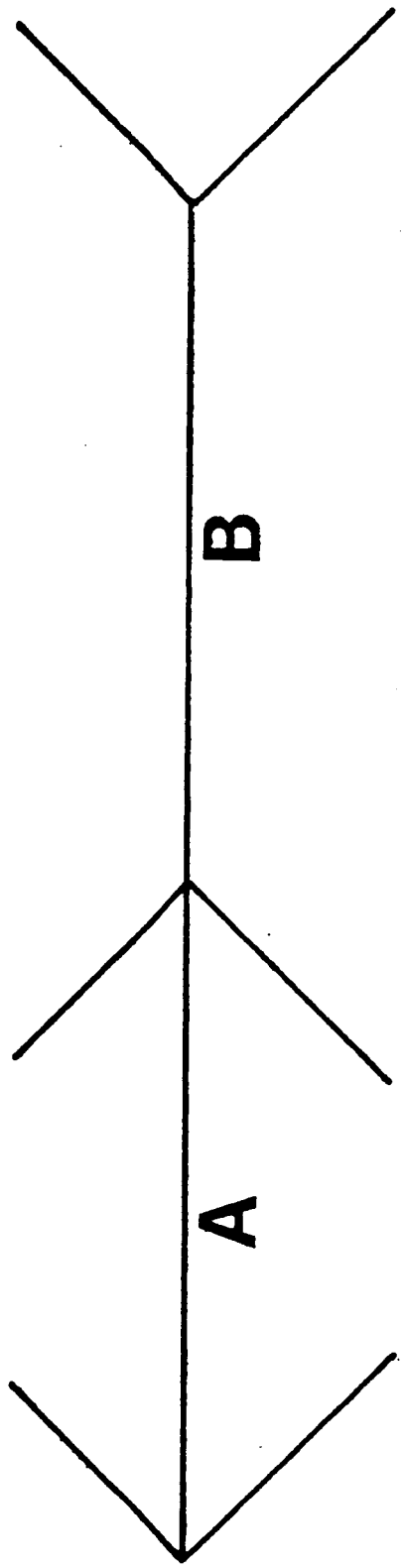
The central part of the tongue is not very sensitive to taste.

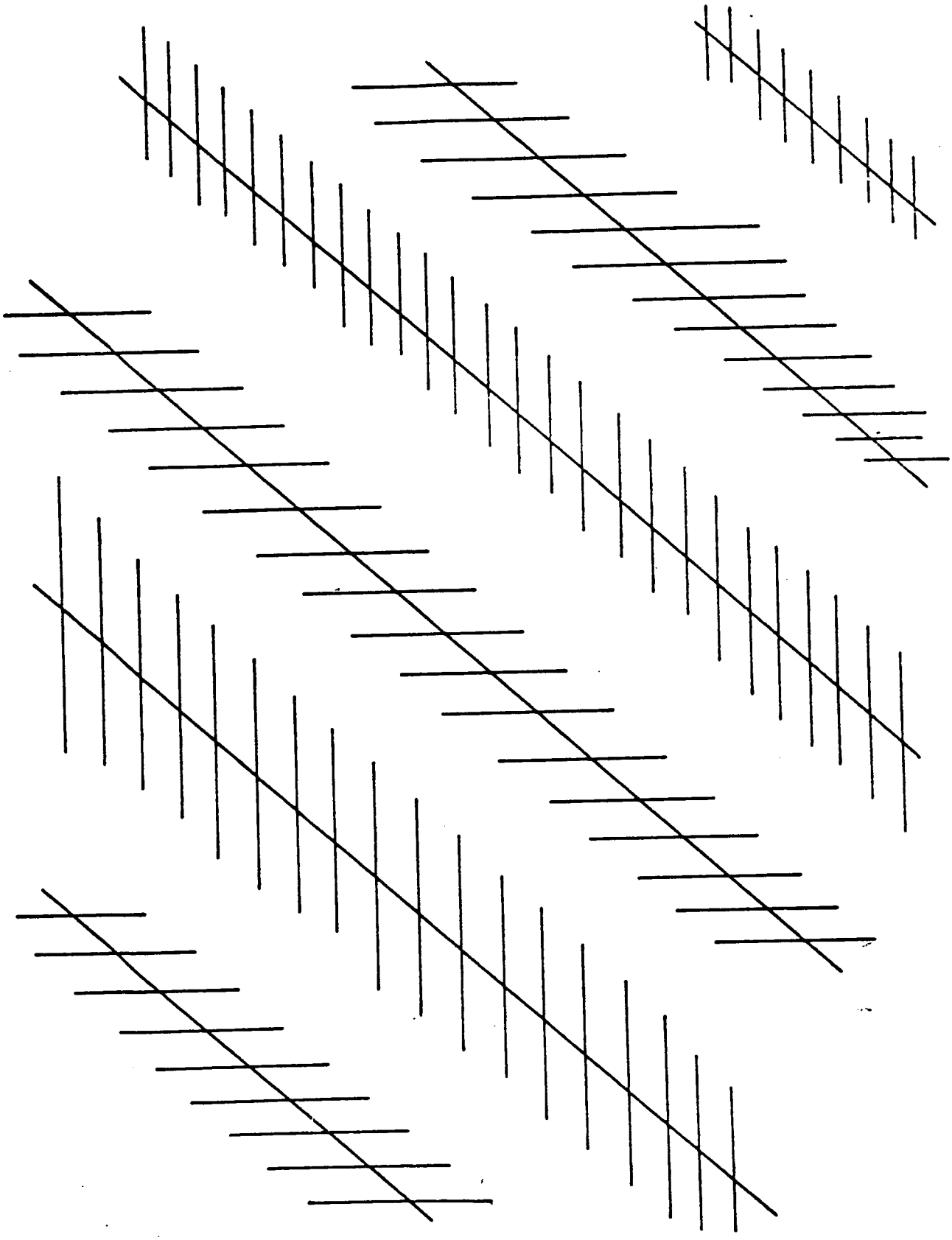
Touch (Cutaneous Sensations)

