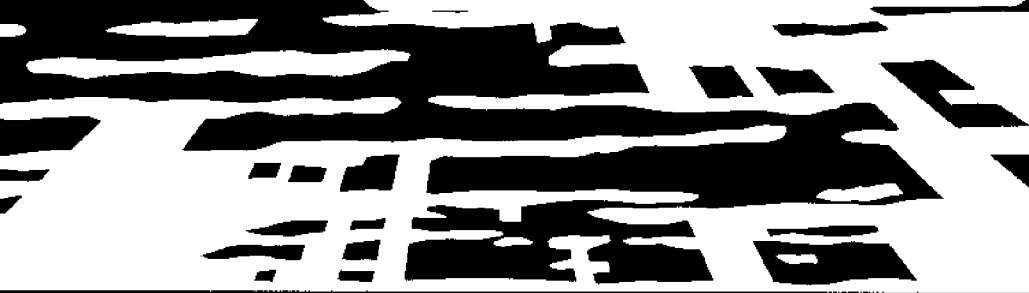


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# Understanding the Oceans

Motivating Today's  
Youth to Work for Tomorrow



Proceedings  
The 8th Annual Sea Grant  
Lecture and Symposium

# Understanding the Oceans

Motivating Today's  
Youth to Work for Tomorrow

Tuesday, 16 October 1979  
3 pm

Room 26-100  
Massachusetts  
Institute of Technology

**Lecturer:**

Herman R. Branson  
President  
Lincoln University

**Panelists:**

James W. Mayo  
Scientific Advisor  
U.S. Department of Energy

Mary P. Rowe  
Special Assistant  
to the President and Chancellor  
for Women and Work, MIT

Logan H. Sallada  
Policy Analyst  
President's Reorganization Project  
Office of Management and Budget

Roderick M. White  
Dean of Academics  
U.S. Coast Guard Academy

**Moderator:**

E.R. Pariser  
Associate Director  
MIT Sea Grant College Program

Sponsored by the  
MIT Sea Grant College Program

Herman R. Branson, scientist and educator, has been President of Lincoln University since 1970. A graduate, summa cum laude, of Virginia State College, Dr. Branson received a doctoral degree in physics from the University of Cincinnati in 1939. He began his career as an instructor in mathematics and physics at Dillard University in 1939 and joined the Howard University faculty in 1941 as Assistant Professor of physics and chemistry, culminating his service at the school as Department Head during the years that spanned 1955-1968.

Throughout a distinguished career, he has held an impressive array of posts that reflect an abiding commitment to education, science, and equal opportunities for blacks. His interests and expertise were tapped this year by MIT when he was named to the Massachusetts Institute of Technology Corporation. He has also served at Tuskegee University on the Board of Trustees of the Carver Research Foundation since 1960.

The latter post, like his membership on the Board of Directors of the National Association for Equal Opportunity in Higher Education, provides him with special opportunities to assist today's generation of black and minority students in the pursuit of successful educational and professional careers. Additionally, Dr. Branson co-chairs the Sub-Task Force on Manpower of the Urban Coalition; is on the Board of Directors of the American Foundation for Negro Affairs; is a member of the Association of the American Medical College Task Force on Minority Student

Opportunities in Medicine; and serves as a member of the Committee on Minorities in Engineering for the National Research Council.

Dr. Branson has also dedicated himself to educating educators to foster excellence in their students. In 1957-1958, he chaired a Committee on Teaching Award, Washington Academy of Sciences. During the years 1960-1962, he was Secretary-Treasurer for the National Association for Research in Science Teaching. He has been Vice President and Acting President of the Institute for Services to Education. From 1963-1965, he was Secretary and Program Director of the American Council on Education, a member of the Board of Trustees of the Bank Street College of Education in 1964-1968, and a member of the Carnegie Corporation Commission on the Education of Educators from 1967-1969.

The Lincoln University President has been called upon by both government and private institutions to act as consultant in the field of physics and his speciality, biophysics. He has worked with the Atomic Energy Commission, the Control Systems Laboratory at the University of Illinois, the Office of Naval Research, the Phelps-Stokes Fund in New York, and the Surgeon General of the U.S. Army with the biophysics group at Brooke Memorial Hospital in San Antonio, Texas.

He is a member of Alpha Boule, Sigma Pi Phi, Alpha Phi Alpha Fraternity, Inc., Sigma Xi Society, Beta Kappa Chi Honor Society and is an honorary member of the Smithsonian Institution.



Dr. James W. Mayo is a Scientific Advisor in the Office of the Assistant Secretary for Energy Technology in the Department of Energy. Prior to taking this position, he had been a member of the National Science Foundation (NSF) staff from 1971-1977.

His career has blended a commitment to advancing the state-of-the-art of science education with efforts to encourage minority participation in science and resource management. Dr. Mayo's association with NSF began when he served as a member of the Advisory Commission of Science Education from 1969-1971, during the time he was Chairman of the Department of Physics at Morehouse College in Atlanta, Georgia, a period that spanned 1964-1971. His first staff position with the Foundation was as Program Director of COSIP-D Program (historically black colleges) in the Division of Undergraduate University Education in Science. In 1973 he was appointed head of the Instructional Implementation Improvement Section in the Division of Higher Education and Science and was appointed Deputy Director of Science Education Resources Improvement Division. In 1977 he became the Special Assistant to the Assistant Director of Science Education of NSF following a six-month mobility assignment in

planning and policy analysis in the Office of Planning and Resource Management, where he played a major role in the preparation of National Science Board reports on research in small, four-year colleges. During this period he also designed a study to initiate development of a comprehensive policy for increasing the participation of minorities in science and engineering.

Dr. Mayo received his B.S. in mathematics from Morehouse College in 1951 and his S.M. in mass spectroscopy from Howard University in 1953. He first came to MIT in 1957 when he served as a volunteer Research Assistant in the Research Laboratory of Electronics (RLE). From 1958-1961 in the Institute's Laboratory of Insulation Research he worked with Arthur Von Hippel as a Research Assistant, earning his M.S. in solid state physics. In 1961 he returned to RLE to work with Malcolm W.P. Strandberg until 1963, when he received his Ph.D in physics.

