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ABSTRACT

A proposal commissioned by the American Association for the Advancement of Science suggests a science programing group for U.S. public television with the mission of increasing the level of understanding of science by a large part of the public. It is proposed that programing be undertaken at WBGH-TV Boston for the entire Public Broadcasting System. A first project of 30 one-hour programs is outlined, with specific suggestions of topics, including the genetic code, the green revolution, the immune reaction, and others, and with detailed explanation as to how the suggestions might be implemented. Use of such techniques as macrophotography, microphotography, electron microscopy, and others are advocated and described. Details of cost and funding are also analyzed. Five other projects, including a series for children and programs to analyze scientific news items, are also briefly discussed. (SK)

A A A S

American Association for the Advancement of Science

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The Science Program Group for Public Television in the United States

by
Michael Ambrosino

Office of Communications Programs for the Public Understanding of Science

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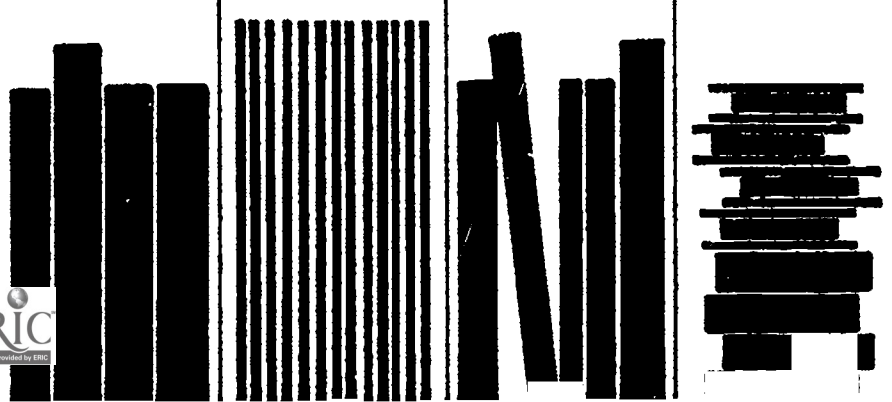

OBJECTS

The objects of the American Association for the Advancement of Science are to further the work of scientists, to facilitate cooperation among them, to improve the effectiveness of science in the promotion of human welfare, and to increase public understanding and appreciation of the importance and promise of the methods of science in human progress.

Edited by Blair Burns
Cover design by Anne D. Holdsworth

INTRODUCTION

The American Association for the Advancement of Science (AAAS) has had since its earliest times a fundamental commitment to the public understanding of science and today considers that function one of its central aims. To that end the Association maintains a Committee on the Public Understanding of Science to oversee the development of communications programs in this area.

In more recent years, the AAAS has considered television broadcasting to be of special utility in advancing the public understanding of science.

The Association's first significant use of television began in 1967 at the AAAS Annual Meeting and, every year since, the AAAS has financed and broadcast science programs over the public television network.

In October of 1970 the AAAS Committee on the Public Understanding of Science commissioned four special consulting studies. The Committee's purpose was to seek recommendations on topics of particular interest to it in order to guide its future deliberations. The studies were on the subjects of publishing, science kits, programs of "colleagueship" of scientists with non-scientists, and broadcasting, especially television.

The study on television broadcasting was conducted by David Prowitt, television science producer, under the direction of Lloyd N. Morrisett, President of The John and Mary R. Markle Foundation of New York. Mr. Morrisett is a member of the Committee on the Public Understanding of Science. Financial support for that study was provided by funds from the Alfred P. Sloan Foundation of New York.

The Prowitt study[1] surveyed the current status of science programming on radio and television and concluded that science was significantly underrepresented. The report then recommended that AAAS, through its Committee on the Public Understanding of Science, should play a leadership role in seeking to stimulate more and better science programming on television. The Committee endorsed this posture and instructed the staff to seek the funding necessary to create a definitive operating plan.

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[1] David Prowitt, Science Programming on Radio and Television (September, 1972), published by the American Association for the Advancement of Science, AAAS Misc. Pub. #72-17.

The Rockefeller Foundation of New York made a significant leadership grant to the Association specifically to support this television planning study, and a portion of the funds from a National Science Foundation grant to AAAS were earmarked for this purpose.

It was the Association's intention to hire an experienced television professional to its staff for a period of time in order to develop the operational plan for science on television. In searching for that person, the Association staff met with Mr. Michael Ambrosino, executive producer with WGBH Educational Foundation, the Boston, Massachusetts public television station widely noted for its innovative contributions to television programming. Mr. Ambrosino, who had recently returned from a year's leave at the British Broadcasting Corporation where he had been a Corporation for Public Broadcasting Fellow during 1970-71, had initiated planning for the creation of a science programming group which would function from WGBH-TV, but service the entire Public Broadcasting System.

It was clear after initial conversations that the mutuality of interests of both the AAAS and WGBH-TV was remarkable, both philosophically and practically. Consequently, the AAAS elected to invest its planning funds in support of the WGBH-TV project.

Mr. Ambrosino's final report, published here, outlines the plan for the creation of a science programming group for public television.

If this project can be funded and implemented over a long period of time, the American Association for the Advancement of Science believes it will have significant impact on the level of understanding of science on the part of increasingly large numbers of citizens.

Further, it is hoped that the presence of this undertaking will demonstrate the vitality and importance of science as program content and stimulate increased programming in the sciences throughout television commercial as well as non-commercial.

The AAAS wishes to thank the Rockefeller Foundation (Dr. Ralph Richardson) and the National Science Foundation (Mr. Clarence Ohlke, Mr. Richard Stephens, Dr. Robert Wilcox*) for grants which supported this study.

March 16, 1973

James C. Butler
Director of Communications Programs
for the Public Understanding
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The Science Program Group
For Public Television in the United States

by

Michael Ambrosino

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Introduction

I propose the establishment of a Science Program Group for public television in the United States. Its purpose will be to introduce the public, through television, to the ideas and experience of science, to communicate the most significant pursuits in science today. This design for the group has been developed by WGBH-Boston, with the cooperation and assistance of the American Association for the Advancement of Science.

Given sufficient support, the group will plan and produce a variety of television series, each designed to attract and inform both the adult and the young audience. Once engaged in extended documentary projects, the group will also be able to respond quickly, with special programs, to breaking news of scientific research.

The group will have a national and an international reach. In the United States, it will work closely with scientists and scientific institutions. In its relations abroad, the group will arrange for cooperative production and program exchange with the leading science program production units of broadcasting organizations.

The Science Program Group will be based at WGBH-Boston, taking advantage of the station's considerable experience in film, television, and radio production for local, national, and international audiences.

Objectives

We, the Science Program Group, have these aims:

We want to show the way the world works.

We want to reveal the unfolding relations in life, the earth, and the universe, to present the beauty and order of nature, to examine the conceptual laws that govern our view of the world and of ourselves, to question the most telling theories and experiments.