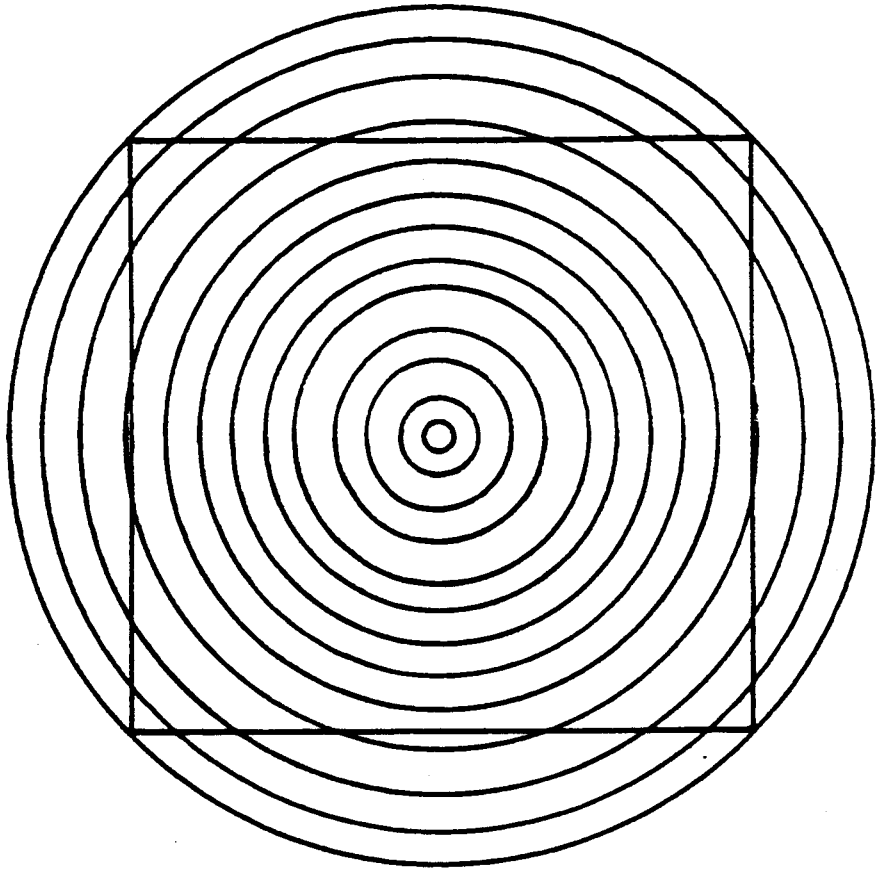
In this category are the various sensations aroused by stimulating the skin. They are five in number – touch, pressure, pain, heat, and cold. Touch is sensation elicited by lightly brushing the skin. Pressure is the sensation experienced when something touches the skin with enough force to be felt beneath the skin. Pain is experienced if the object is pressed still more firmly into the skin. Touch, pressure, heat, and cold each are dependent upon special nerve fibers which respond only to their particular stimulus. Pain receptors, on the other hand, respond to any other type of stimulus – mechanical, thermal, electrical, chemical – provided it is intense enough. So pain serves as a protective function, signaling a potential threat of injury to the body.

The different cutaneous receptors are separated from each other by measurable distances. By applying appropriate stimuli to the skin one can determine the various sensitive areas called touch spots, hot spots, cold spots, etc. Touch spots are most numerous on the tips of the fingers and the tip of the tongue. In the regions covered with hair (all skin surfaces except palms of hands and soles of feet) the touch spots lie on the "windward" side of the hairs (the side that the hairs slant away from). Therefore, light contact with the tips of the hairs causes a sensation of touch. So touch, pain, and pressure are very accurately localized, but heat and cold sensations are more diffuse. Depending on the region of skin, there is a minimum distance that two stimuli must be separated by to be felt as separate sensations.

The brain interprets tactile sensations on the basis of previous experience. Aristotle devised an experiment to demonstrate this which is one of the touch experiments given later – a small object felt between two adjacent fingers is felt as a single object, whereas crossed fingers feel it as two objects.