His associations and honors include Beta Kappa Chi, Sigma Pi Sigma, Sigma Xi and Phi Beta Kappa. He is a member of the American Physical Society, the American Association of Physics Teachers, American Association for the Advancement of Science, the Georgia Academy of Science, and the National Institute of Science.



In her position as Special Assistant to the President and Chancellor for Women and Work, Dr. Mary P. Rowe is concerned with the quality of life for women working and studying at MIT, a traditionally male-oriented community. Her office at the Institute provides for women a critical mechanism through which to raise, discuss, and resolve complaints of discrimination and to suggest methods for making MIT a more open and responsive environment. As an Institute ombudsperson, she also reviews issues that affect the entire population of the school, both men and women. In 1977 the Alumni Association honored her for contributions to the Institute by giving her the Billard Award for outstanding service.

For many years, Dr. Rowe has researched, written, and consulted on women's problems of inadequate day care systems and discrimination in male-dominated professions. She has also written on the conflicts of balancing and accommodating the multiple demands of nurturing a marriage and bringing up children while seeking a professional career.

She received her Bachelor of Arts from Swarthmore College in history with a specialty in international relations in 1957 and her doctorate in economics from Columbia University in 1971. That same year she joined Abt Associates, a consulting firm in Cambridge, where she worked with Harvard-Radcliffe and Brown Uni-

versities to establish child care systems for students and staff. As an economist, she consulted for the Massachusetts Early Education Project, Graduate School of Education, Harvard University to study the need for establishing family day care and mixed systems for Massachusetts, efforts which resulted in the State Office for Children.

In the first stage of her professional career, Dr. Rowe pursued her studies in international relations by going to Lagos, Nigeria from 1963-1966 to complete field work in which she helped to set up accounting methods, marketing and information channels for a group of 170 Nigerian industrialists. While in Africa, she also assisted in establishing an American International School in Lagos, chairing the initial scholarship and admissions committee.

In 1962-1963 she was an economist on the Planning Board of the Office of the Governor of the U.S. Virgin Islands, collecting and evaluating population and labor force data for a development grant. With the World Council of Churches and the Office of the U.N. High Commissioner for Refugees she worked in Salzburg and Vienna in Austria to integrate refugees into the local economy.

Dr. Rowe has published extensively in books, journals and magazines to a wide spectrum of readers, from academicians, government officials to concerned parents.



Logan H. Sallada is currently a Policy Analyst on President Carter's Reorganization Project, Human Resources Division in the Office of Management and Budget. He has most recently been working on the development of an energy plan for the nation. Prior to this assignment, Mr. Sallada, as a member of the Reorganization Project, spearheaded the formulation of a proposal to establish a new federal Department of Education.

Throughout his career in public service, he has sought and completed a number of assignments to attune government programs to public needs, especially in the fields of education, the environment, energy and marine sciences. From 1975-1978, while serving as Policy Advisor to the U.S. Commissioner of Education, he helped to organize the Energy Education Action Center and developed ways to foster citizen participation in planning and implementing government policy in human and natural resource development.

As a master's degree student at the Harvard Kennedy School of Public Administration, he

worked as Special Assistant to the Commissioner of Education in the Commonwealth of Massachusetts to improve the relevance, accuracy and quality of manpower data required and used in designing realistic vocational educational programs.

As Assistant Executive Secretary for Education, Civil Rights, and Child Development from 1970-1972, he helped establish a new management structure, the Executive Secretariat, for the Department of Health, Education and Welfare, then led by Eliot Richardson. His first position in Washington was Special Assistant to the U.S. Commissioner of Education which he held in 1969-1970. At the Center for International Studies and World Affairs, State University of New York, in 1967-1969, Mr. Sallada applied knowledge and experience gained as a Peace Corps worker during 1964-1967 to investigate ways for the university to utilize the talents of its students and faculty to assist developing countries tap their human and natural potential more fully. Mr. Sallada has written extensively on the subject of manpower training and education.



Roderick M. White, a 1950 graduate of the U.S. Coast Guard Academy, now serves as the maritime school's Dean of Academics. In 1971 he received the Coast Guard Commendation Medal for outstanding organizational and administrative ability for contributing to the Academy's research program. And more recently, in 1977, he was honored with the Meritorious Service Medal for superior performance as Dean of Academics.

From 1953-1956, he studied Naval Architecture and Marine Engineering at the Massachusetts Institute of Technology. While a student at the Institute, he received an MIT Fellowship to study shipbuilding in Copenhagen, Denmark, and the following year was awarded a full membership in the Society of Sigma Xi and was graduated with a degree as Naval Engineer.

For a period following graduation from MIT, Dean White worked in the Production Department of the U.S. Coast Guard Yard in Curtis Bay, Maryland, first as ship superintendent in charge of repair, and then as the person responsible for constructing 95-foot patrol boats. In 1957-1959 as Engineer Officer of the U.S. Coast

Guard Icebreaker WESTWIND, he cruised on four extended trips to both the Arctic and Antarctic, qualifying for handling the ship in ice on many occasions, bringing this experience to bear on icebreaker design studies at Coast Guard Headquarters. In addition, he has served as a consultant on polar operations and engineering to industry. He was most notably consultant for the necessary modifications to the S.S. MANHATTAN.

Dean White has been a member of two advisory groups of the Ship Research Committee of the National Academy of Science and the National Academy of Engineering. In 1969 he was awarded the American Society of Naval Engineers' Gold Medal as the outstanding Naval Engineer of that year. He is a member of the Society of Naval Architects and Marine Engineers, the American Society for Engineering Education, the American Conference of Academic Deans, the American Association of University Administrators, and the Eastern Association of College Deans and Advisors of Students.



**Dean A. Horn:**

Welcome to the 8th Annual Sea Grant Lecture. I am Dean Horn, the Director of the MIT Sea Grant Program, and your host for this afternoon. The National Sea Grant Program, established by congressional action just 13 years ago this month, is a university-based, partially government funded program that combines research, advisory services, and education to foster marine resource development. Shortly after the Sea Grant Program was established in 1970 under the directorship of Dr. Alfred Keil, we sought to establish a special annual event that would be a milestone in the marine field to present perspectives on future marine development important to the nation and to the world.