In all of this, we want to involve the audience as much as possible in the same process and excitement of discovery that impel scientists themselves.

We want to show, further, how science changes our everyday lives through technology. And we feel deeply the obligation to show how science bears on the great national issues that are too often seen only in political terms.

We want to explain how science views the long-term prospects for the survival on earth of human and other life, the choices that arise from a technological civilization -- how the demands for energy, food, plastics, metals collide with ecological and aesthetic values; how major unsolved problems assume their present shape partly because of the very success of technology.

At the same time, we want to make people less fearful of technology, to give them the confidence of knowledge in using their new tools and methods to help shape the better civilization they want.

We hold these views:

Science is part of our culture -- we want to show that.

Science is allied to our sense of wonder. We need to keep that sense alive.

Science is more than observing facts in nature or experiments and then putting them together, science is the creation of new concepts, new ways of looking at the facts. The great scientist is one whose new approach has overwhelming power to explain and predict phenomena, thus stirring a revolution in the way we understand nature and ourselves.

Science is a human enterprise. The impersonal, inexorable "scientific method" endures as a schoolboy myth; actually, the discoverer at the moment of breakthrough is often more artist than scientist.

Science is not easy to understand -- it is sometimes too difficult even for scientists. But many basic principles and applications can be widely understood if explained with intelligence, artistry, and sprightly irreverence. The right approach can seem like pure entertainment.

Scientists are more than a special-interest group. Technically trained people make up a growing fraction of our labor force; they hold an increasing proportion of the key jobs in our society. This trend will continue as our dependence on advanced technology increases.

Because science leaves an ever greater mark on our everyday reality, it cannot be ignored. It deserves to be represented in the chief popular form of discourse in a technological society: television. Most important, it is from television that people should have the chance to learn about science. But consider the 1972-73 network season. Except for the coverage of Apollo 17, fewer than 25 out of 4368 scheduled prime-time network hours are to be devoted to science - about 0.5 percent of the total. With the rare exceptions of five National Geographic specials, four Jacques Cousteau films, and an assortment of other specials, the list plainly shows that network television, including network public television, simply ignores science. There is no certain solution to the difficulties of presenting science on television, but it is wrong not to present science at all.

The record of neglect is especially ironic in view of the last research in 1958 on attitudes toward science and the mass media conducted at the Survey Research Center at Michigan State University. It shows that 28% of respondents said they read all the science news in newspapers, 37% read all medical news, up to 52% of the men wanted more science, and up to 60% of women wanted more medical news. When asked to judge the mass media as sources of science information, the sample rated television more complete, more accurate, more interesting, and more understandable than magazines, radio, or newspapers. That was 15 years ago. What must the figures be now?

We need an organization that will bring science to television. We need a vehicle to help laymen deal with the timeless, fundamental questions of man and science and the impact they have in a swiftly changing society. We need a group whose sole responsibility will be the presentation of science on television, a group capable of understanding science and how best to present it to a lay audience. We need, in short, an effective link between the science community and the public. This does not now exist. I therefore propose the creation of the Science Program Group.

Why a Program Group for Science?

It is important to understand that we are advancing the concept of a group as the best method for ensuring that science be done on television -- and done well.

Television can be a bridge between the happenings in the scientific and technological communities and the public's understanding of the details and implications of those happenings only if the responsibility is clear and continuous. Otherwise, public television can never attract and develop the personnel necessary to do the job; nor can it establish the close associations with the scientific and research communities without which the job cannot be done. For it is this bond between the professional in science and the professional in communications that is a prerequisite for programs that will do justice to the material and to the audience. The scientist will contribute his knowledge of the subject; the communicator, his knowledge of the medium. All this will take time and commitment, since in this relatively unexplored field of science on television no prior assumptions can be made -- other than that the public has a right to be exposed to the information. We cannot assume an interest, nor can we assume that one method of approach is the "right" one. We must talk, try and test, and try again.

Because there may not be funds available specifically for the creation of such a group, we are suggesting the underwriting of a specific project as a means of getting it under way. The project itself is of great import, but the group, as a concept, is uppermost.

The First Project

The Science Program Group will be founded on its first project: the development of an imaginative and entertaining science series for the adult and young audience, to awaken an interest in the nature of man and his world and to foster public understanding of science. This popular approach to science will match scientific accuracy with television artistry. In its first year, it would bring to the public a 30-week season of hour-long programs in a variety of styles.

The first project will interpret science in its broadest context. It will produce programs in three major areas: basic science, science and technology's effect on society, and science's impact on public policy.

Basic science finds out how the world works. Here we take advantage of man's curiosity and joy in discovering the processes of life and the universe. Drawing their examples from human life, nature, the small world of bacteria, and that of the immense galaxies, these programs will examine well-known theories and recreate the circumstances leading to their formulation. They will assess and try to make sense of the new, sometimes startling, ideas coming from the various fields of science. They will investigate some current controversies in science in order to show that some of our accepted truths may yet be only hypotheses.

Programs will examine the process of science as well. It is not the neat linear typescript of the journal abstract nor the white coat and bubbling flask of the Hollywood film. We will show it as a human endeavor, complete with tedium, chaos, and failure. In all of this, the project will aim at having the audience feel, "I can understand how science works. I can make sense of the world. I have an insight I didn't have before." We want to help dispel some of the mystique that surrounds science.

Certainly these programs will include sophisticated process and detail, and the more one knows about science, the greater his understanding of a given program will be. But the primary audience will be the curious lay public, and the project's producers will strive above all to meet their needs.

Science and technology affect society in two major ways. First, a new technology changes the economic and political development of people. Whether by stone ax, power loom, automobile, or television, the effect is dramatic and long lasting. Second, new discoveries and theories often revolutionize

man's understanding of the universe and his place in it. Science and technology are the means by which the whole of our civilization is continually and rapidly being transformed.

These changes sometimes result in benefits to mankind, other times in problems, and often in both. For example, wire screen and DDT have suddenly halted malaria in tropical nations. What happened then? What did success breed? What was science's effect on these societies and its response to the problems induced by its success?

As with all science, the end of one story is merely the beginning of another. In telling these stories, the project will avoid historical romanticism, on the one hand, and hysterical myth-making, on the other.

Science and public policy collide when major national decisions hinge on the applications of science. Remember the debate on the ABM, SST, DDT, phosphates? All the clamor and claims left much of the public frustrated. They knew something had to be done but were often unable to evaluate the information presented.

This project will pursue major national issues with scientific implications which affect millions of lives and involve billions of dollars. The programs will clearly explain the fundamentals of a topic and will subject informed proponents and opponents a scrutiny as rigorous and impartial as the toughest scientific peer review.

Criteria for choosing programs

The objectives and key issues of science will be established by the project's advisory staff, which will be drawn from the nation's active scientists and science journalists. Suggestions for individual programs will be made by staff, advisors, scientists, and the public. The topics selected will be developed into program proposals by producers and researchers, and the final choice of ideas will rest with the project's science editor.