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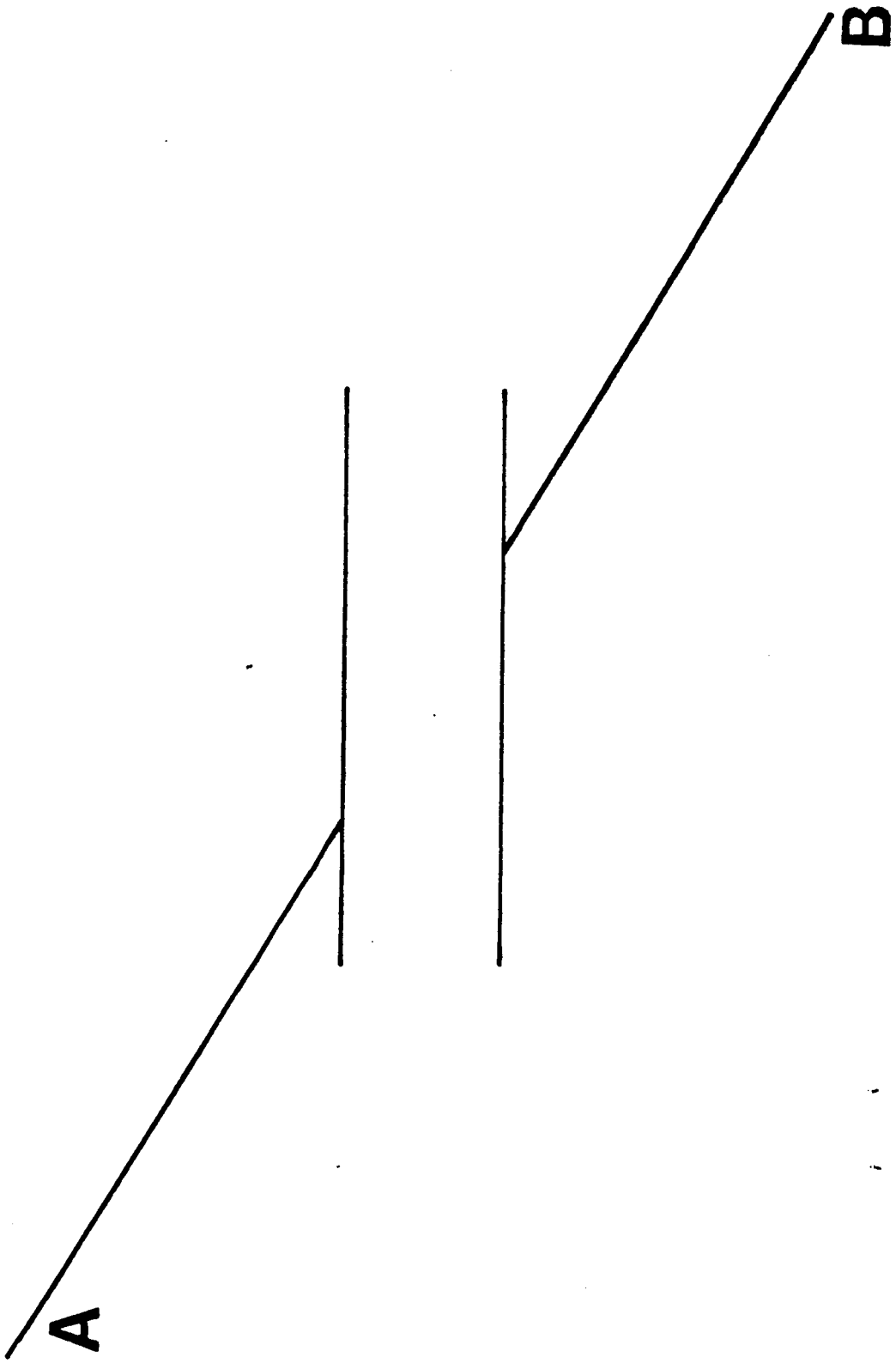
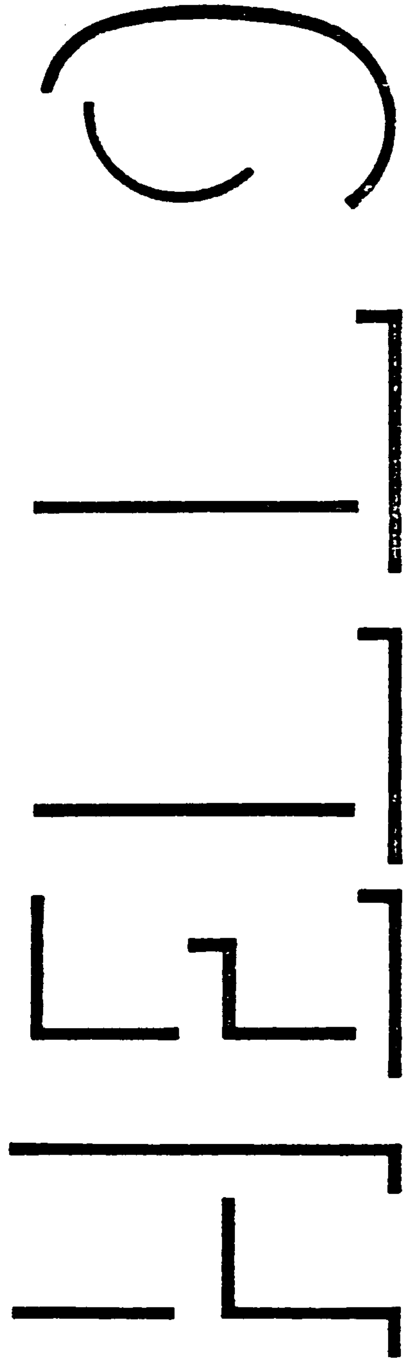

B
A



Show the students each of the optical illusions. Ask them to tell you what they see. After all the illusions have been shown, go back and discuss each one briefly, pointing out where the brain was led astray.

Set the illusions up where the students can see them. Allow them to reconstruct the lines for themselves, either on paper or on the blackboard. It would be fun for them to take home some of the optical illusions they make to show their families or friends.

Allow each student two pieces of construction paper of each color. Have them draw a circle 5 inches in diameter on one white and one black sheet of paper using the two pencils, the piece of string, and the ruler. Then tell them to cut out the circles, and paste the white circle in the center of the black paper and the black circle in the center of the white paper. Ask them to tell you what they see; explain that the white circle looks larger because of the spreading effect of the bright light on the retina.

Vocabulary

optical illusion
retina

Taste Experiments

Materials

Quart bottles of salty water, quinine water (bitter), diluted vinegar (acid), and sugar solution (sweet), labeled A, B, C, and D, respectively.
Small vials.
Swabs (Q-Tips, for example).

The four solutions represent the fundamental tastes. All other tastes are due to varying concentrations and combinations of these four tastes. Also, different parts of the tongue are sensitive to different tastes. The tip of the tongue is sensitive to sweet tastes, the sides to sour, the back to bitter. The salt-sensitive taste buds are more uniformly distributed, with some being strongly concentrated on the front edge. There seem to be different taste buds for each of these tastes.

Give each student a small vial containing one of the solutions. The contents are unknown to the students, but label each vial A, B, C, or D so that its contents can be identified later. Have each student dip a Q-Tip applicator in his solution and taste it only on the tip of the tongue. Then ask what was tasted and have the students write the results in their Worksheets. Some children will not be able to taste anything, so have these students redip and taste on the sides, back, or middle of the tongue to find the

area where the solution finally has a definite taste, then write the results in the Worksheets.

Repeat this process so that each student samples at least two of the solutions. Then take a poll by show of hands on what was in solutions A, B, C, and D. Compare the results of the poll with the actual contents of the bottles.