We have had the great good fortune to host this series of outstanding speakers, and I am sure today will continue to perpetuate this fine record. Athelstan Spilhaus, who many of you know was the first to propose the Sea Grant concept, was our first Sea Grant Lecturer in 1973; and he set the tone for this series by talking about the multiple, exciting potential for using the seas. Later topics such as world energy and the oceans, planetary engineering and international management, science engineering and the politics of ocean hard-mineral development have elicited stimulating discussions and have had an effect on the development of our Program.

To date the Lecture topics have largely related to engineering problems. This year, however, we decided to venture out and to look at another area, an area that is no less important to the welfare of our country, no less central to the concerns of the Institute, and certainly no less fundamental to the Sea Grant concept. It is the question of education and training for marine careers and professions.

The question we raise today has at least three separate and important facets. First of all, does

there exist a substantial well-defined, marine-related job market, and what is the market's likely development and trend in the future? Second, do available marine-oriented jobs require education and training in the sciences or humanities that are specifically and basically different from the education and training for land-based jobs? And if the answer to that question is yes, how do we motivate young people to opt for the requisite studies in this area? And third, and perhaps most important, what are the obstacles, challenges and opportunities to which we must respond in order to attract women and minorities to the marine field?

To address some of these complex questions we have chosen Dr. Herman Branson. He is not only one of the country's outstanding scientists, but he is also justly regarded as the Dean of American Black Education, a person who has devoted his life to the improvement of education and training for blacks and minorities in general. So, ladies and gentlemen, it's my great pleasure to present our 1979 Sea Grant Lecturer, Dr. Herman Branson, President of Lincoln University. Dr. Branson.

**Dr. Branson:**

In considering any art or science, we ask who are the productive people, the people who are in the lead, the people who are doing the work. Today we inquire especially if women and minorities play a reasonable role in the marine science field. If any group is not represented in a major human enterprise, then hindrances must exist limiting their participation. We are fast coming to realize that human resources are our number one resource. Unless we can somehow mobilize these resources intelligently and effectively our ability to advance the use and management of our marine resources will be severely limited.

Perhaps we should explore a new science,

demos-oceanography, demos coming from the Greek word for people. It would be concerned with people, their participation in, their understanding of, and the benefits which they reap from oceanography.

Today we will look closely at two groups in America, namely women and minorities, and try to suggest how this magnificent field, which will be important in the future, can better utilize and provoke interest from this group. When I refer to the "group" from now on, I refer to women and minorities.

The sea is a fascinating and important topic for modern study. The resources of the sea in meeting man's need for energy, food and minerals loom large in all plans for the future. Then, too, the sheer size of the sea is awesome. It covers 71 percent of the surface of the earth and with 330 million cubic miles of water which equals 2.75 times 10 to the 20th power gallons. This water is 97 percent of the earth's total water supply.

As a child, I remember seeing a dramatic sketch in an encyclopedia of how to extract gold from a cubic mile of seawater. Recently, I've discovered that the most valuable thing in a cubic mile of seawater is not gold, not even the other minerals that can be extracted, but the water itself. If you could extract fresh water from salt water you would produce a resource that is needed by many nations around the world. So we have here an exciting field of study which will become more interesting and dramatic in the future as the demand on all our resources increases.

A most absorbing recent development is the prospect of applying oceanography to medicine. We have for instance, just discovered that when Japanese carp suffer from a syndrome called sokoake, they develop lesions in the pancreas, kidneys, and nerve cells simulating the diabetes mellitus effect in humans. How can this knowl-

edge be used to elucidate human problems? When salmon and trout adapt in moving from sea to fresh water they show reactions that may shed light on arteriosclerosis. Most intriguing perhaps, is the discovery that a deep-sea female angler fish collects husbands which graft themselves into her body without being rejected as foreign tissue. Thus, rejection problems in grafting and transplantation in humans may be solved from studies of this bizarre fish. All of these are possibilities that stimulate the interest and enthusiasm of young people.

The sea seems to offer an opportunity for just about every land-based science that we know, and therein lies the difficulty. Young people invariably go into the areas that they've heard about. In high school they will perhaps study biology, chemistry, and physics. Therefore, when they get to college they've heard something about these subjects. But hardly any of them will have heard about organic geochemistry, a very useful and desirable field for anyone pursuing a career in oceanography. It becomes necessary for us to devise some means of introducing young people to the marine sciences. Perhaps one of the strongest recommendations which this panel might propose is how can we bring these subjects before young people who do not encounter this material through their families and daily experiences?

Some of the relevant topics that might be introduced into high schools could include: the sea as an environment, water circulation and movement, physics and chemistry of sea water, estuaries, the sea bottom, how to get power from the sea and who owns the oceans and the seabed. This last topic is the subject of the United Nations' long running Law of the Sea Conference, a forum in which many nations are interacting and attempting to share equitably the rich resources of the world's oceans. In summary, there is no doubt that the study of the sea

is one of the most relevant of all human activities, both in the present and the foreseeable future. Consequently, we must concern ourselves and encourage able young people to give time and attention to this area.

### **Women and Science**

If we look at the existing literature we find that women have not been encouraged or given the opportunity to go into the sciences. For example, Professor Mary R. Lefkowitz, writing in the *Chronicle of Higher Education*, August 6, 1979, told women that they may first need to develop certain capabilities and academic skills. They also need self-assurance, self-esteem, and the ability to cooperate, all the talents that are necessary to get anywhere in a man's world.

Heretofore, the sea has been essentially a man's domain, and more specifically, a white man's domain. Even today, in pictures of the *Glomar Challenger*, a research vessel collecting information of the earth's crust, we never see a woman or a minority participating in research work.