The designation, then, of broad topics and areas will be done by the scientific community, deciding on objectives, key issues, and trends. The choice of specific ideas and their execution is the responsibility of the program group.

Our first standard in choosing specific ideas will be a subject's importance to the public, to individuals, and to the general world view. Does the idea change or condition daily life?

Does it bear on the important choices we face as a democratic society? Does it challenge our notions about the nature of man and the world? Can the audience relate to the subject on its own terms? Does the approach have a human scale, even if the subject doesn't?

Next, we have to be convinced of a subject's importance to science. Does it touch on and give insight into the fundamentals of science? Does it involve us in its process? Will a scientific approach be more significant than simply a good job of journalism? Does science have something to contribute to this subject's factual basis and its implications?

Third, will the subject make good television? Can it attract an audience large enough to warrant the expenditure it would require, and does it meet the practical requirements of this demanding and expensive medium? Will it make a good show -- is there a good story working? Can we make it? Is it realistic? How rigorously can we portray the subject and still keep the audience? Can it be translated into understandable language? Would it make a better book? Are there articulate spokesmen to call on? Are the key people in the field willing to participate in our program?

The following program topics serve as illustrations of our approach and criteria.

At first glance, this list may appear to be an interesting series of disconnected topics. But a closer look will show the main concerns running through these illustrations - an examination of basic science, science and technology's relation to society, and science's impact on major public (often political) policy issues. The difficulty we face will be not lack of inspiration for topics, but choice.

The gypsy moth

A summer storm in 1869 blew over some caterpillar cages belonging to a Professor Truvelot at Tufts University. A problem that could have been eliminated in the 20th century with a can of bug killer quickly spread throughout Massachusetts and the Eastern United States, resulting in tens of thousands of square miles of dead trees and wasted woodlands.

Widespread chemical spraying has been tried, but the results are mixed -- often there are more moths the year after the spraying than before. What can be done? What research is under way?

We would examine the basic problem of insect control and

population dynamics and see how these can be used against the gypsy moth, particularly Knipling's sterile male technique, the synthetic sex attractant Gyplure, and the use of juvenile insect hormones. These new methods will be contrasted with the effects of wholesale spraying.

Whales

Living as they do in the vast stretches of the open ocean, whales communicate by sound. The finback produces a 20-cycle tone with a volume louder than that of a jackhammer breaking up concrete. Right whales, once common along the coasts of North and South America, exist now only as a small herd off the coast of Argentina. Here they mate and raise their young in clear water, where most details of their biology can be photographed. The humpback whales stop off at Bermuda on their northwest migration and sing complex songs on the outlying reefs. These songs probably serve to keep the herd together over hundreds of miles of ocean, but no one knows for sure.

This program will consist of a visit with Payne and his family at the Peninsula Valdaz, Argentina, where he swims with the whales, films them and records their songs. Then the program will move north to Bermuda to present the songs of humpbacks and study their habits, as we examine the largest animal that has ever lived and see how a sensitive scientist pursues his subject.

Agnes

Born in the warm tropical ocean, hurricane Agnes grew while leisurely meandering towards Florida. She matured while ambling up the East Coast and died a slow but violent death in Pennsylvania. During her short life, Agnes caused billions of dollars in damage and many human lives. How was Agnes born? How did she travel? Why did she die?

We investigate how tropical storms originate, how they are measured, why they move, how this movement is predicted, and the effects of both the storm and the predictions on the human population. Is there any hope of controlling these storms?

The sun

Beyond the sun's visible disc lies a world that few people have ever seen. Clouds of ionized gas the size of the earth, with temperatures ranging from 10,000 to 1 million degrees kelvin, are catapulted by magnetic fields whose intricate structure astronomers are learning to record in ever-greater detail. This strange world has its closest terrestrial counterparts in laboratories where plasma physicists are attempting to construct

devices for producing energy by controlled nuclear fusion.

What is the origin of the vast and complicated magnetic fields that dominate the complex phenomena recorded by our cameras? What is the nature of the vast explosions known as solar flares - the most recent, and one of the most spectacular, of which occurred, completely unexpectedly, in August 1972? How do these explosions accelerate charged particles to energies of a billion or more volts? And how do they produce the great noise storms recorded by special radio telescopes, which this program will show in operation?

We will meet the scientists who are trying to find the answers to these questions -- with optical, ultraviolet, infrared, and x-ray telescopes mounted on artificial satellites, in balloons, and on mountaintops or with less elaborate equipment, such as the pencil, paper, and blackboard of the theoretical astrophysicist.

Bird navigation

Fish swim and birds fly, yet how they navigate to get where they're going is still a mystery. Immense journeys are involved: for example, the arctic tern flies over 20,000 miles per year. Recent experiments disclose that different birds use different techniques and some use a variety of strategies.

We will observe the experiments at Cornell's vast pigeon loft and planetarium, watch the migration of birds on tracking radar, and follow Walcott on foot and in the air in pursuit of the answer.

Power and energy

Delays in the completion of new power plants have accumulated in the past year -- nuclear plants were 56% behind schedule, hydropower units 35%. One of the major causes of these delays has been court battles with ecological groups seeking to block construction.

The annual U.S. demand for energy in all forms is expected to double in the next ten years. Between now and the year 2000, we will consume more energy than we have in our entire history. This program will analyze the scientific questions involved in power technology and pose alternatives involving the philosophy of energy use.

Populations and stress

Ecologists predict disaster as the world's population continues to increase. In part, they cite the change in the quality of

life as the number of people per unit area increases. Indeed, animal studies have shown that all sorts of behavioral abnormalities occur in dense populations. The pioneering work of Calhoun on rats showed that the adrenal glands were enlarged by population stress and that the social structure of rats is radically altered as the population increases in a confined area.

This program will explore the effects of population density on human behavior. It will draw on the work of Milgram and of other investigators who have studied the behavior and social pathology of urban and rural populations. The issue is one of quality and preference, not just of survival -- and, in that, the ecologists may well be right.

The automobile

The issue is not just how to control automobile exhaust, but the place of the automobile in our civilization. The Bay Area Rapid Transit system in San Francisco was supposed to save that area from asphyxiation. It is now expected to account for only one percent of all the vehicle miles traveled in that nine-county region. The cost: well over $1.4 billion.

Was it worth it? What would be the effect of banning all further interstate highway construction near big cities? How pleasant or cost effective is an extended urban area based completely on automotive transport? Should we really strive for an alternative? What answer has BART given us in San Francisco?

The immune reaction

Tissue transplanted from one animal to another may flourish briefly, but ultimately it will wither and die. There are exceptions: corneas may be freely transplanted, and identical twins will accept skin grafts or organ transplants from each other. But, in general, we react to tissue from another individual in the same way we react to disease germs: it is the immune reaction.