Vocabulary

taste	bitter
sensitivity	salty
fundamental	sour
taste buds	sweet

Touch Experiments

Materials

Toothpicks
Marbles or dried peas
Small objects not over 2 inches in size (brought by the students)
Small dark bag (a clean sock will do)

Experiment 1

All the students are divided into pairs. One partner will test whether his partner can tell if he is being touched with one or two toothpicks. The areas to be tested are the back of the neck, the back of the hand, and the fingertips. To avoid blindfolding, the student will hold his hand behind his back. Caution the students to press gently but firmly. If they press too hard the "memory" of the pressure will remain too long to get accurate results; if they press too lightly their partner will not be sure he was touched.

Two toothpicks can be distinguished only if they touch two separate nerve endings. Nerve endings are at different distances apart in different areas of the skin.

Experiment 2

Each student rolls one or two marbles between two fingers. It is easy for him to tell how many marbles he is playing with. The student now crosses his fingers and rolls one marble. Even with his eyes open, he feels two marbles.

Our sense of touch can be fooled. Experience has taught us that the touch receptors between adjacent fingers sense both sides of an object placed between the

fingers. So feeling an object with the opposite sides of the fingers gives one the impression of feeling two objects.

Experiment 3

All objects brought by students are placed in a sack (or a clean sock). Each student tries to pick, by touch alone, the object he brought. Then each student tries to identify other objects. The bags are exchanged between tables and then each student will try to identify one or two objects.

Our sense of touch can be trained and used to distinguish many objects that are of the same size but have different shapes or textures. Our sense of touch can be trained to "see."

Vocabulary

information	sensitive
message	stimulate
nerve ending	stimulus, stimuli

Maze Experiments

Materials

Blindfold
Bar of strong-smelling soap or some strong perfume

These experiments are games in which individual students try to negotiate simple mazes by relying on specific senses or combinations of senses.

The student selected as "it" leaves the room while the rest of the class, under the teacher's direction, forms a simple maze, holding hands to make the maze walls. The student who is "it" is then positioned at the start of the maze, and he tries to walk through the maze as quickly as he can under one of the conditions specified below. When he is finished, a new student is selected to be "it," a new maze is formed, and a new condition is imposed. Time each run.

The conditions:

1. All senses available and operating.
2. Blindfolded; hands behind back (no sight, touch, or hearing).
3. Blindfolded; hands used freely (touch emphasized).
4. Blindfolded; guiding sounds made by students (hearing emphasized).
5. Blindfolded; bar of scented soap at goal (smell emphasized).

OPTICAL ILLUSIONS

1. After seeing the various optical illusions, what would you say an optical illusion is?

2. When you know you are looking at an optical illusion would you say it is your eyes or your brain that sees the image wrong?

3. In the space below, draw the optical illusion you liked best.

TASTE EXPERIMENTS

	Part of tongue			
	Tip	Sides	Back	Middle
Solution A				
Solution B				
Solution C				
Solution D				

1. Sweet taste was in Bottle _____.
2. Sour taste was in Bottle _____.
3. Bitter taste was in Bottle _____.
4. Salty taste was in Bottle _____.

Fill in the blanks with sweet, sour, bitter, or salt:

5. The tip of your tongue is good for tasting _____.
6. The back of your tongue is good for tasting _____.
7. The sides of your tongue are good for tasting _____.
8. The taste you liked the most was _____.
9. The taste you disliked the most was _____.

TOUCH EXPERIMENTS

Experiment 1

Touch your partner with toothpicks on the back of the neck, the back of the hand, and the fingertip. Use one or two toothpicks as it says in the table, and write down how many toothpicks he feels in each place.

	Back of neck	Back of hand	Fingertip
Two toothpicks 1 inch apart			
One toothpick at center			
Two toothpicks 1/2 inch apart			
Two toothpicks 1/4 inch apart			

Which part of the skin is the most sensitive?

Experiment 2

Roll a marble on the table with one and two fingers.
Roll two marbles with one and two fingers.
Can you always tell by the feel how many marbles there are?

Roll one marble with two fingers crossed. How many marbles do you feel?

Experiment 3

Try to identify objects by touch alone. Can you pick the object you brought?

Can you tell what some of the other objects are?

In a bag that you have not seen, can you identify some of the objects by touch alone?

MAZE EXPERIMENTS

Senses operating:	Time to reach goal
1. All senses	_____
2. No senses	_____
3. Touch only	_____
4. Hearing only	_____
5. Smell only	_____

Name the five senses in the order that they are most used, based on the results of the maze game.

1. _____
2. _____
3. _____
4. _____
5. _____

INSTRUCTIONS

You need three pans. Put cold water in one, very warm water in another (but not too hot to put your hand in), and lukewarm water in the third.

Place one hand in the cold water, and the other in the very warm water. Leave them there for about half a minute. Now place both hands at the same time in the lukewarm water.

QUESTIONS

How did the lukewarm water feel to the hand that was in cold water? _____

How did it feel to the hand that was in very warm water? _____

The same water feels different to each hand. Does the sense of touch remember how it felt before? _____

In how many other ways do you learn about the world outside of you? What other senses besides touch bring you information about the outside world? Make a list of the other senses and the part of your body that does the sensing.

Sense	Part of the body that does the sensing

Lesson 10

Heat II: Thermal Expansion

Most materials expand (get bigger) when they are heated and contract (get smaller) when they are cooled. If we consider what happens to the molecules in a material when it is heated or cooled we can visualize what causes expansion or contraction. As heat is added to a material, its molecules start moving faster (vibrating in the case of a solid or moving randomly in the case of a gas or liquid), bumping into neighboring atoms and knocking them away. Thus, the average distance between the molecules increases and the material expands.

This might be easier to visualize if we consider the analogy of a row of people sitting next to each other on a long bench. If everyone is sitting still and as close together as is comfortable, let us assume that the occupied length of the bench is, say, 20 feet. But if we ask each person to sway in place from side to side (but not in time with his neighbors) and then ask the row of constantly swaying people to arrange themselves as close together as is comfortable, we would find a much longer portion of the bench is used: perhaps 25 or 30 ft. This "expansion" of the row of people is very much like the expansion that takes place in a heated wire.