What then are the first steps? My experiences with women and minorities convinced me that we cannot expect to develop the requisite intellectual skills for any endeavor unless that group is convinced that by exerting the necessary sustained effort, the members will achieve an acceptable self-image and essential ego reinforcement. This psychological jargon means that you must think well of yourself, and you must think that what you are doing is worthwhile. Only the rare person works hard for a career that is not viewed as a realistic aspiration. It is important to convince the group that a career related to the sea is realizable.

Even I, working in the field of education, do not realize the range and persuasiveness of the impediments facing women and minorities. The major premise pervading the educational sys-

tem is that the group does not possess the intellectual and social qualities for careers in sea-related disciplines. *Science* magazine, on October 12, 1979, had a wonderful article about an able woman mathematician, Cathleen Morawetz. She is almost singular in that well developed discipline. When you read her story you are truly shocked to find that, in 1979, a brilliant career could be snuffed out merely because the person was a woman. Cathleen Morawetz's father was John L. Synge, an eminent applied mathematician. Cathleen also had ability in mathematics but she could not get anywhere because of her sex. Fortunately, her father's good friend was Richard Courant of the Courant Institute at New York University. Synge and Courant met one day and Courant said, "I can help your daughter." So he gave Cathleen a job at the Courant Institute soldering connections in the computer. When she arrived, she found that someone else already had that job. So they asked her to edit a book on supersonic flow and shock waves. She moved slowly into mathematics by taking courses and eventually getting her PhD. She was also married and had four children, and like many women today in that situation, her whole career depended on how her husband felt. It turns out that her husband came from a wealthy Czechoslovakian family which was accustomed to having servants, so he encouraged her to work in mathematics. But think of how difficult that was. She needed a distinguished father, with a distinguished friend in a position to help her, and then on top of that, a husband who was completely sympathetic for her to pursue a career as a first-rate mathematician. I think that asks too much of women. We must be sure that a Cathleen Morawetz of this generation will not have to have the right father, friend, and husband before she can become a brilliant applied mathematician.

There are many basic factors today that work

inexorably to bar women and minorities from certain careers. Sheila Tobias writing in *Atlantic Monthly*, in September, 1978, observes that of the freshmen entering the University of California at Berkeley in 1972, 57 percent of the men and only 8 percent of the women had taken four years of high school mathematics. Without four years of high school mathematics, students are ineligible for the calculus sequence, inadequately prepared for statistics or economics, and unlikely to attempt chemistry or physics. Among minorities the situation is worse. Many minority students are deliberately shunted into consumer or business mathematics even before high school. The number attending a high school where four sequential years of mathematics are offered is small. The number opting for that sequence when it is available is an order of magnitude less. If the group does overcome these hurdles, what can it expect? Certain headlines in the *New York Times* in July, 1979 generate pessimism:

*Women Held Back By Their Sex Not Personalities*

*Women's Groups Assail Low Levels Of Grants From Foundations*

Of the two billion dollars in foundation grants awarded in 1976, only six-tenths of one percent went to women's programs. It was part of educational history when a group of us called on President Nixon, in May 1970, protesting the low level of support to predominantly black colleges. He responded by placing funds in Title III of the Higher Education Act which has meant much to these schools. All this leads to the reasonable position that we must exert ourselves to remove insidious sexism and racism from American life if we expect a field like oceanography to gain the people it needs. Still, the attitudes are so

deep and the measures so unclear that we may see little except more rhetoric and small, but hopefully effective, advances.

### **Impediments to Blacks**

Do minorities have special problems? My feeling is, yes, they do. Minorities, especially blacks, have a unique burden in society, in the public schools, and in their social interactions. Even if we overcome the view that the public schools should not be expected to combat society's discontents, we find singularly little sensitivity of and skill in handling the problems of our students. It is the worst kept secret of our society that most large school systems have given up on these young black people. They classify inordinate numbers of them EMR, educable mentally retarded. Few of them escape some stigmata, even if they do escape the EMR classification.

The data on Berkeley freshmen that I have spoken about support the conjuncture of why women are under-represented in the sciences and mathematics. Evidence of poor participation by blacks is given in the *Chronicle of Higher Education*, in March, 1978. In the period between 1973 and 1976, 2,562 white males received doctorates in mathematics.

There were only 31 black males that received this degree. In earth sciences, which is very closely allied to oceanography, there were four black males getting doctorates. Even in education, a field where too many minorities have been shunted, data show that 70,000 white males and only about 2,200 black males had graduated with this degree. Among women, the situation was a bit better. Of the women who took doctorates in these years, 19,483 were white women and 1,177 were black. In brief, while one third as many white women as white men got doctorates, one half as many black women as black men got doctorates. Remem-

# Number of Doctorates Awarded in the United States, 1973-1976

	White	Black	American Indian	Chicano	Puerto Rican	Asian	Other & Unknown	Total
<b>Men</b>								
Mathematics	2,562	31	14	14	5	20	300	2,946
Physics and astronomy	3,166	20	11	11	4	18	400	3,630
Chemistry	4,227	75	10	21	4	32	432	4,801
Earth sciences	1,679	4	10	4	6	11	183	1,897
Engineering	5,663	52	23	16	17	46	615	6,432
Biosciences	10,217	153	54	63	20	116	1,113	11,736
Psychology	5,795	146	36	39	21	28	586	6,651
Social sciences	7,425	187	37	53	12	37	913	8,684
Arts and humanities	10,141	191	62	77	23	27	1,239	11,760
Professional fields	3,332	78	13	14	8	10	354	3,809
Education	15,438	1,315	134	201	35	54	1,733	18,910
Other	55	1	-	1	-	1	8	66
Unknown	8	-	-	-	-	-	6	14
<b>Total</b>	<b>69,708</b>	<b>2,253</b>	<b>404</b>	<b>514</b>	<b>155</b>	<b>400</b>	<b>7,882</b>	<b>81,316</b>
<b>Women</b>								
Mathematics	299	5	-	1	-	4	19	328
Physics and astronomy	113	3	1	-	-	2	11	130
Chemistry	426	6	2	-	-	8	29	472
Earth sciences	121	3	1	-	-	-	12	137
Engineering	86	-	-	-	-	-	2	88
Biosciences	2,470	71	12	7	4	29	211	2,804
Psychology	2,594	86	11	6	7	19	225	2,948
Social sciences	1,978	68	11	8	9	6	154	2,234
Arts and humanities	4,543	107	28	33	10	31	446	5,198
Professional fields	633	53	5	6	2	5	62	766
Education	6,196	775	42	49	30	39	588	7,719
Other	20	-	-	-	-	-	-	20
Unknown	3	-	-	-	-	-	-	3
<b>Total</b>	<b>19,482</b>	<b>1,177</b>	<b>113</b>	<b>110</b>	<b>63</b>	<b>143</b>	<b>1,759</b>	<b>22,847</b>

Note: Figures include native-born U.S. citizens only.

