

(Mr. Sproul left the meeting during consideration of this proposal.)

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It was, on motion,

RESOLVED that the sum of One million dollars (\$1,000,000) be,
RF 54174 and it hereby is, appropriated to the UNIVERSITY OF
CALIFORNIA as an outright grant, payable before
December 31, 1954, for the development of a research
program in marine biology at the Scripps Institution
of Oceanography.

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The following considerations were presented:

Natural Sciences and Agriculture: Nonconventional Agriculture - Marine Resources

Previous Interest: Since 1930 a total of \$124,100 has been appropriated by The Rockefeller Foundation to the University of California for the Scripps Institution of Oceanography. Of this sum, \$40,000 in 1930 was contributed to the building fund for laboratory facilities and the balance was for specific research programs in the field of biochemistry, including a current grant of \$35,100 for research on the biochemistry of marine organisms under the direction of Professor Claude E. ZoBell which terminates June 30, 1955.

General Description: Over seven-tenths of the surface of the earth is covered with water, but mankind gets only about 1.2 per cent of his total food from the sea. Scientists are just beginning to realize that the long-range food requirements of our planet make it essential to work toward a substantial modification of the 1.2 per cent figure just quoted. This, in turn, means that we must have a vastly improved stock of basic knowledge concerning the now almost wholly unknown biological resources of the oceans and seas.

The study of marine biology is, by virtue of certain obvious physical facts, difficult and expensive. Over 50 per cent of the surface of our earth is covered with water to a depth of more than 10,000 feet. The study of the cycle of life existing in these vast and hidden regions cannot be done with small-scale equipment in the laboratory. It is necessary to go to sea in fairly large and expensive research vessels, equipped with complicated mechanical gear which permits sampling of the sea bottom, the sea water, and the marine life itself at depths which run from the surface down to many thousands of feet. It is also necessary to have many other types of equipment located in the research vessel, such as sonar equipment. The development of marine biology has been

seriously handicapped by such factors and by the fact that a really effective approach to problems of the resources of the sea requires a sizeable staff of men trained in a variety of scientific disciplines.

In connection with the developing interest in marine biology of the Division of Natural Sciences and Agriculture, a number of small or modest grants have been made to a variety of marine biological laboratories (Woods Hole, Miami, Columbia University, Plymouth, São Paulo). The project here proposed constitutes, in the judgment of the officers, the one really major existing opportunity in this field.

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The Scripps Institution of Oceanography, one of the important branches of the University of California, is located at La Jolla in southern California. It is an impressive establishment with five buildings and five seagoing vessels, most of which are capable of traveling the open ocean to any point in the world. There are at the present time 18 on the professional staff and some 50 more on the technical staff. The entire personnel of the Institution, including all of the staff on ships, is approximately 350.

The primary purposes of the Scripps Institution of Oceanography are research and the instruction of graduate students. Approximately 50 graduate students are in residence. The Institution offers four basic courses on physical oceanography, chemical oceanography, marine geology, and marine biology. Within the staff, there are divisions of marine physics, marine biochemistry, marine botany, marine microbiology, marine geology, marine geophysics, and both vertebrate and invertebrate marine zoology. The men responsible for the various disciplines just mentioned are individuals of outstanding scientific and personal qualifications. Dr. Denis L. Fox, the professor of marine biochemistry, Dr. Claude E. ZoBell, the professor of marine microbiology, and Dr. Adriano A. Buzzati-Traverso, the professor of biology, give evidence of the quality of the present staff. In Dr. Robert W. Holmes and Dr. Francis T. Haxo, the Institution has made an excellent start toward getting together a group interested in phytoplankton physiology, biochemistry, and ecology.

It is characteristic of this Institution as a whole that all of its members tend to think of the sea as one vast organism, with each one interested in one or another aspect of the great metabolic cycle of this whole organism. Underlying all of the individual activities are two basic problems. The first problem relates to the individual organisms of the sea, and has as its leading curiosity the bewildering fact that there are so many and so widely divergent kinds of organisms in the sea. The second problem has to do with the over-all aspects of the marine populations - what is the standing crop of marine life, and what are the factors that limit this standing crop and the factors which produce in it such dramatic variations from year to year.