Experiment 1. Solid Expansion

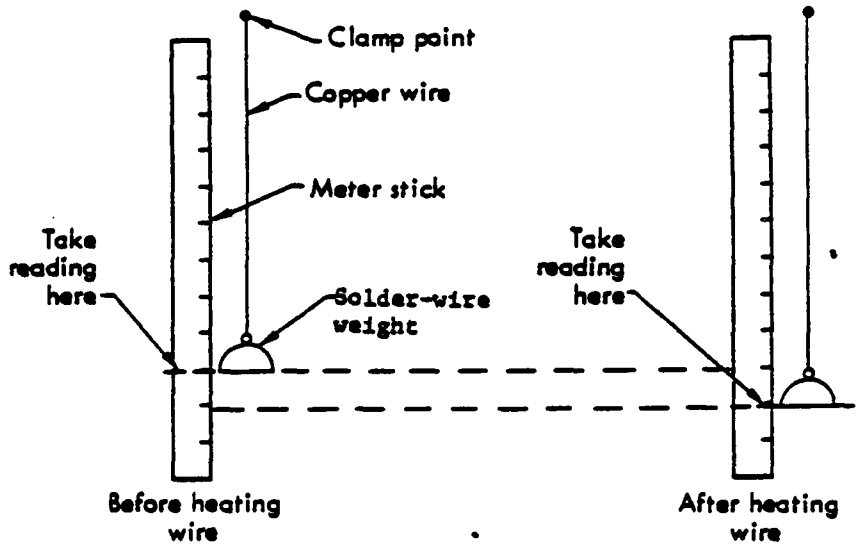
When the molecules in a solid vibrate more rapidly as temperature increases, the distance between them increases and the space they occupy expands. This expansion is easily seen by the expansion of a strand of copper wire when it is heated.

Materials

Copper wire
3 inches of 1/8 in. diameter solid solder wire
Meter stick
Disposable butane lighter
Clamp

Procedure

Fasten the solder wire to one end of the copper wire, and clamp the other end so that the wire hangs vertically. Hold the meter stick vertically next to the weight, with one end firmly on the floor. Have several students read the position of the bottom of the weight to the nearest millimeter. Then heat the length of copper wire with the flame of the lighter. Notice that the copper wire gets longer. Have several students watch the reading on the meter stick change while you heat the wire.



Experiment 2. Liquid Expansion

As in a solid, when the temperature of a liquid increases, the increase in the speed of its molecules tends to drive them apart. Thus, when a liquid-filled thermometer, for example, is placed in hot water, the expanding volume of the liquid inside it (mercury or alcohol is commonly used) forces the liquid up a calibrated narrow tube and allows us to measure the temperature of the water.

Materials

Pyrex container, such as a beaker
Hot water
Thermometer

Procedure

Immerse the thermometer in the beaker of hot water. Note the temperature indicated by the thermometer before and after immersion. What happens to the fluid in the thermometer when it is immersed in the hot water?

Experiment 3. Expansion of a Gas

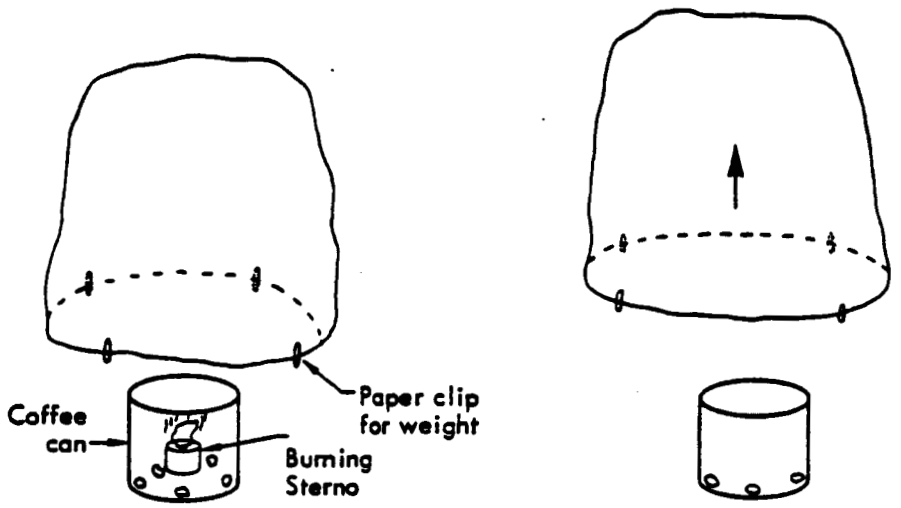
As the temperature of a gas increases, the molecules force themselves farther apart, just as in a solid or a liquid. This fact is nicely demonstrated by a hot-air balloon.

Materials

Dry-cleaning bag (plastic)
Paper clips
Coffee can
Can of Sterno

Procedure

First, remember to use caution so as not to ignite the plastic bag. Remove the top of the coffee can and punch about five holes around the side of the can as near to the bottom as possible. Center the Sterno in the bottom of the coffee can, and set the can on the floor, and light the Sterno. Place four paper clips evenly spaced around the open end of the dry-cleaning bag and hold the bag, open end down, over the coffee can so that it fills with hot air. (To do this requires a little practice.) The bag will fill with hot air and float away. As the air inside the bag cools, it will settle back down to the floor.



Heating air in a dry-cleaning bag

Warm air expands and makes bag rise

The bag floats when the air inside is heated, because the air expands when heated, and, therefore, less air is required to fill the bag when the air is hot than when it is cold. That is, a given volume of hot air has fewer molecules and weighs less than the same volume of cool air.

Name_____ Date_____ 10. Thermal Expansion
HOME EXPERIMENT

HEAT CONDUCTION AND THERMAL EXPANSION

Turn on the hot-water faucet in your bathroom sink. Turn the water on only a very small amount so that the water comes out as little more than a trickle. At first the water will be cold, but as the water gets hotter, see if you notice a change in how much water comes out of the faucet. Can you explain why this happens?