Source: Survey of Earned Doctorates, National Research Council

ber, these are not statistics of 1873 and 1876, but statistics of 1973 and 1976.

Minorities do have additional educational problems that can interfere disastrously with their learning. These inequities must be recognized in the design of an educational system. A minority youngster of excellent intrinsic intellectual quality may have two problems that his non-minority peer will not have. In learning a concept, the minority student is prone to experience proactive interference because what he learns in his family and social life is sufficiently different from what he is taught in the schools that he may have difficulty in adapting. The second difficulty is that what the youngster absorbs in school may be interfered with retroactively when he returns to his neighborhood and home.

### Language in Education

It is necessary for the educational programs of a society to use the language of the society. We should carefully study the language of the minorities if we are to advance minority education. In 1975, a report in England warned that we should urge the teachers of history and science to understand the process by which their students take possession of historical or scientific information. Such an understanding includes paying particular attention to the part that language plays in learning. I am not advocating the use of Black English. I am suggesting that the problem needs better definition and understanding. An example of the kind of language barriers confronted by blacks is referred to in *New Scientist*, May 18, 1978. A pupil observed that acid produces a more rapid reaction in ground-up pieces of limestone than the material did when it was in lump form. The pupil said, "I think it's coming off quick because there's more sort of cut faces to the smaller bits." In direct contrast, the textbook says, "The rate of a chemical reaction depends on the stated division of the reac-

tors." They are both saying the same thing, but the language is different. The conclusion of this article ought to be understood by all teachers in schools attended by minorities. Such formal writing convinces pupils that their own thinking doesn't really count, and that in examinations, all that really counts is the regurgitation of someone else's thought in someone else's language. This position does not mean a renunciation of the goal of learning the accepted language of a discipline, but the humane position of not viewing students as stupid or demented because of their language. The emphasis must be on applauding the content of their thought and on pointing out that formalized writing is the accepted norm of the field. The students must realize that their thinking may be accurate, crisp, and pleasing, but they must also be made to realize that they will eventually need to understand the formal language of journals and textbooks if they want to continue to study the sciences.

The final concern on the special problems of minorities, which women do not have, at least to the same degree, is the almost universal belief in the inferiority of non-white races. Although the weight of scientific consensus is overwhelmingly against this view, we are startled to find that on September 24, *Time* magazine printed a full page on Mr. Arthur Jensen. Very recently, geneticists in England and the United States clearly reversed their published remarks on the effects of race crossing between 1930 and 1950. Since it is so amenable to many wayward interpretations, being closely influenced by social attitudes and political considerations, we should not be surprised to find today in so developed a nation as England, this position is espoused by influential politicians with the seeming endorsement of distinguished scientists, according to *New Scientist*. I quote: "The claim that all races are equal is totally false. Races differ and scien-



tists tell us that these are not the result of environment only, but mainly heredity." Of course they want you to draw the conclusion that some people are just naturally stupid and cannot do certain things. It is not difficult to find social action or sometimes, inaction, in America, which can be attributed to the potency of this view of mental inferiority. In brief, we find a continuation of certain attitudes even though all of their foundations have been removed.

#### **What Can Sea Grant Do?**

What can we do then in the Sea Grant Program to insure that this neglected talent in America is properly utilized? Perhaps we should move immediately to social action to point out what can be done even in small and limited steps we can take. There are some programs in effect now which give us insight. I particularly admire the one at Johns Hopkins where two young men have been carrying out a program called Study of Mathematically Precocious Youth (SMPY). They have what they call a Four-D Program: discovery, development, description and dissemination. Their first step is to find young people of high quality in mathematics and give them necessary assistance to develop in that field. In describing their program they have said that just to discover talented youth is not enough. Instead it is necessary to design a long range program of support and encouragement. This approach is what Sea Grant and other government programs should be following in the marine science field.

First, agencies dealing with the sciences of the sea must work with minority and women's colleges to increase the attention given to careers in ocean sciences. How can this be done? Students need summer positions to work in biology, chemistry, and physics. I would like to see small grants of a certain critical size designated for this purpose distributed by the Sea

Grant Program. At MIT we used to talk about a "zach," which is a grant of about a quarter million dollars, named in honor of an MIT physics professor, Dr. Jerrold Zacharias. The Sea Grant Program grants don't have to be that large. What would a \$25,000 grant do for a school like Morehouse or Clark in Atlanta? These are very good minority colleges which attract able young people. Give them a grant for use in interesting science students to work with a professor to carry out research associated with the sea. Give the money for more than one year. Give the grant for at least five to ten years so that the professor will be able to build up a group of students who will concentrate on marine studies during the academic year and could participate on field work at MIT or Woods Hole during the summer. Then you will have gained young people with the particular qualities about which we are talking. Ten of those \$25,000 grants would be only a quarter million dollars. I really would like to see a hundred of them tried. That's only \$2,500,000. Surely if we can spend \$10,000,000, or \$15,000,000 repairing a military plane, then \$2,500,000 a year over a ten-year period would not be an unthinkable amount of money to put into convincing minorities and women they can go into ocean fields. I'm confident that the rewards would be great and the satisfaction immeasurable.

We recognize that even these modest undertakings must be long term, honestly and forthrightly conceived and managed, and not programs designed for failure. We must call attention to the fact that demos-oceanography must have as its most important concern the utilization of that primary raw material, namely human talent. Perhaps by creating a two-D program—development and dissemination—we can achieve a great deal. This knowledge would go a long way, I feel, toward relieving some of the social tension which exists at the present

time and which we will continue to see in the future unless something is done.

