MOLECULAR SCIENCES LABORATORY

September 23, 1964

I. OBJECTIVES

A. The primary purpose of the Laboratory is research on the nature of the animate world. Its central efforts will be directed toward understanding the most basic attributes of life those principles common to the organization and activity of all living things.

B. The Faculty of the Laboratory enthusiastically supports the novel and ambitious plan of the Graduate Research Center to create, in the Southwest, a new center of excellence, a prime producer of highly-trained and gifted scholars and scientists. It proposes to help in this endeavor by recruiting scientists of outstanding quality in the most significant fields of research, and by providing for them an atmosphere of the highest academic freedom and opportunity.

C. The Laboratory plans to participate in the efforts to catalyze an improvement in the quantity and quality of graduate education. Its Faculty agree that this is an essential step in mobilizing the intellectual potential of the region and directing its power into productive channels. They are prepared to contribute specialized knowledge, diversified experience in higher education and a long apprenticeship in the evaluation, analysis, and solution of problems.

D. The Laboratory is prepared to cooperate with interested colleagues from universities and industries of the region in finding ways to improve the dissemination of knowledge and to speed up the application of new findings for the benefit of mankind. The past generation has witnessed the tremendous repercussion of basic research in biology on industry, medicine and agriculture; most scientists agree that biology is just beginning to enter its golden age.

II. ORIGIN AND CONCEPT OF THE LABORATORY

A. The decision to establish an interdisciplinary Laboratory of Molecular Sciences was a wise one. Biologists recognize that life, in its most elementary aspects, is basically a chemical phenomenon, and that our insight will be deepened by description of biological phenomena in terms of the relevant physical and chemical laws. The research effort increasingly requires the close collaboration of physicists, chemists, and engineers with basic biologists and physicians. The former bring sensitive techniques and sophisticated insights, the latter, a deep understanding of biological laws, an appreciation of the complexities of living things, and the delicate experimental skills necessary for attack on biological questions.

B. For two reasons, the Division of Genetics was the first to be organized. (1) This field of the science has been preeminently successful in describing biological phenomena in molecular terms. (2) More importantly, it has addressed itself to the most central of all biological entities, the gene. The gene is the fundamental unit capable of self-reproduction; further, it carries the information necessary for the elaboration of all the other substances and attributes of the organism.

C. Activation of the Laboratory grew out of a series of conferences in Dallas and Europe which led to the recruitment of distinguished and versatile scientists who will insure the interdisciplinary character of the Laboratory from its very beginning. The initial Faculty has already developed an ambitious scientific and educational program.

D. The choice of the Division of Genetics as the first in the Laboratory was a daring stroke, its successful organization an achievement of significant

proportions for the Center and the Southwest. Of all biologists, molecular geneticists are in the shortest supply and greatest demand.

E. Development of other Divisions of the Laboratory, notably in the areas of biochemistry, biophysics, cell biology, development, etc., will be undertaken as rapidly as is consonant with the maintenance of high standards.

F. With the momentum now achieved, it will be increasingly easy to recruit a distinguished Faculty. If we provide adequate space and facilities, this can become one of the exciting and productive Laboratories in the scientific world.

III. PERSONNEL OF THE LABORATORY

The coming year will witness great strides in actual initiation of many phases of these plans and a continuous growth of the faculty. A number of able scientists with broad interests in biology, physics, and chemistry have accepted appointments, and plan to arrive in the period from October 1964, through August 1965. Many others of equal stature are considering offers to join the staff. A summary of present and prospective staff members, as well as projections on the growth of staff through 1969, are included in attached Tables I and II. Table I gives a precis of the present positions, scientific interests, and honors received by members of the present and prospective faculty.

IV. EDUCATIONAL PROGRAMS

A. Lectures and Formal Courses

1. In the winter of 1964-65, a lecture course surveying the field of molecular biology will be offered by Professor Daniel Harris at the Center or one of the institutions in the Dallas area.

2. In the summer of 1965, Professors Carsten Bresch, Royston Clowes, Walter Harm, and others will give a series of lectures on the fundamentals of genetics at several institutions in the Dallas area.

3. In the summer of 1966, and in subsequent summers, laboratory courses in bacterial genetics and viral genetics are planned for presentation at the Center. These courses will rival those now offered at Cold Spring Harbor which have so greatly influenced the growth of molecular biology in the United States and Europe.

4. Additional lecture series and/or formal courses will be developed by Center faculty during 1965-66 and subsequent years, in accordance with the mutual interests of the faculty of the Center and the regional universities.

B. Seminars and Symposia

1. The Laboratory will sponsor from time to time seminars by distinguished visitors to the Center which will be open to interested faculty and students of the area.