Understanding this process is the key to understanding not only how the body fights disease, but also why it rejects skin grafts and organ transplants -- and why it sometimes fails to respond to invasion by "foreign" tissue. Some medical scientists believe that such a failure is at the root of cancer. They reason that, if the body recognized cancerous tissue as foreign, it would mobilize the immune reaction to isolate and starve out the cancerous cells. Thus, an understanding of the immune reaction is basic to medical problems that are not only of fundamental scientific importance, but of fundamental human importance as well.

We will show how medical scientists devise and carry out experiments that have already illuminated much about the immune reaction and that will one day lay bare its last secrets.

The genetic code

The Watson-Crick model of DNA, put forward in 1953, has been called the most important scientific discovery of the century. It revealed for the first time the physical basis of heredity in plants and animals, and it initiated a decade of research without parallel in the history of biology. Within a few short years, an international coterie of brilliant scientists -- sometimes working together, but more often in fierce competition -- succeeded in answering virtually all of the fundamental questions concerning the nature of life. An enormous amount remains to be done, but the basis for all future work has now been firmly established.

The story is a fascinating one, both in its human and its scientific dimensions. It is like a complex jigsaw puzzle in which the individual pieces themselves represent the solutions of intricate puzzles. The sheer intellectual beauty of these scientific achievements forms one main theme of the program. A contrapuntal theme is provided by the sociology of an international community of scientists divided into intensely competitive teams, each striving to reach the same goal and each determined to get there first.

The green revolution

Far from being an overnight sensation, the recent revolution in the growing of food grains is the result of three decades of hard work. The new high-yield varieties of wheat, rice, and corn began with the determination of Wallace, the money of Rockefeller, and the skill and political insight of Bradfield, Stakeman, Mangelsdorf, and Nobel Laureate Borlaug.

How does one "grow" a revolution such that in 25 years impoverished Mexico is transformed into an exporter of food and food technology? How is that peaceful revolution spread, and what are the problems bred of its success? Are we creating vast, single variety crops, thereby inviting disaster from blight or insects?

This program would trace the scientific and historical background of this revolution through the eyes of scientists, farmers, and ecologists.

The new planetology

Mariner has explored Mars, Apollo the moon, and the Glomar Challenger the floor of the seas of the earth. Their combined data suggest a new theory about the evolution of planets.

We will explore this new science of planets, as scientists look forward to further information from the Pioneer that will pass by Jupiter in December 1973 and the Mariner that will go by Venus and Mercury in 1974.

Presenting science on television

How will this project be different from previous efforts?

First, science programs too often presuppose an interest in and possible knowledge of the subject. This project makes no such assumptions. Our task is to awaken interest, to lead the viewer to the insights and inspirations of men and ideas. The programs will deal more with specific topics than with general areas or issues -- real examples in human scale best illustrate general themes.

Producers should take the time necessary to place the audience squarely in the process of discovery. Understanding science involves more than learning the results of things. These programs must thrust the viewer into the guts of science: the development of experiments, the nature of evidence, the clamor, the chaos, the tedium of investigation, and the quiet, glowing elegance of a small discovery.

Films don't always start at the beginning. And that is the way it should be. Many times a nonlinear approach will be used to create more excitement and take advantage of the audience's immediate interest. That, however, is no excuse for slighting fundamental questions of science. The films will show how a storm works if it deals with weather, or why Leakey chose Africa in his search for ancient man.

Time should also be spent getting acquainted with the men and women of science. It would help eliminate myths and mistakes, destroy cliches, and bring us closer to our talented neighbors.

The project will show a willingness to reach out and experiment in form as well as content. The producers should:

1) create the human experiences involved in natural, dramatic events.

2) document how scientists conduct basic research -- their promising leads, some false; their choices along the way; and their ultimate success or failure.

3) dramatize moments involving historical personalities or issues in science. (How would you cast Copernicus debating Ptolemy?)

4) deal with scientific disputes by establishing a court in which advocates of a particular view attempt to convince a jury of their fellow scientists of the validity of that view.

5) create magazine formats in which several related topics might form a review of one subject area. At times, one subject might be analyzed by a number of different investigators.

In addition, the producers would take advantage of the techniques that television offers:

1) Macrophotography - uses tubes and bellows to fill the screen with a small animal such as an ant.

2) Microphotography - substitutes the microscope for the naked eye.

3) Electron microscopy - employs the highest magnification available to allow the observation of nature's smallest creatures and objects.

4) Telescopic photography - catches a subject miles away and allows the most subtle filming of nature.

5) Infrared photography - is one of a number of techniques employing films sensitive to other portions of the electromagnetic spectrum (using infrared, we can film heat).

6) Time-lapse photography - speeds up movement that cannot normally be seen.

7) High-speed cinematography - slows down movement and allows us to observe and analyze actions that are normally too fast to be seen.

8) Optical techniques - such as stop action (freezes the motion), step printing (repeats selected frames to accentuate a movement for analysis), and multiple images (allows a ready comparison or a montage of impressions) can be used.

9) Animation - employs drawings to display actions that are beyond the reach of cameras.

10) Computer animation - can speed up or slow down a process, extend the possibilities of a design to infinity, or rotate an image so that the many dimensions of an object can be seen.

The programs should delight in irreverence and humor. These productions aim not at uplifting science or scientism, but at engaging the mind of the curious viewer in an active, dramatic, and entertaining experience.

As producers experiment with a variety of forms for individual shows, the series as a whole should display an identifiable style. Style is essential to building a regular and enthusiastic viewership. First, this would include a permanent host, a well-known and friendly explainer whose scientific credentials match his poise and personality.

Second, scientists working in nature are constantly coming across beautiful and dramatic images: photographs of the earth, the moon, the galaxies; x-rays of the hand; electron scan microscope images of minute living things; the famous Edgerton milk drops; the mundane rotting peach; and the spectacular, time-lapse film of a thunderstorm in Canada. We would integrate these images into programs (and occasionally produce brief features around them to fill the air time remaining after short programs purchased from abroad.)

The project will develop techniques to help the audience do something after viewing. Each program will test methods of offering book follow-ups and especially prepared book lists - perhaps an argument between contradictory books, each "saying" a sentence in combat with the other, or a rapid-sequence, page-by-page video audit of an entire book or set of books. Some programs might follow closely the argument of a newly published book. In these cases, special low-price editions will be offered in conjunction with the network release of programs. Experiments with joint advertising campaigns of the Public Broadcasting Service (PBS) and publishers might also prove valuable. Science news, games, and puzzles should be tried as well, all in the bright, nonelite, energetic style that typifies the best commercial art.

International cooperation

Since science has no national boundaries, the project will develop extensive international working ties.

Europe and Japan have several network science program units.

These units feature articulate spokesmen, immense stores of information and knowledge of research projects, and coverage of expeditions, and explorations. They send teams to many nations to research and film stories, but they are particularly interested in the United States because, they maintain, "the U.S. is where science happens." A science program group in this country would be an asset to them.