I can think of no more noble purpose than raising the consciousness of mankind toward the proper respect and utilization of the talents and qualities of all Americans. As the Sea Grant Program at MIT makes its plans for the future, let us hope that its objectives reflect the recognition that the talents of women and minorities must be tapped.

I would like to end my lecture with a story that illustrates why I believe we should rigorously search for talent wherever we believe we can find it. If you wondered who was the first American to win a Nobel Prize in a science you might have guessed a graduate of MIT, or Harvard, or someone from the Ivy League. But the first American to win a Nobel Prize came from a family which had a pushcart out in Nevada. When the time came for him to go to college he didn't have any money, but luckily he'd heard that the United States government ran two free colleges called West Point and Annapolis. He rushed to see about getting in, but the local representative said, "You're just a little late. I've given out all my appointments. But you can go to Washington and the President can appoint you." Remember, this happened in the 1880's and President Grant was in the White House. So this youngster got together enough money and rode to Washington to see the President. Even in those days you couldn't just walk in and see the President, especially if you were a young Jewish boy from Nevada. He went back several times and was rebuffed. Finally someone told him that the President took a constitutional behind the White House every afternoon about three o'clock, and perhaps he could speak to him then. So Albert Abraham Michelson hid behind a tree until President Grant walked by. Michelson then jumped out and said, "Mr. President, I want to go to Annapolis; I want to go to college." The Presi-

dent was so impressed with the young man that he gave him an appointment. So Michelson went there, received an excellent background in optics and eventually ended up being the first American to win the Nobel Prize. Not someone with a silver spoon, not someone from a well-equipped laboratory, but someone from the wilds of Nevada who had no opportunity to go to college except under the flukiest of circumstances. Such is the nature of human talent, you do not know where greatness lies.

#### **Mr. Pariser:**

Thank you very much for your inspiring lecture, Dr. Branson. I will now ask our panel members to respond. We will start with your comments please, Dr. Rowe.

#### **Dr. Rowe:**

Dr. Branson's lecture is certainly compelling. Are there others in the audience who, like me, feel that perhaps you ought to turn around and get an oceanography degree and change your profession? Actually I think my major response to Dr. Branson's lecture is exactly that. I could feel, throughout his speech, my rising interest in the oceans because of his personal, one-to-one address to us.

This illustrates, I think, a major point. *Our best recruitment technique for men and women, minorities and non-minorities, is still: one-to-one relationships.* We were asked today to consider "simple management solutions." I'd like to talk about this one. Excellent institutions have always recruited their best people by personal contact, by one-to-one discussions which help build new images. These new images can be of a university, of a department, of a discipline, or of a field. These images motivate young people to join that particular institution, department, or specialty. Of course if we want to get new people into fields like oceanography, we need major

publicity, exciting first-person stories, internships like those mentioned this afternoon, and undergraduate research opportunities. We also need a great deal of one-to-one participation from all of us, especially if we are interested in recruiting women and minorities. If you want to see progress in this area, you can do it easily yourself. In fact, it may *only* happen if each of us does it, himself or herself.

If you are on a faculty or are a major or minor administrator, you can meet all the minority and female faculty and administrators within the oceanographic context. Support and promote their best ideas, seek them out, hire them, and meet all those that you can find at professional meetings. If you're an oceanographer you can talk about your special interest to students at a house, a dorm, a fraternity, and black and women's colleges. Each of us can go to a high school and seek out the non-traditional students there. Remember, Dr. Branson said that young people study what they know about. Each of us can bring questions of oceanography to high schools and even to elementary schools around us. We can take on minority and female colleagues and students as close colleagues and protégés, learning from them, or being their mentor. Those who are male and/or white can encourage their white and their male colleagues to do the same thing.

Several different things are gained from such one-to-one contacts. Most whites and most males have never had a black or female colleague at all. If you can persuade the white males around you just to *meet* minorities, and to encourage minorities and women to be absolutely excellent within any ocean-related field, you begin to undermine the racist and sexist stereotypes that make women and minorities invisible in the first place. Meeting "non-traditional" scientists also gives new perspectives and provides a recruiting network.

Let us summarize then: the major thing I thought about this afternoon is that the most potent source of change for each of us is one-to-one contacts. Recruit blacks and women as students, graduate assistants and colleagues in research projects. Create a network of marine scientists who will act as mentors for the next generation. And then... think of the geometric progression, as each "non-traditional" person recruits and helps support others. Perhaps someday minorities and women can be just randomly represented and no longer "non-traditional" at all.

**Mr. Parisier:**

Thank you Dr. Rowe. We will proceed now with Dr. Mayo's comments.

**Dr. Mayo:**

I think of the sea in terms of man against nature. This train of thought leads me to think of man against man; man exploiting man, and man exploiting nature. Each of these is associated in my mind with the reason we are here today, man against nature. Many people feel that minorities and others decide to avoid fields like oceanography or the study of the ocean because of the fear of a hostile environment. Apparently experience with the sea is not a criterion. A number of the ocean scientists here today come from Nebraska. They were not born on or near the sea.

The speaker today talked about intellectual skills and questions that are raised about intellectual skills by persons like Mr. Arthur Jensen. This fits the category of man exploiting man. If we were told that all of the Joneses of the world had I.Q.'s lower than all of the Smiths of the world, how would we react? What would we think? It is important to consider this question because the answer has a bearing on why minorities are not represented in fields like

oceanography. Intellectual skills are purported to be measurable, but more importantly, judgments must be made about them. The measure isn't the thing, the judgment is. Everyone is affected by judgments and evaluations. It is possible to follow more closely the effect and impact of the resulting actions on minorities simply because they are identifiable. The problem arises in the disparity of effect or impact.

I believe that the core of the problem stems from what I will call "the business of science" which involves money, grants, the programs under discussion. Even more important than "the business of science" are "the social contracts of science". They involve scientists and non-scientists; they are the one-to-one relationships that exist between a student and a mentor, an admissions officer and a neighbor. This is the realm and regime of the *judgment*.