Although the Scripps Institution is at present the world's largest and most effective organization for the study of marine biology, it is

nevertheless true that to date marine biology has necessarily occupied even there a secondary position. The Institution has large and significant resources for the study of physical oceanography. This aspect of its work is of great interest to the Navy, and large support has come, and will doubtless continue to come, from the Navy for physical oceanography. It is completely impractical to have a great development of marine biology apart from a similar development of physical oceanography. But to date physical oceanography unfortunately has received most of the support, and has therefore quite inevitably received the major emphasis.

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The outright grant of \$1,000,000 now proposed would enable the Scripps Institution of Oceanography to undertake a major development of its program and of its activities in marine biology. First, this assistance would make possible the addition of four new faculty positions. One of these would be a full professor of experimental biology, and the other three would be new assistant professors in such fields as phytoplankton nutrition, population dynamics, general physiology, or biochemistry of marine organisms. A stabilizing contribution toward the annual research budget of each of these new professors would also come from the grant.

Secondly, the general level of activity of the Institution on the biological side would be very considerably augmented by a program of postdoctoral fellowships, by an annual visiting professorship, by funds for holding an occasional symposium, and by the addition of a modest amount of needed equipment. A fairly substantial cost is the operation of certain research ships. Enough of a contribution to make it possible for the marine biologists to be accepted on the various research cruises, as active, participating, partners rather than as tolerated guests would be of great significance.

Thirdly, each of seven present members of the faculty (ZoBell, Fox, Buzzati-Traverso, Haxo, Hubbs, Johnson, and Isaacs) would receive a stabilizing contribution toward his annual research budget.

Finances: The University of California would use the proposed outright grant of \$1,000,000 over a period of approximately eight years, so that, in principal and interest, slightly over \$1,105,000 would be available. If funds can be attracted from other sources, the Foundation's grant would be used over a longer period. At present the University contemplates expenditures in approximate accordance with the appended budget.

Future Implications: The continuation of the new professorships provided by the proposed grant would be the responsibility of the University of California. The development of the program may be of such a character, however, that The Rockefeller Foundation will wish to reassess it in about five years, to determine whether or not further assistance for the researches then in progress seems wise.

APPROXIMATE BUDGET FOR PROPOSED ROCKEFELLER GRANT OF \$1,000,000

	<u>1955</u>	<u>1956</u>	<u>1957</u>	<u>1958</u>	<u>1959</u>	<u>1960</u>	<u>1961</u>	<u>1962</u>	<u>Totals</u>
<u>A - Support for Present Faculty</u>									
(1) Professor ZoBell	\$ 6,000	12,000	12,000	12,000	11,000				\$ 53,000
(2) " Fox	8,000	8,000	8,000	8,000	7,000				39,000
(3) " Buzzati	10,000	14,000	14,000	14,000	13,000				65,000
(4) " Haxo	8,000	8,000	8,000	8,000	7,000				39,000
(5) " Hubbs	3,000	3,000	3,000	3,000	2,500				14,500
(6) " Johnson	3,000	3,000	3,000	3,000	2,500				14,500
(7) " Isaacs	1,500	1,500	1,500	1,500	1,500				7,500
						Total Support for Present Faculty			\$232,500
<u>B - New Activities</u>									
(8) Postdoctoral fellowships	15,000	27,500	27,500	16,500	11,000				97,500
(9) Visiting Professorship	6,000	10,500	10,500	10,500	6,000				43,500
(10) Ship Operations	35,000	45,000	45,000	45,000	40,000				210,000
(11) Symposia	15,000			15,000					30,000
(12) Basic Equipment	20,000	15,000	15,000	10,000					60,000
						Total for New Activities			\$441,000
<u>C - Four New Faculty Positions</u>									
(13) New Faculty Salaries	17,000	30,000	30,000	30,000	35,000	36,000	38,000	38,000	254,000
(14) Support for new faculty	10,000	27,000	27,000	27,000	27,000	20,000	20,000	20,000	178,000
						Total for New Faculty			\$432,000
Total Expenditure	\$157,500	204,500	204,500	203,500	163,500	56,000	58,000	58,000	
						Grand Total			\$1,105,500
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Remainder at end of year	\$842,500	671,680	494,047	310,308	159,220	109,588	55,971	209	
Interest at 4%	33,680	26,867	19,761	12,412	6,368	4,383	2,238	8	
Remainder and Interest	\$876,180	698,547	513,808	322,720	165,588	113,971	58,209	217	
						Total Interest			105,717