These networks now cooperate among themselves, and the result is a more comprehensive coverage of the world's science, a more efficient use of staff and funds, and a healthy competitive challenge for ideas, methods, and styles. This cooperation does not represent a major portion of any unit's output, but its results notably affect the overall quality and scope of each network.

With this in mind, then, our project will consider three methods of program development: (i) productions - made by science group production teams and filmed mostly in the United States; (ii) coproductions - cooperative international productions filmed in the United States and around the world; and (iii) acquisitions - productions purchased from international networks and their distributors, with universal topics in international locales. These arrangements involve compromises. An original production is expensive, but the project retains complete editorial control and ownership. Coproduction increases the project's scope at a reduced cost per program, but results in shared ownership and alternate editorial control. Acquisition involves a finished product the cheapest and least risky procedure, but it allows no editorial control and possession is limited to short-term rental with recharge for reuse. The trade-offs, however, make sense. Once underway and dealing with specific topics in known locations, we can weigh control versus expense and develop a healthy and interesting balance of original works, coproductions, and purchases.

The first and foremost resource is the BBC (British Broadcasting Corporation) Features Group in London - 100 producers making over 600 programs each year and spending the American equivalent of 20 million dollars to do them Ten of their 32 series involve science, and three in particular are uniquely set up to provide programs and program assistance to us: "Horizon," a weekly series examining the whole spectrum of science and technology, "Chronicle," a monthly program exploring archaeology and history, and "World About Us," a weekly series documenting the world of nature and exploration.

This reservoir of talent and unrivaled energy is available to us. In July, BBC executives in London again expressed their eagerness to cooperate with the science program group and to engage in coproductions of topics that we originate. They are encouraging a two-way flow of programs and information and look

forward to a long-term association with a continuing science production unit on this side of the Atlantic. Such a cooperative enterprise will greatly increase the horizons of this project and vastly improve its potential for success.

Granada Television in England and the Canadian Broadcasting Corporation have also developed active units dealing with anthropology and natural history. Both of these English language resources are available to us, as well as ORTF in France, RAI in Italy, and NHK in Japan.

The project will search for films already produced by acknowledged experts and international networks. The following small selection of those immediately available illustrates their range and interest.

The crab nebula

In the study of this one object in the sky, we see reflected the whole of modern astronomy: the story of how a worldwide fraternity of scientists go about the business of discovery and their joy in tackling, stage-by-stage, a never-ending puzzle.

The story begins in the year 1054, when a Chinese astronomer saw a "guest star" - almost certainly the cataclysmic destruction of a star whose remains are now the Crab. It ends with a crucial experiment that asks if this explosion is the origin of us, is this the death that makes life possible?

The total war machine

On the night of February 13, 1945, 3000 tons of high explosives and 750,000 incendiaries destroyed the city of Dresden so completely that the number of people killed can only be guessed at. It was the greatest single act of destruction in the history of mankind, greater even than Hiroshima, and the ultimate expression of a policy of total war that had begun with the tentative development of the bomber 30 years before.

Nowhere have science and technology had more impact on military policy than in the use of the airplane in war - and few policies have generated more controversy than the bombing of civilians in World War II, in the 50 wars since, and in the war in Vietnam.

Critics have claimed that this policy of total war gained acceptance not because it is effective, but because it is possible. This program examines just how effective the bomber has been as an instrument of war and what sort of role it will play in the future.

The billion-dollar marsh

Stretching for more than 2,000 miles along the eastern seaboard

of the United States is one of the world's largest marshlands, renowned for its wild life. Yet looking at its flat, unending landscape, it is easy to understand why many people regard it as a wasteland fit only for development and industry.

Recently, however, scientists at two marine institutes in Georgia and Virginia have been demonstrating that the marshes are a far more valuable source of food than even the best agricultural land and that they are essential not only for the survival of the wildlife, but of the whole multimillion-dollar offshore fishing industry.

Kuru

Kuru is a disease that affects only one small tribe in the remote highlands of New Guinea. It starts with a slight trembling of the hands and finally leaves the victim a helpless shaking jelly, unable to control any movement, unable to live.

What makes it more bizarre and fascinating to E. F. Field is its link with cannibalism. It has been suggested that, to contract Kuru, one has to have eaten someone who has died of the disease. For Field, it is this seemingly irrelevant information that makes Kuru more than an isolated curiosity. It helps to link Kuru with multiple sclerosis, with schizophrenia, even with the process of aging, in a new group of diseases all thought to be caused by slow-acting viruses.

Nefertiti and the computer

Nefertiti was the most beautiful and famous queen of ancient Egypt. Was she also one of the most powerful? A remarkable new research project strongly suggests this was so. At Karnak, Egypt, 3300 years ago, the heretic pharoah Akhenaten, husband of Nefertiti, built a vast and brightly painted temple for his new religion.

After his death, the priests of the old religion hastened to destroy it, leaving only some 45,000 carved stone blocks scattered in the core of the later monuments as witness to its short-lived glory. During the last five years, Ray Winfield Smith, former U.S. diplomat and general, has been directing the project, which, with the use of a computer, has been rediscovering for the first time the nature and shape of Akhenaten's temple complex. In addition, the project has produced a new assessment of Nefertiti's status and importance.

Reaching the audience

The prime method of distribution would be the 223-station network of the PBS. The PBS now covers 72% of the nation and is fast expanding. It offers a coast-to-coast, simultaneous network transmission to most of its stations, with the rest served by video tape on a slightly delayed basis.

Film distribution to schools and colleges will be developed to extend the usefulness of these materials.

Staffing the project

In the final analysis, programs are not planned, they are made. And they are made by people.

The principal stages in the production of a program are (i) a period of research in which the producer collects material, discusses its content with those familiar with the subject, and attempts to assess suitable situations and participants; (ii) a period of filming or recording of material and interviews; (iii) a period of editing, in which his film or tape is juxtaposed in sequences that he considers best suit his subject; and (iv) a period in which his program is, if necessary, viewed by advisors who can correct errors and offer suggestions, and by an executive producer who has been familiar with the program since its inception and who must be satisfied when questions of balance and taste arise.

A producer is rarely an expert in the subject matter of his program. The range of subjects he must cover in any year is so wide it effectively prevents this. A producer of science programs has usually had several years of experience in the techniques of science productions and is usually a college graduate, but not always with a degree in science. These are by no means his only qualifications. He has to have proved his facility for making a satisfactory end product. This includes the ability to maintain truth and accuracy, to edit his material and marshal it into a comprehensive and artistic form.

Executive producers and science editors are chosen and paid to make responsible decisions about a producer's program: about his sources of information, the way material has been collected and assembled, and the final balance or imbalance. The executive

producer can and will call in advisors for independent opinions before the final decision is made to offer a program for transmission. Nonetheless, these advisors have no editorial control; that remains with the executive producer and his staff, who, in turn, are accountable to the station management.

This project will require a staff of slightly more than 20 professionals. Four teams of three each will produce original films and the coproductions. Each team, led by a producer, will have an associate producer and a researcher and will be responsible for approximately three programs per year, the exact number to vary depending upon topic, scope, and locale.