It is extremely important for all of us to realize that because these judgments give access, that programs don't offer opportunities, people do. Programs and institutions don't erect barriers, people do. And people make things happen.

**Mr. Parisier:**

Thank you very much Dr. Mayo. We will now turn to Dean White and ask him for his comments.

**Dean White:**

At the Coast Guard Academy we are small in size, and therefore small in sample. We do not have presidential or congressional appointments. It is strictly a merit system. By our own enthusiasm and by law, we may not discriminate in terms of sex, race, creed or color.

Let me just highlight some points. Take a look at the class of 1980 at the Coast Guard Academy which has only 173 students, including 14 women. There are 18 student cadets in electri-

cal engineering, and one is a woman. Three out of 26 government majors are women. Out of the 14 women cadets that we have had for four years, 11 are in technical majors. This is surprisingly high according to national statistics. We would probably have another woman included in those statistics but she transferred to MIT.

There were a total of nine minorities out of 193 in the class of 1980. In the class of 1979 there are only three. This is not something we are proud of, but recruiting minorities is not very easy and often frustrating because MIT and the other prestigious universities are clearly competing for a small resource pool.

Students have to be challenged, not at the college or university level but in junior high and high school. It is clear that the sea offers opportunities to women and minorities to find rewarding, satisfying careers. But I think we should really differentiate between opportunity and interest. I think that there is a tremendous difference there. I am deeply involved with the sea, and find many activities interesting, but not necessarily rewarding as career opportunities. I think that in designing programs to interest pre-college students in marine science we must advocate truth in advertising.

Four years ago about a third of our excellent candidates elected to go into the marine sciences. In 1979 that group of 63 has shrunk to 14 people. I am convinced that if you talked to many of these people you would find out that they dropped out due to a "truth in advertising" problem. Students enter colleges and universities with an oversimplified television image of marine science: it's all scuba-diving, picture taking, boat riding, and beautiful fish. But what do they really find when they enter a marine science program? They find a lot of math, science, and homework. In fact, we have more people than ever migrating into civil engineering. Civil

**Distribution of 1980 Graduating Class by Major**  
United States Coast Guard Academy

Major	Women	Minorities	Total	Percent of Total
Civil Engineering	0	0	11	6.3%
Electrical Engineering	1	1	18	10.4%
Marine Engineering	0	0	9	5.2%
Ocean Engineering	2	0	19	10.9%
Government	3	0	26	15.0%
Mathematical Science	4	4	36	20.8%
Physical Sciences	2	1	14	8.0%
Marine Science	2	2	14	8.0%
Management	0	1	26	15.0%

**Migration and Attrition of 1981 Graduating Class**  
United States Coast Guard Academy

Major	Fall 1977	Fall 1979
Civil Engineering	20	21
Electrical Engineering	38	16
Marine Engineering	19	13
Ocean Engineering	29	19
Mathematical Science	29	26
Physical Sciences	24	7
Marine Science	63	16
Government	36	14
Management	42	40
<b>Total:</b>	<b>302</b>	<b>172</b>

Total Attrition: 43%

Marine Science Migration/Attrition: 61%

engineering is a tough major, but it is one where the student's interests and expectations at least match reality.

Where do we go from here, especially in terms of minorities and women? We can encourage high school students to stick with the sciences and math. In addition, all of us have some very personal one-to-one contact with members of school boards or PTA's. We all know teachers, and many of us have children. Today's problem is not only related to the marine sciences but to all engineering disciplines. High school students are foreclosing opportunities in these fields when they elect not to take physics, chemistry and mathematics.

We can encourage minorities and women to enter into fields which have good employment opportunities, and are, in fact, interesting. There are some very good programs such as Minority Introduction To Engineering (MITE). We have a project in which we take candidates during the summer for about a three day period and run them through a miniature cadet program. The MITE members of the program stay on an extra three days to try some engineering. They get to meet marine scientists, ocean engineers, and other scientists in a one-to-one situation. This we have found to be a highly effective program. Another recently-started, highly successful program is called Philadelphia Regional Introduction to Minorities in Engineering (PRIME). It brings high school students into the college environment and allows them to mix with college professors during the summer. Many of the 150 minorities who participate go on into engineering in university level programs. There are many things which we can do. It is not all doom and gloom.

**Mr. Parlser:**

Thank you Dean White. Now we will turn to our final panelist Mr. Logan Sallada to give us his remarks.

**Mr. Sallada:**

Dean White and Dr. Branson have covered a number of important areas such as institutional constraints, barriers of tradition and negative attitudes towards motivating youth to seek marine and aquatic employment. However, there are several areas which I would like to bring into this dialogue which have not been mentioned or were just briefly touched upon. I prepared some comments to give further information on educational discrimination. An even larger problem is the disfunctional nature of the educational institutions within our country with regard to the relationship of the subjects in the world of water. Specifically when one starts working in the marine sciences one feels that the topic really falls between the cracks of disciplines in the educational system. The rigidity of the university system, its isolation of disciplines and faculty are inherent in its very structure and have historically evolved from medieval times.

To expound on our evolution as a people, we have often ignored these subjects of energy and marine sciences that really cross the faculty lines. The aquatic sciences have a social science and a physical science aspect, and indeed they cross all faculties within a university system.

One of the major barriers in motivating youth in marine sciences that I have found in my years of travelling to schools is that there needs to be a greater collaboration and cooperation among elementary and secondary level teachers and university faculty members from the various disciplines. Most often the identification of marine opportunities, employment, or problem resolution comes only from the collaborative activities and cooperation of faculty members in various disciplines, such as labor economics, the natural and physical sciences, and the social sciences. The current structure and rigidity of the educational system has been changing too

slowly to meet the demand for this sort of approach.