Lesson 24
Molecules

PURPOSE

To acquaint the students with the basic properties of molecules and how molecules are formed.

MATERIALS

Iron filings, iron powder, or steel wool.
Sulfur powder (available from a drug store or a nursery).
Magnet (any small magnet will do).
Matches.
Small Pyrex or ceramic dish or test tube (do not use plastic).
Bunsen burner, propane torch, or stove.
Copper: filings, wool, fine wire, or powder, the finer the better.
Balance.

(The last two items, the copper and the balance, are for Experiment 2, if time and facilities permit.)

SAFETY

A fire is used in the experiments presented in this lesson. Be sure that torches, fires, stoves, and anything else that's hot, are handled in a safe place with good ventilation, and that there is a fire extinguisher in the room.

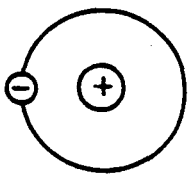
It is especially important to do the iron-and-sulfur experiment with good ventilation. This experiment can smell bad. If you can stand the smell, the room is safely ventilated.

BACKGROUND

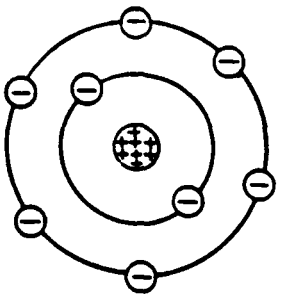
What is a molecule? A molecule is a stable combination of two or more atoms. You remember from Lesson 8 that atoms are the basic building blocks of nature; each atom consists of a nucleus with one or more electrons orbiting around it.

Why do molecules form? In general, molecules form because the atoms have less energy when combined as a molecule than they do as separate atoms. For example, when a carbon (C) atom combines with an oxygen (O) atom to form a carbon monoxide

hydrogen and oxygen are shown here as examples. The chemical properties of an element are determined by the number of electrons the element has, and by how these electrons are arranged around the nucleus. The electron arrangement forces the chemical properties of an element to fall within one of eight groups. This grouping is called the periodic chart of the elements.



Hydrogen



Oxygen

How does the periodic chart of the elements tell us which elements will combine? To see this, let us look at a simpler sort of periodic chart, made up of letters from our alphabet. The "molecules" that we will form will not be real molecules, but they will give us an idea of how the real periodic chart works.

Periodic Chart of the Alphabet

I	II	III	IV	V	VI
T	G	C	L	Y	Q
N	H	V	A	E	X
S	J	D	O	I	Z
R	M	F	B	U	
K	P	W			

Here our two-atom molecules will really be two-letter words. Not all combinations of two letters (atoms) can form words (molecules). Likewise, with real elements, only those with the proper electron arrangements can form molecules. In general, atoms with similar electron arrangements will be near each other in the periodic chart and they will have similar chemical properties. This can be seen in our alphabet chart; the three neighboring letters (atoms) N, H, and S can form two-letter words (molecules) with letters (atoms) A, O, and I. A, O, and I have similar properties to each other but differ from N, H, and S. The words that can be formed from these two groups of letters are AN, AS, HA, NO, SO, HO, IN, HI, IS.

The letters (elements) in a column do not form molecules with other elements of the same column; looking at Column I, for example, we see that no combination of T, N, S, R, K is a word (molecule).

What two-letter words can you make with the letters in Columns III, IV, and V?

In the real world, it is possible to construct molecules with many thousands of atoms. Of course, in these large molecules there are a very large number of atoms of a relatively few elements.

DEMONSTRATIONS

You have some disks with bumps and some with slots. The ones with bumps are labelled H and Na, and the ones with slots are labeled O and F. These disks are models of simple atoms, like the "friends" and "enemies" pictured above.

Try fitting the disks together to form compounds. What compounds can you form? What compounds will not form?

Answer: H_2O, Na_2O, HF, and NaF will form; HNa, and OF will not.

Experiment 1

Materials

Matches
Pyrex or ceramic dish or test tube.
Iron powder (Fe) or steel wool.
Sulfur powder (available at drug store or nursery).
Magnet.

Procedure

1. Feel and smell the iron powder and sulfur. Test each material's response to to the magnet.
2. Mix the iron and sulfur together (about 2 to 5 cubic centimeters of each).
3. Use the magnet to separate some of the iron out of the mixture. Note that neither the iron nor the sulfur has been changed by the mixing or by the separating.
4. Take a small amount of the mixture (a few cubic centimeters, or a heaping teaspoon) and put it in a ceramic dish or test tube. Light this small sample of the mixture with a match, or heat it in a test tube over a stove.

NOTE: Step 4 should be done outdoors or in a well-ventilated area.

5. After the material stops "burning," let it cool down.
6. Test the new material's response to the magnet.

Further Exercise for Interested Students

Subtract the weight of the dish from the weight of the dish plus the copper before heating. This tells you how much copper you had.

Subtract the weight of the dish and the copper before heating from the weight of the dish and its contents after heating.

How much did the weight change?

This tells you how much oxygen combined with the copper. Look up the atomic weights of copper and oxygen on your periodic chart. Divide one by the other (find the weight ratio). How does this compare with the weight ratio of the amount of copper and the amount of oxygen used in your experiment?

This shows you that about one atom of oxygen combines with one atom of copper to form copper oxide.

Experiment 1 (iron and sulfur) will be more interesting also if everything is weighed before and after.

These experiments both will show that you can "burn" something – that is, you can produce a chemical reaction – and not lose much material; or, in fact, you can even gain some.

When you burn a piece of wood or paper, almost everything goes away. That is because the new compounds you make are steam (H_2O) and carbon dioxide (CO_2), which are both gases and which both mix with the air and disappear unless you take special trouble to catch them (as we did to catch the water made by heating sugar in Lesson 8).