Three resident guest producers will augment the main staff each year, each doing one film. In this way the project will be enriched by calling upon individuals such as John Marshall, Roger Payne, Bill Eddy, and Alan Root, respected cinematographers in their respective fields of anthropology, natural history, and conservation. A small executive staff will lead the project, headed by an executive producer, a science editor, and individuals to manage production, research, and publicity.

Thus the project will combine generalists, continuing and growing with the project, with specialists of unique talents who join for specific tasks. The pattern of continuity and outside contributions is deliberate. The ambiance should be one of creation mixed with increasing professional sophistication - both of which are vital to the success of the individual programs and the growth of the science program group itself.

The small size of the proposed staff is feasible because of the supporting role of WGBH. The project need concentrate only on staffing its immediate creative assignments; the rest of the necessary services are provided at standard costs by WGBH. It would be wasteful to duplicate the administrative, production, film, art, financial, legal, and public relations staff and facilities already available at this national television production center.

The BBC would also be of help in building the staff. Together, in London, we developed a "short list" of BBC contract and guest producers who have the qualities we seek. The BBC Features Group has also agreed to receive American staff members into the "Horizon" production teams for training.

The advisory staff

The term "advisor" suggests a relationship that is occasional and peripheral. This is not the role planned for the project's

advisors. The science advisors to this project will be expected to function as though they were members of staff. This is exactly as Joan Cooney described the Children's Television Workshop:

> We never wanted our board of advisors to be an "outside independent board." They were not meant to pass judgement on what we were doing. They were meant to come in and grub with us, and we pay them to do that ...
>
> Sometimes our lawyers will say to us, "Gee, you don't have an outside independent board of advisors," and I can say, "No, we learned that from PBL [the Public Broadcasting Laboratory] ... that they weren't to come in and tell you what to do. They were to come in and live your problems with you and then give you their best advice. And we're free to take it or reject it."
>
> They are part of the staff as far as we are concerned. They're part-time staff; we're full-time staff.

The advisory staff will contribute substantially to the design and implementation of the project, advise on goals and methods, and act as an initial point of contact with American science. They are to help attack the inevitable problems of content and priority. As individuals, they will often be called on for advice and guidance by executives and producers in the midst of developing new program ideas and proposals.

They will be drawn from the articulate, knowledgeable men and women of American science and communications. A partial list of potential members is included in the Appendix. These individuals were consulted during the research phase of this proposal, and, knowingly or unknowingly, they were being considered as potential advisors as well.

Research

The staff will want to know how many people watch its programs. Local and national ratings are relatively inexpensive, and public broadcasting now obtains fairly accurate data on its audience size. Of much more interest, however, is knowing who watches and to what effect. For that reason, the project will create its own small research department to measure intensively the effect of its programs on the audience.

Research will also be used as a program-building tool to test the understanding of certain segments and programs in order to improve their effectiveness in communicating to a wide range of people. We want to examine:

1) Appeal - Did viewers like the program? Which parts? Is it what they expected? Will they watch again?

2) Comprehensibility - Did they understand it? Which segments didn't they understand? Do they have a sense of the whole? Can they relate the information to their lives? To society?

3) Information, attitude, and value changes - What did they learn? Do they see the world in a new way? Do they see science in a new way?

4) Activity-eliciting potential - Did this program make them do something? Read a book? Examine weeds? Look up at the sky at night? Take more notice of science in the magazines?

A less rigorous but equally important function of this department will be to develop professional feedback. Using science institutions and organizations, specialist and popular science magazines, clubs and museum associations, the researcher would establish and maintain a continuing dialogue with the professional scientific community.

Publicity and utilization

It is also very much our task to build a large and informed audience for the project's programs. For that reason, we will include an expert in publicity as part of the basic staff. His first job will be to plan and prepare accurate and interesting information for PBS member stations, major magazines and newspapers, and commercial news and conversation programs. He will prepare advertising and promotional materials for both general and specialized media.

He should also develop a variety of joint media projects to develop broader uses for these programs. This might involve simultaneous scheduling of television programs and book publication, as well as special magazine supplements in popular and youth publications to preview or augment programs.

In addition to helping attract the audience, he must work to intensify their use of each program. We want the audience to be

moved to thought and action by these programs, and we aim to make it inviting for them to take that next step into self-guided discovery and investigation.

Cost

The final project, as presented (an annual 30-week season, with 12 productions, 4 coproductions, 12 purchases, and 6 repeats), would cost an estimated $2 million per year.

Funding

In the spring of 1972, this project was presented to the PBS and to the Corporation for Public Broadcasting for funding. In their final list of new series to be supported, none, we were told, rated a higher priority than did the Science Program Group.

When public broadcasting legislation at the $65-million level, and subsequently at the $45 million level, failed to become law, all new series in the 1972-73 season were postponed.

The need for the projects proposed by the science program group has not diminished, and the recognition of its value among those in science and television continues to grow. We therefore are developing a funding consortium made up of agencies representing public television, public science, private philanthropy, and private industry.

We expect this first project to begin, as a pilot series, in the spring of 1974 and to begin its annual 30-week season that fall.

The Second Project

Once the first project is launched and underway, it is our intention to develop additional projects in science. Certainly the proposal just described does not exhaust the possibilities -- it merely opens up areas and techniques, some of which deserve further development.

The science program group would also develop a program series devoted exclusively to sociology, psychology, anthropology, and education. It is far more difficult for man to learn about himself and society than it is to find out about the stars. First, man the observer is also the observed. Second, human society is more than the sum of the individuals under study. Third, although normal scientific study involves isolating phenomena, social science by its very nature concerns the interrelationships among people. A difficult job, then, but not impossible.

This project would examine man and his society in the midst of change, seeking out specific, authentic, personal examples that illustrate general theses and theories.

Dealing with work and its meaning, for example, we might explore the automobile assembly line at Lordstown, Ohio, where men recently struck, not for more wages, but against what they termed "the degrading and demeaning act of tightening a bolt every 23 seconds." These workers asked General Motors to investigate the Volvo works in Goteborg, Sweden, where experimental work teams assembled Volvos from the wheels up - a more involving and satisfying experience Volvo has redesigned its two plants under construction in Kalmar and Skode, replacing the planned assembly lines with bays for work teams.

The project might also deal with Charles Levy's recent research into violence among returning Marines who live in a proud and patriotic Irish neighborhood in Boston. The connection with Vietnam may be camouflaged when the victim is a veteran's mother and his weapon is a hurled television set, but the underlying parallels remain. Levy continues his research, while calling for a "boot camp" to rehabilitate returning veterans.

Arthur Jensen's theory about the heritability of IQ, which attracted popular attention after Richard Herrnstein's article in The Atlantic, Nov. 1971, continues to be the subject of heated debate. A recently published attack on Jensen's methodology and research techniques, in the new journal Cognition, might provide an opportunity to examine the relationship between IQ and

inheritance, while at the same time questioning the quality of social science's instruments for measurement.