Another serious institutional and organizational problem is the shortage of information available about marine and aquatic related employment. It is easy to find evidence that most Americans are unconscious of, or at least unaware of, the marine environment. For more than 100 years the U.S. Department of Labor, and its predecessor agencies, have reported national employment statistics. In spite of their economic importance, fishing, shipping and other marine employment statistics have been incorporated into the land-based industry statistics. Poor classification severely limits the usefulness of these figures. If we are to motivate youth for marine and aquatic employment, we must develop a sophisticated and comprehensive accounting picture of the opportunities across major fields such as mining, construction, manufacturing, transportation, communication, public administration, and trade. We must also look at opportunities for occupational groups: professional, technical, clerical, sales, craft, labor and service. I would strongly recommend that Sea Grant here at MIT engage some outstanding faculty and students in economics to identify marine-related jobs, where they are located, and who fills them. What are the skills necessary to compete for jobs, what is the entry salary and growth level? How and where does one get training or experience? The next endeavor would be to disseminate this information throughout the educational system.

Efforts to develop new curricula must then take into account existing conditions if students are to be equipped to deal with reality. I applaud Dr. Branson's recommendations for achieving affirmative action for women and minorities in this field which is dominated by white males. Very few minorities occupy key occupational roles and their access to leadership positions is

severely limited. The access ability of attractive marine occupations for women and minorities will not be achieved simply by expanding programs of vocational and occupational education. A comprehensive education program is required from kindergarten through grade 12 that provides all students with the necessary experience to make wise career decisions. The approach taken must reflect actualities of the job performance requirements rather than traditional folklore. If push button skills are required, one need not be a weightlifter to qualify. If diagnostic ability is essential, that can be specified in objective and measurable terms. A far more serious handicap in preparing for a marine career is that many occupations are deeply rooted in the male culture, such as harbor masters, sailors, and fishermen. This system will change only when educators and employers face the problem openly and when successful programs of affirmative action begin early and receive adequate planning, cooperation, resources, and commitment.

I have one last point to make. We need to bring children and students at all levels into an educational experience where they learn to be creative, where they become entrepreneurs responsible for their own destiny, where they learn to create their own jobs. Too much of American society has been too mainstream and too security conscious. We need to revitalize within the American spirit the creative factor that built this country, so that individuals develop at an early age the capacity for creating their own jobs.

**Mr. Pariser:**

Now I would like to open the discussion to the public.

**Broadus N. Butler: Robert R. Moton Institute, Washington, D.C.**

A difficult problem about human utilization is not that there is a lack of talent but that the educational system, for various reasons, doesn't want to utilize it. Let me just offer the audience a couple of figures. The National Achievement Scholarship Program requires young people to go through three separate tests in order to win grants. Last year 67,000 black young people in 1,700 high schools went through the initial procedure to compete for only 585 grants. The semi-finalists numbered 4,200 and that population of talent had to be narrowed down to 585 grants. Half of those 585 grants were just \$1,000 for one year. What frustration is produced among these young people by this experience.

Let's see what happens after they get into college. The National Science Foundation (NSF) is a billion dollar science investment made by the U.S. Government. They administer National Science Foundation Fellowships. The year before last, only 534 NSF fellowships were awarded. Of the 111 black scholars that were recommended for fellowships, only one received a grant. Of the 17 Native Americans recommended, none were given a grant. Hispanics were awarded 9 and Asians received 6. That amounts to 16 grants for all minorities out of 584 grants. Only 2 percent of those 585, including those in the minority groups, were women.

I would hope that in this era we begin to examine how to reach out and get the talent that exists. The Westinghouse talent search, the PRIME program and all of these talent search operations including Upward Bound have demonstrated abundantly that there is talent, motivation and desire. The challenge now is to find rewards for that sector of talent, motivation and desire.

**Edith Ruina: Research Associate in MIT Education Division.**

I hope that all of you who have been listening to the presentations are thinking about ways of establishing some of these one-to-one relationships. I feel as though this whole meeting was a cue for the program that I have been associated with at MIT for the past few years. It's a small project which has lots of difficulty maintaining continuity and getting commitment from the local schools. For the past several years we have been trying very hard to do with secondary and middle schools some of the things people here are talking about. I think the situation is worse than one might expect from hearing the people here.

It is not that people don't know about the jobs that relate to the ocean; they don't know about the job opportunities in general. We discover in the local schools that most of the teachers and counselors have never heard about jobs that exist next door to them. I talked to one corporation recently that had 600 jobs open and was having difficulty filling them. This year we have some federal funding from the Emergency School Aid Act which was a component of a whole packet of proposals that Boston submitted to the Federal Government. We are funded to develop some in-service programs for teams of educators from 15 Boston schools. Those teams will include a math teacher, a science teacher, a counselor and an administrator. Our part of the project will be planning some workshops over the next year for them, so they will hear some of the realistic information that all of you people are pleading for the schools to present to youngsters. But the only way that we will be able to present that information is by having people in this room, your friends in industry and students, give talks to schools, work with the teachers, participate in workshops.

A version of PRIME started in Massachusetts about a year ago. We will be cooperating with another program, Massachusetts Pre-Engineering Program for Minority Students (MassPEP), which is trying to identify able minority students. Ray Pariser has a program working with students in the schools. All of us are struggling with rather small amounts of money and we need to find better ways to cooperate and to maximize the leverage and the leadership that this institution can contribute.

**Mr. Pariser:**

If there are no more questions or comments from the audience, I would like to thank Dr. Branson very sincerely for his wonderful talk, and the panelists for their responses. There is no question that if we don't solve this enormous problem of the proper utilization of natural resources, the most important of which is human resources, I think that we will have a lot to lose. We hope that this year's Sea Grant Lecture has clearly defined the challenge we face in motivating today's youth to enter the marine field, where their talents are greatly needed.

I would like to close the meeting and thank you very much for coming.

We of the MIT Sea Grant College Program dedicate this occasion to the identification and study of inventive approaches to major national and international opportunities in the oceans, and to all persons whose vocations or interests are served by the seas.

The MIT Sea Grant College Program presents the annual Sea Grant Lecture to provide a forum for discussion of perspectives and opportunities for our current and future uses of the seas. The Lecture also explores and heightens awareness of the roles of engineering, science, and the social sciences in developing marine resources, reflecting the Institute's commitment to environmentally balanced development of the oceans and coasts.

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