Appendix 7

Project SIP Certificate of Achievement

THE ALABAMA A&M UNIVERSITY DEPARTMENT OF CHEMISTRY

and

THE A&M-UAH REGIONAL INSERVICE EDUCATION CENTER

present this

SIP Program

Certificate of Achievement

to

_____

in recognition of successful completion of the 40 hour **Science Improvement Project** workshop

Presented this _____ day of _____, _____ Huntsville, Alabama

Annie M. Wells
_____
Regional Inservice Education Center Director

_____
SIP Program Director

Appendix 8

Abstract and Paper Presented at National NOBCChE Meeting

Abstract of Technical Presentation

Submitted for

The 14th Annual NOBCChE National Conference
April 13 - 18, 1987
Hotel Meridien, San Francisco, CA

Submitted by

Saundra Yancy McGuire
Department of Chemistry
Alabama A & M University
Normal, AL 35762

The Alabama A & M Science Improvement Project:

Getting Minority Students Involved in Science!

In view of the rapidly dwindling number of minority students enrolling in high school science and technology classes and the attendant decrease in minority students graduating with technical degrees from colleges and universities, there is an urgent need for Black scientists and educators to devise methods to reverse these trends. The Science Improvement Program (Project SIP), based on the Lawrence Livermore National Laboratory Elementary Science Study of Nature (Project LESSON) is coordinated by the Department of Chemistry at Alabama A & M University. The program assists teachers in school systems with a significant minority student population to bring science alive in their classrooms. Teachers are taught science principles and a variety of hands-on activities that are easy for elementary and middle school students to perform, but still demonstrate basic scientific principles. Evaluation efforts have demonstrated that the teachers use the materials effectively in the classrooom and students become excited about science. This presentation will provide information on Project SIP as well as information on how scientists and educators in other locations can work together to improve the science education available to pre-high school youngsters, thereby increasing the number of minority students possessing the motivation and aptitude to pursue a technological career.

Friday
9:00–12:00
COLOMBARD

Jones and Young (continued)

It is hoped that this presentation will elicit a greater response from the black constituents of the ACS and help provide constructive engagement between black chemists and chemical engineers and their white majority cohorts.

THE ALABAMA A&M SCIENCE IMPROVEMENT PROJECT (SIP): GETTING MINORITY STUDENTS INVOLVED IN SCIENCE

S. Y. McGuire, Department of Chemistry, Alabama A&M University, Normal, Alabama

In view of the rapidly dwindling number of minority students enrolling in high school science and technology classes and the attendant decrease in minority students graduating with technical degrees from colleges and universities, there is an urgent need for black scientists and educators to devise methods to reverse these trends. One such method is the Science Improvement Program (Project SIP), based on the Lawrence Livermore National Laboratory Elementary Science Study of Nature (Project LESSON). It is coordinated by the Department of Chemistry at Alabama A&M University.

Project SIP assists teachers in school systems with a significant minority student population to bring science alive in their classrooms. Teachers are taught science principles and a variety of hands-on activities that demonstrate basic scientific principles and are easy for elementary and middle school students to perform. Evaluation efforts have demonstrated that the teachers use the materials effectively in the classroom and students become excited about science.

This presentation will provide information on Project SIP as well as information on how scientists and educators in other locations can work together to improve the science education available to pre-high school youngsters. Hopefully, this information will result in other methods being devised to increase the number of minority students possessing the motivation and aptitude to pursue a technological career.

The Alabama A & M Science Improvement Project: Getting Minority Students Involved in Science!

A paper presented at

The 14th Annual NOBCChE National Conference

April 17, 1987

Hotel Meredien, San Francisco, CA

by

Saundra Yancy McGuire

Department of Chemistry

Alabama A & M University

Normal, AL 35762

Introduction and Statement of the Problem

Far too many students leave the Nation's elementary and middle schools with an inadequate foundation in mathematics and science(1). This lack of preparation translates directly into a deficiency in science and mathematics when these students emerge from high school. The problem of inadequate science and mathematics preparation is particularly acute for minority and disadvantaged members of the population who are located in large urban school systems. In 1980 only 28% of black high school seniors had taken a year of chemistry, as compared to 37% of white high school seniors.

Whereas a number of intervention programs exist that are designed to increase interest and proficiency in science for students at the high school level and beyond, few programs targeted at elementary and middle school teachers and students currently exist. However, in a November 1983 report published by the Rockefeller Foundation (2), Sue Berryman points out that the primary determinant of a desire or lack of desire for pursuing a scientific career for some students is their pre-high school interests. The pre-high school interests of some groups of students trigger an education sequence that will ultimately result in the group's underrepresentation among science and mathematics related doctorates.

In a September 1983 report to the National Science Board, the National Science Commission on Precollege Education in Mathematics, Science and Technology indicated that early and substantial exposure to mathematical and scientific concepts and processes is critical to later achievement (1). The Commission recommended that top priority be placed

on increasing effective science and mathematics instruction at the elementary level and on retraining present teachers and recruiting and retaining new teachers in order to insure that elementary and secondary science and mathematics teachers will be of high quality.

The problems addressed by this presentation are the lack of preparation of elementary and middle school science teachers in the basic sciences and the paucity of science materials that are available for use by these teachers. These problems lead to inadequate pre-high school science education and a subsequent decline in the number of the Nation's youth, especially minorities and females, who are prepared to pursue a technological career.

Approach to the Problem

A successful approach to improving science education at the high school and university levels has been the involvement of instructors in research activities with practicing scientists (3). The enthusiasm generated during the research project is carried back to the teachers' classrooms and they are able to make their subject matter more alive and interesting for all students in their classes. This approach is particularly cost effective because one classroom teacher may interact with 150 students during the course of a year. Student research programs, as effective as they are in motivating individual students, can never reach as many students as can programs aimed at teachers. Furthemore, it is somewhat counterproductive to send a student who has been successfully motivated by a summer research experience back to a

classroom in which the teacher is unprepared to continue the types of experiences which can make science an exciting discipline. The participation of a classroom teacher in the NASA astronaut program demonstrates the importance of involving classroom teachers in the scientific process. One of the ten finalists in the NASA teacher astronaut program was assigned to the Marshall Space Flight Center (MSFC) for a one year period and interacted with some of the teachers participating in this project. Whereas elementary and middle school science teachers do not have the background to perform scientific research, they can certainly benefit from a project that allows them to perform science activities in the presence of scientists who will serve as valuable resource persons for them and their students. However, few programs for pre-high school science teachers currently exist. Project SIP provided an opportunity for elementary and middle school teachers to interact with scientists and become as excited about science as their high school counterparts do as a result of similar experiences.