These examples would make interesting programs. They would also allow us to examine and assess the fundamental forces at work in forming and changing our society.

Other programs would seek out the variety and excitement of society as it is often portrayed in the small unfoldings of life: how individuals are alike and different; ties that bind as well as divide; joy and pain; happiness and grief. In this continuous study of man, we would examine individuals, groups, clubs, unions, friends, and neighbors; birth and growing up; marriage and divorce; death and grief; success and failure; freedom and imprisonment; work, leisure, and sport - in short, the experience of men and women in 20th century society.

A production system of teams and guest producers would be used to produce 30 half-hour programs per year at an estimated annual cost of $1.5 million.

The Third Project

Television should also return reality to children. The group's third project will give children an alternative to just watching television. Using the process of discovery, we will stir youngsters to conduct experiments and create projects. These programs will stimulate children to explore their environment in a safe and constructive fashion and will impart the sense, "I can do that with a little help and some planning." We would climb a mountain, build a flying machine, predict the weather, construct a log cabin, study a cubic yard of dirt, make a pot, excavate a site, plant a garden.

Besides fresh air and sunshine, the children will also meet with scientific investigation. The child will be led to:

1) Inquire - What questions do I ask? In what order? How do I check my answers? Can I measure it?

2) Observe - What happened? Did I really see that? Can I describe it as well as measure it?

3) Investigate - What worked? What didn't? Why? What is an experiment?

4) Analyze - What did I find out? Can I duplicate it? Is it significant? What new questions arise?

In order to climb a mountain, one must prepare; in order to build a flying machine, one must design. Each experience will balance these components of science and action to open up new ways of thinking and problem-solving for youngsters.

Special follow-up materials will be created for each program to help support the youngster. The project will also arrange cooperative ventures with organizations such as the Boy Scouts and Girl Scouts, the Appalachian Mountain Club, the Sierra Club, and the Explorer's Club of New York.

These films will be made in a variety of locations throughout the United States and in cooperation with individual public television stations whenever possible. The 20-program annual series will cost an estimated $840,000 per year.

We will also explore additional services for children. The group will make available its raw materials and staff at cost to children's television production units such as "Sesame Street," "Mister Rogers' Neighborhood" and "Zoom." The object will be to

help them incorporate science into their series, too. Thus the value and reach of science presented to children on television will extend far beyond the audience of a single series.

The Fourth Project

Most educated Americans have been exposed at least to the history of Greece and Rome, the wars of Caesar, and the wives of Henry VIII. But these same people are almost totally ignorant of the origins of the first Americans or how they lived. Many people carry with them the image of the Hollywood Indian - wearing war paint and feathers, astride a pinto, and attacking the wagon train.

North America was home to thousands of tribes and alive to the babble of 500 tongues. Some Indians wandered in the dust in small groups with few possessions and no shelter, while others built complex governments and cultures rich in art, music, dance, poetry, and oratory.

The Science Program Group proposes a fourth project, relying heavily on archaeology, which would, over a period of years, present a continuing television document of the people of North America.

The project will reconstruct the older cultures, such as the Hohokam, the Anasazi, and the Adena. The Hohokam's extensive irrigation system dates back 2000 years. They built dams on Arizona's major rivers to feed large canals, some of them 30 feet wide in places and more than 25 miles long. The Hohokam were known for being receptive to new ideas, making excellent jewelry and distinctive pottery, building pyramids and ball courts, and, apparently, using astronomy to calculate planting dates.

The Anasazi created the most distinctive architecture. Their huge apartment houses at Pueblo Bonito, New Mexico, contained 800 rooms. The Anasazi culture came to an abrupt end about 1300 A.D., perhaps because of the great drought that began in 1276 and lasted until 1299.

A remarkable fact about the Adena culture, in Ohio, Kentucky, and West Virginia, is that it achieved political complexity, social classes, a large population, rich pottery, and elaborate ornamentation - all without the influence of agriculture.

Hardly a collection of savages!

We would use archaeology, anthropology, linguistics, and history to recreate Indian culture immediately before and during contact with white civilization: for example, Iroquois, Algonkian, Cheyenne, Zuni. Our recreations will not lean solely on myth and legend.

The sources are varied and extensive, including DeSoto, Jefferson, and deTocqueville. The project will show the variety of contact, including the resistance of the Seminole and the attempted assimilation by the Cherokee, resulting in a trial of blood for one and tears for the other.

The project would also document Indian life today, studying acculturation and assimilation - or more to the point, acculturation without assimilation. Many Indians use U.S. currency and banks, speak English to whites, furnish modern-style homes with canned goods and television sets, and yet, like the Shawnee, with steady intransigence maintain their own identity in the face of a white majority. In contrast, the tribal council of the Navaho recently installed a computer to keep track of its million-dollar-monthly income from oil and mineral leases.

This living document of North American societies would introduce the viewer to disciplines of social science as it examined the rise and fall of civilizations.

A pilot film in this area will be produced by WGBH in the spring of 1973 with funds from the National Endowment for the Humanities.

The cost of the total project will be an estimated $1.1 million for 12 programs per year.

The Fifth Project

From time to time, the public's attitudes become confused, distorted, and even dangerous because scientific understanding is so poorly communicated to the average man. This leads to contradictory statements, a confusion of claims and counterclaims, and, often, unnecessary alarm. At such times, the public needs good, clear, reasonable, objective explanation and analysis. It is not now available anywhere on television in this country.

Most harassed newsmen plainly do a bad job when they tackle complex science issues. Their reports, often sensational, rarely, go beyond the surface to deal with the basic science involved. One has only to remember the recent crises involving mercury in swordfish, phosphates in detergents, the 1975 auto emission legislation, the SST boom and the DDT ban, the Atomic Energy Commission's emergency core-cooling system, the power crisis in New York, and New England's Red Tide to appreciate the need for a capable source of cool, understandable television programming in moments like these.

The science program group will, on such occasions, have the expert knowledge to deal with such issues, either as specials or as inserts into weekly and daily public affairs programming. The existence of such a group would provide an important new communications asset for the nation as a whole.

The Sixth Project

There are available, from all over the world, exciting series involving natural history, archaeology, anthropology, and explorations. These series are not seen in the United States. There are also excellent U.S. materials that have not been shown on television.

We propose that the group make an annual choice from among these series for purchase and framing for U.S. distribution.

For example, the following are available immediately:

1) "The Glory That Remains" - Robert Erskine surveys the surviving monuments and ancient archaeological sites in India, Persia, the Middle East, and North Africa; 13 programs, 30 minutes, color.

2) "Great Zoos of the World" - Zoologist Anthony Smith discovers how the world's most famous zoos are keeping up with changed conditions of the late 20th century in San Diego, Antwerp, Tuscon, West Berlin, London, Basel, and Frankfurt; 8 programs, 30 minutes, color.

