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be ample for the limited number of fields which he proposed to develop. While this full budget was not possible of realization, sufficient funds were obtained to carry on important research in genetics, plant physiology, biophysics, and biochemistry. The one serious gap was general physiology. Under the present Foundation appropriation Professor Morgan, after a world-wide search, appointed Dr. C. A. G. Wiersma, of Utrecht, professor of general physiology, and Dr. van Harreveld, also of Holland, as his assistant.] Dr. Wiersma and Dr. van Harreveld arrived in Pasadena last fall and began the work of equipping five rooms assigned to their use. The purchase and installation of this equipment consumed part of the year, but good progress has been made on several preliminary pieces of work with results so promising that Professor Morgan feels entirely justified in requesting a completion of the original plan.

CALIFORNIA
INSTITUTE OF
TECHNOLOGY -
PROFESSOR
MORGAN -
GENERAL
PHYSIOLOGY
(Continued)

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California Inst. Technology
Biology
Chemistry

The following general statement was made bearing upon items presented within the program in experimental biology:

The Natural Sciences items for the first half of 1935 are largely concentrated in this meeting.

These items fall into four groups, as follows:

- 1) Application of physical and chemical techniques to biological problems

Bohr-Krogh-vonHevesy (Copenhagen)	5 yrs.	\$54,000
Svedberg (Upsala)	5 "	55,000
Heavy Water (Columbia)	1 yr.	12,500
Spectroscopy (Michigan)	2 yrs.	14,000
- 2) Physiology

Physiology in relation to genetics (CIT)	2 yrs.	\$40,000
Neurophysiology - Schmitt (Washington U.)	3 "	16,500
Physiology of respiration (Michigan)	5 "	25,000
Cellular Physiology (Iowa)	5 "	40,000
- 3) Endocrinology

Evans (California)	1 yr.	\$20,000
Corner (Rochester)	3 yrs.	9,900
- 4) Support to groups working on several phases of Natural Science Program

University of Chicago	3 yrs.	\$150,000
Stanford University	1 yr.	12,500

The standard docket information relative to each of these projects will be found on following pages. Under the heading "Relation to Program", reference is made in each instance to the following general statements.

- 1) Application of physical and chemical techniques to biological problems:

The program in experimental biology has a special interest in researches in which the analytical and quantitative procedures of chemistry, physics, and mathematics are directed towards the solution of basic biological problems. In studying the opportunities for Foundation co-operation, the officers have been impressed by the number of important centers where physical and biological leaders are thinking and working together on such problems. Several opportunities have been found and presented, notably at Chicago, McGill, Harvard, Massachusetts Institute of Technology, Graz,

Utrecht, Leeds, and Michigan, the last item being the one which is presented in this docket. Such studies have already demonstrated their usefulness and the field is recognized as having future possibilities of the highest practical importance.

The items of this group have in common the important factor of collaboration between biologists and physical scientists of high ability. The program at Columbia is under the general direction of Professor H. C. Urey, and concerns the biological importance of the so-called "heavy" hydrogen for the discovery of which Professor Urey recently received the Nobel Prize. The substances which contain hydrogen are the most numerous and the most important, from the point of view of the chemistry of vital processes. The researches of Professor Svedberg at Upsala constitute one of the most noteworthy instances of the application of physical techniques to biological problems. The opportunity at Copenhagen is a particularly attractive one since it arises out of the group interest of Professor Krogh, a distinguished biologist, Professor von Hevesy, one of Europe's leading physical chemists, and Professor Niels Bohr, theoretical physicist.

2) Physiology

The terms "physiology" and "general physiology" have come to be used with wider and wider meaning in biology. Whereas earlier medical physiology was largely directed towards the study of the functioning of human organs, the word physiology is now regularly applied to a much wider range of investigations dealing with "the processes, activities, and phenomena incidental to or characteristic of life or living organisms"; and general physiology, as exemplified by Jacques Loeb, is especially concerned with the treatment of basic problems by chemical and physical techniques. Most of the work mentioned

above at Copenhagen and at Columbia University could fairly be described as physiology, as could also the Corner project mentioned below. Furthermore, modern physiology is often concerned with cells, single nerve fibres, and tissues rather than with whole organs. The refined modern techniques are permitting a breaking up of impossibly complicated problems into simpler component parts.