The Elementary and Middle School Science Improvement Program (Project SIP) represents an effective coalition between scientists and pre-high school educators to improve the elementary science curriculum. Project SIP involves an in-service workshop for teachers to provide instruction and materials for hands-on activities in the areas of biology, chemistry, physics, and electricity and magnetism. The Project SIP materials include approximately $400.00 worth of science equipment for use in the teachers' classrooms and a lesson plan manual that provides background information in the science areas covered as well as detailed information on how to use the materials provided for hands-on

activities in the classroom. Additionally, the manual contains suggestions for home experiments that the students can perform. The Project SIP concept and materials were created by scientists at the Lawrence Livermore National Laboratory in Livermore, California. The project, called LESSON by the Livermore Scientists, has been successfully operating in California since the early 1970's and has been introduced in a number of other states in the country. The workshop has been conducted for teachers in Alabama for the past three years with funding provided by the Lawrence Livermore National Laboratory for the first two years and by the National Aeronautics and Space Adminstration for the third year. It is anticipated that the Project will continue for the next two years with NASA funding.

GOALS

The goals of Project SIP are:

1. To increase the amount of hands-on experiences provided to science students in North Alabama elementary and middle schools,
2. To increase the interaction between North Alabama scientists and pre-high school science teachers, and
3. To increase the number of minority and female students who actively engage in science activities in the pre-high school classroom.

Objectives

The specific objectives of Project SIP are:

1. To conduct a two-week workshop for thirty North Alabama teachers of elementary and middle school science,

2. To involve at least fifteen different area scientists in presenting information to teachers and in performing science activities with them,
3. To provide a mechanism whereby the NASA teacher astronaut assigned to the Marshall Space Flight could interact with North Alabama elementary and middle school students and teachers in formal and informal settings,
3. To increase by a minimum of 50% the number of science activities that are demonstrated and performed in the classrooms of participating teachers, and
4. To increase by a minimum of 50% the cognitive skills in science of participating teachers as determined by pre-post-testing, and
5. To increase the number of minority and female students who are interested in science as a possible career.

Activities

The activities conducted to accomplish the objectives stated above are described below.

A two-week workshop for thirty teachers from North Alabama was conducted on the campus of Alabama A & M University during the weeks of June 16 - 27, 1986. The workshop involved forty hours of instruction in the basic concepts of biology, chemistry, physics, and electricity and magnetism. Personnel from the Marshall Space Flight Center were involved in the planning and implementation of the workshop, and a representative from the Johnson Environmental and Energy Center also

participated in the workshop activities. The teacher participants were selected on the basis of recommendations from principals and on self-referral. The workshop was coordinated by Dr. Saundra Y. McGuire, assistant professor of chemistry at Alabama A & M University.The workshop presenters included professors from the science departments at Alabama A & M University as well as scientists from the the North Alabama scientific community.

Since one of the ten finalists for the NASA teacher astronaut program was assigned to the MFSC for a one year period, she worked with the project to serve as a role model for local teachers as well as for students. However, due to the Challenger tragedy she was in such great demand as a speaker that she was only able to visit two schools. However, her visists to the schools was inspiring to the students as well as to the teachers.

In addition to the two week workshop, follow-up visits were conducted at some of the schools of participating teachers during the 1986-87 academic year to assist with science instruction and to provide scientists as role models for the students.

Teachers evaluated the effectiveness of the Project SIP materials in their classrooms and suggested some modifications for improvement of the program. Teachers were encouraged to share the information and materials with other teachers in their respective schools. One of the requirements for participation in the project was a willingness to share the philosophy and activities of the Project with other teachers at a participant's school.

To date the Project SIP philosophy and materials have been

presented to approximately 90 North Alabama teachers. The teachers continue to indicate that receiving the materials and the instruction in basic science concepts has transformed their classrooms into places where science is an exciting subject to study.

FUTURE ACTIVITIES

Now that the materials have been disseminated to a number of classrooms in North Alabama, it will be possible to do research to determine whether the materials are really making a difference in the test scores and science attitudes of the students. These types of research activities will be conducted in the near future. However, for the present the project has succeeded in turning science from (as one teacher put it) "the stepchild of the curriculum to the belle of the ball.

HOW OTHER SCIENTISTS CAN HELP

Although Project SIP is presented at considerable effort and significant cost, variations of these activities can be conducted by virtually any scientist who is interested in the improvement of pre-college education. Some activities that individuals or groups of scientists can perform are:

1. Visit pre-college classrooms to share information with students about science and scientists.

2. Become visible role models for students who have never had a chance to interact with a minority scientist.
3. Provide resources and ideas to local schools that seek assistance.
4. Encourage community groups of which you may be a part to present programs and discussions on science and the Black community.

If the activities suggested above are not performed, and scientists continue to ignore the condition of pre-college science, there will be no significant number of new scientists to replace those who are currently doing science. The technology needs of this Nation will require that all of our resources are developed to their full potential.

References

1. National Science Board Commission on Pre-College Education in Mathematics, Science and Technology. Educating Americans for the 21st Century. National Science Foundation. Washington, D. C., 1983.
2. Berryman, Sue. Who Will Do Science? The Rockefeller Foundation, New York, 1983.
3. Vivio, Frank M. A National Resource to Meet a National Need: The Role of National Laboratories in Pre-College Science Education. Proceedings of a Conference hosted by Argonne National Laboratory, February, 1985.

Appendix 9

Representative Photographs from Workshop and Classrooms