3) "Wild New World" - Heinz Seilman makes a naturalist's voyage through Canada and America; 5 programs, 25 minutes, color.

4) "Private Lives" - Studies of birds, animals, insects, and fish filmed in great detail (for example, the kingfisher, starling, large white butterfly, wandering albatross, robin, great-chested grebe, and the Siamese fighting fish); 7 programs, 24 minutes, color.

5) "The Family of Man" - A social comparison of five different communities, in England, India, New Guinea, and Botswana, concerning married life, children, teenagers, weddings, birth, old age, and death; 7 programs, 50 minutes, color.

6) "The Netsilik" - A rare glimpse of the Netsilik eskimo at home, on the hunt, in their spring ice camp, hunting for trout, caribou, and seal; 21 programs, averaging 30 minutes, color.

Although prices of purchase and framing vary, it is estimated that a 20-week series of half-hour programs might be compiled for $300,000 each year.

A Concluding Note

The group would evolve a policy for publishing books, television cassettes, and records. We also envisage a parallel radio group, which would share resources and provide National Public Radio with feature inserts to "All Things Considered," as well as special series and services.

Those are in the future. The first priority is to establish the Science Program Group as a first-rate television production unit and to get its first series before the American public.

Appendix

Our thanks to those who gave generously their ideas, suggestions, and comments.

Yale Altman	Science Editor, M.I.T. Press
Spyros Andropoulos	Information Officer, Stanford Medical Center
Olle Berglund	Deputy Director, TV II, Swedish Broadcasting Corporation
Frank Blakaby	Economist, National Institute of Economic and Social Research, London
Jacob Bronowski	Resident Fellow, The Salk Institute
Harvey Brooks	Dean, Division of Engineering and Applied Physics, Harvard
James Butler	Director of Communications Programs for the Public Understanding of Science, American Association For the Advancement of Science
Robert Byers	Director, M.I.T. News Office
Joan Cooney	President, Children's Television Workshop
Robert Davidson	Director of Institutional Relations, Children's Television Workshop
David Davis	Program Officer in Charge, Office of Television, The Ford Foundation
Pierre Fraley	President, Council For the Advancement of Science Writing
Walter Gilbert	Professor of Molecular Biology, Harvard
Peter Goodchild	Editor, "Horizon," British Broadcasting Corporation

Robert Grant	Director, Office of Public Affairs, Federation of American Societies of Experimental Biology
Gene Gray	Principal, Mason-Rice School, Newton, Massachusetts
Gerald Holton	Professor of Physics, Harvard
Franz Inglefinger	Editor, New England Journal of Medicine
Philip James	Executive Assistant to the Chancellor, University of California, San Diego
Paul Johnstone	Editor, "Chronicle," British Broadcasting Corporation
Jacques deJouffroy	Associate Director, La Service de la Recherche, Office de la Radio Television Francaise
James Karayn	President, National Public Affairs Center for Television
Henry Kendall	Professor of Physics, M.I.T.
Jonathan King	Assistant Professor of Biology, M.I.T.
George Kistiakowsky	Professor Emeritus, Harvard
John Lannan	Special Assistant to the President's Science Advisor, U.S. Office of Science and Technology
Carl Larsen	Director of Public Affairs, Smithsonian Institution
David Layzer	Professor of Astronomy, Harvard
Gerald Lesser	Professor of Education and Developmental Psychology, Harvard
Jerome Lettvin	Professor of Biology and Electrical Engineering, M.I.T.
Howard Lewis	Director, Office of Information, National Academy of Sciences
Adam Leys	Head of Television Programs, Central Office of Information, London
Robert Livingston	Professor of Neurosciences, University of California, San Diego

John Mattill	Editor, M.I.T. Technology Review
Victor McElheny	Science Editor, The Boston Globe
Everett Mendelsohn	Chairman, Department of History of Science, Harvard
Phillip Morrison	Professor of Physics, M.I.T.
Leonard Nash	Professor of Chemistry, Harvard
William Nierenberg	Director, Scripps Institution of Oceanography
Clarence Ohlke	Head, Office of Government and Public Programs, National Science Foundation
Hannes Oljelund	Head of Planning, TV 2, Swedish Broadcasting Corporation
Edward Palmer	Vice-president for Research, Children's Television Workshop
Gerard Piel	Publisher, Scientific American
Robert Potter	Associate Director of Communications Programs for the Public Understanding of Science, American Association For the Advancement of Science
Don Price	Dean, John F. Kennedy School of Government, Harvard
David Prowitt	Executive Producer, WNET/13
Donald Quayle	President, National Public Radio
Norman Ramsey	Professor of Physics, Harvard
Robert Reid	Head, Science Features, British Broadcasting Corporation
David Robinson	Vice-president, The Carnegie Corporation
David Ryer	Assistant Chancellor, University of California, San Diego
Jonas Salk	Resident Fellow, The Salk Institute

Paul Saltman	Vice-Chancellor, University of California, San Diego
Pierre Schaeffer	Directeur, La Service de la Recherche, Office de la Radio Television Francaise
Alan Segal	Producer, "Horizon," British Broadcasting Corporation
Benjamin Shen	Professor of Astronomy and Astrophysics, University of Pennsylvania
Aubrey Singer	Head, Features Group, British Broadcasting Corporation
Parker Small	Professor of Immunology, University of Florida
Richard Stephens	Program Manager, Office of the Public Understanding of Science, National Science Foundation
Werner Svendsen	Controller, Danish Television
Basil Thornton	International Director, WNET/13
Lawrence Wade	Editor, "Tomorrow's World," British Broadcasting Corporation
Charles Walcott	Chairman, Department of Cellular and Comparative Biology, State University of New York at Stony Brook
Howard Webber	Director, M.I.T. Press
Robert Wilcox	Head, Office of the Public Understanding of Science, National Science Foundation
Fred Wheeler	Managing Editor, M.I.T. Technology Review
Jerrold Zacharias	Director of Education and Research Center, M.I.T.

Michael Ambrosino is an executive producer at WGBH-TV, Boston. His experience includes 17 years of production and administration of television and film programming in public affairs, the humanities, the arts and science. He developed and administered "The 21-inch Classroom," the State of Massachusetts' instructional television service, and the Eastern Educational Network, the nation's first and largest regional cooperative public television network. In 1969 he created the weekly series, "Michael Ambrosino's Show," which was both an attempt to celebrate life in the city of Boston and a demonstration of experimental possibilities concerning local on-location film and video tape programming.

Mr. Ambrosino spent 1970-71 in London as the Corporation for Public Broadcasting's American Fellow attached to BBC. During that year he produced, wrote and travelled, experiencing at first hand the practice and philosophy of the worlds largest and most experienced broadcasting enterprise. He returned to WGBH with the expressed purpose of developing an autonomous program group within public television for exploring man and his world patterned after the BBC example, but tailored to American needs and opportunities.

That development has been aided since May 1972 by the cooperation and financial support of AAAS, through its committee on the Public Understanding of Science.