The four projects here presented illustrate the range one may expect. In the Iowa project many aspects of the functioning of normal cells are being studied. The program at California Institute of Technology is primarily concerned with studies designed to bridge the gap between the gene-chromosome theory of genetics and the developed characteristics of the mature organism. Professor Gesell's group at Michigan is interested in the physiology of respiration, and more particularly in the nervous control of respiration. His project is therefore partly neurophysiological in character; while Professor Schmitt's work at Washington University is wholly neurological. Such researches on the nature of the nerve impulse and the method of its conduction are basic to an understanding of normal and abnormal behavior, and are in close and direct relationship to the program in the Medical Sciences.

3) Endocrinology

Of all the recognized interests in the program, none stands closer to practical application than the field of endocrinology and the interrelated field of sex research. Moreover, these fields of research are fundamental to the broad, common program of the Foundation, which seeks a rational understanding of human behavior.

Foundation aid has played an important part during the past ten years in developments in endocrinology and sex research, notably through support to the National Research Council's Committee for Research in Problems of Sex. This assistance is being continued and enlarged, the Foundation having assumed support of certain projects which were developed by the Committee. Dr. Evans's work, which falls in this category, has been divided between endocrinology and the biochemistry of the vitamins. Dr. Corner is a pioneer in the field of sex research, his activities being concentrated on a study of the oestrus cycle using monkeys as the experimental animal.

The Foundation is also aiding researches in this field under Cannon at Harvard, Hartman at Ohio State, Swingle at Princeton, Britton at Virginia, Sevringhaus and Cole at Wisconsin, Koch and Lillie at Chicago, Stockard at Cornell, Smith and Engle at Columbia, and Albright at Harvard.

4) Support to groups

It has been gratifying to discover that there exist groups, sometimes including practically a whole department of biology, members of which are working together on problems which fall in several of the recognized subfields of interest of the Foundation program. Grants to such groups not only serve the immediate purposes of the concentrated program, but have the added significance of building up strong centers which may long continue to exemplify the effectiveness of such an approach to biological problems. Such grants, while strictly within the spirit of the present concentrated program, preserve many of the high values attaching to more general support. Chicago presents the most convincing case in this country and the most important program opportunity. The biological research at California Institute of Technology is equally within the Foundation program, but the range of activities is more limited

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than at Chicago, and the support is more nearly adequate. At Stanford University there is being developed a brilliant young group of investigators all of whom are working completely within the spirit and range of our program interests. In these three situations the general programs in biology are sufficiently unified to receive group support.

It was, on motion,

RESOLVED that the sum of Forty thousand dollars (\$40,000), or
RF 35047 as much thereof as may be necessary, be, and it is
hereby, appropriated to the CALIFORNIA INSTITUTE OF
TECHNOLOGY for research in GENERAL PHYSIOLOGY under
the direction of PROFESSOR T. H. MORGAN during the two-
year period July 1, 1935 - June 30, 1937, the amount to
be available annually not to exceed \$20,000.

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The following were the considerations presented:

Relation to Program: Natural Sciences: See general statement
on program in experimental biology.

Previous Action: On December 13, 1933, the Foundation appro-
priated the sum of \$50,000 to California Institute of
Technology for research in biology with the understanding that
not more than \$30,000 was for use during the year 1934, and
that not more than \$20,000 should be reserved to support a
major appointment in physiology during the years 1935 and 1936.

Finances: As indicated above, there is a reserve from the present
Foundation appropriation of \$10,000 a year for the next two
academic years. The present appropriation, together with the
earlier one, will thus provide support for two further years
at the level of \$30,000 annually. Approximately one-third of
this sum is devoted to the major appointment in physiology;
one-third to equipment and assistance for physiology; and one-
third for research assistants for biochemistry and biophysics.

Future Implications: There are good reasons for believing that
the Institute will be in a position to carry this budget for
general physiology at the expiration of the period of the
appropriation. Depending upon circumstances at the time, there
is the possibility that a tapering grant may be necessary.

General Description and Comment: [In 1928 Professor Morgan was
called from Columbia University to the California Institute of
Technology to develop a research department of experimental
biology. It was expected at that time that Professor Morgan
would have a budget of \$100,000 annually and that this would