2. As regional interest and competence grow, more advanced seminar courses will be designed to explore certain research areas in depth, and will give intensive training to graduate students in the region. International leaders in the field will be invited to participate in a coordinated series of lectures. The topics in such courses will change from year to year.

3. International conferences in fast-developing areas of research are also envisaged. Regional faculty and students will be invited to participate as observers but such conferences are not intended primarily to serve a training function. Rather, by bringing together leaders from many fields in an informal atmosphere, they encourage the free exchange of observations, methods, and ideas, and stimulate new research by the participants themselves.

C. New Doctoral Programs

The Laboratory will initiate cooperative action with the universities of the region in devising new doctoral and training programs, establishing curriculae and standards, and participating in these programs.

D. Research Opportunities

New research opportunities in the field will be provided to graduate students, post-doctoral fellows, and faculty of the Center and regional universities.

1. Graduate students of the region may wish to carry on thesis work at the Center, or to include Center faculty on their thesis committees. The student will receive his degree from his home institution.

2. Major emphasis in the Laboratory will be placed on the post-doctoral fellow. A recent Ph.D. can polish his skills and complete his qualifications for university teaching and/or research positions. Many will wish to remain in the region.

3. Research opportunities will also be open to able colleagues from universities and industries in the region. These opportunities will vary from brief or extended consultations to sponsorship of research visits lasting several months.

D. Undergraduate Programs

Cooperation with the undergraduate colleges of the region will also be developed to spark interest in sending more students on to graduate work. Support from the National Science Foundation is being sought for an undergraduate research participation program at the Center, in which visiting faculty as well as Center faculty will serve as sponsors of undergraduate research workers. This will not only capture the interest of the undergraduates but will stimulate

visiting faculty to organize similar NSF-supported programs at many colleges in subsequent years.

V. RESEARCH PROGRAMS OF THE LABORATORY

A. Division of Genetics

During the first part of this century, the brilliant research of geneticists performed by strictly biological methods established the basic laws of heredity which obtain for all organisms. The explosive developments in molecular biology of the last two decades can, in many ways, be traced to the incisive contribution in 1941 of Beadle and Tatum. This work brought together the insights and techniques of both genetics and biochemistry. Active participation by bacteriologists, virologists, chemists, physicists and many others rapidly followed. As a result, we now have a basic understanding of the molecular organization, replication and function of the genetic material. In principle, we now know the genetic code and how the genes direct the synthesis of other molecules. While many aspects of these problems await further clarification, geneticists are beginning to search for new dimensions. As a logical extension of this knowledge two new directions of research emerge.

1. The molecular processes which link the hereditary material with other elements of the cell must be investigated in much greater detail. Insight is particularly needed in regard to the molecular mechanisms which lead to the organization and function of such intracellular structures as chromosomes, ribosomes, mitochondria, cell membranes, and the progressively more complex multi-cellular structures which are characteristic of many living things.

2. Increasingly, geneticists must turn their inquiry toward the fascinating aspects of the control of gene activity and of the relationship of these controls to the development and maintenance of an organism. Biology is just beginning to enter this challenging field of regulation. Only the close collaboration of diverse disciplines will ultimately bring us to an understanding of such biological phenomena as differentiation, cancer, aging, and the interrelationship of a virus and its host cell.

B. Future Divisions of the Laboratory

The brilliant achievements of biochemistry have resulted in the identification and characterization of many of the organic molecules of living things. Most of the chemical reactions which trap metabolic energy or change it into a form necessary for life and its activities are now known. Thousands of reactions which transform the organic compounds in myriad ways have been identified. Research in biochemistry now faces in two directions. (1) On the one hand, it attempts a more elegant description of the molecules in terms of physical-organic chemistry. Many of the subtle properties of the macromolecules which make them so peculiarly suitable for life must be sought in the underlying chemistry. The fundamental explanations of the mechanism of catalysis by enzymes, so highly developed in life, must surely be sought in this domain. (2) On the other hand, biochemistry is increasingly turning its attention to more strictly biological questions: the regulation of metabolism, the mechanisms of action of hormones, the chemical events during development, the mechanisms of transducing chemical to mechanical energy, the biochemistry of the central nervous system, etc. In truth, biochemistry is pervading all of biology.

In the history of biology one must note the profound contributions made by classical cytology and histology. Direct microscopic observation of cells and tissues has revealed a wealth of morphological detail. These fields are now in renewed and vigorous growth by virtue of the development of biochemical techniques which permit identification of enzymes and other molecules which are localized in particular cell organelles such as mitochondria, golgi apparatus, cell membranes, etc. Moreover, the development of the electron microscope permits direct visualization of structure down to molecular dimensions. With these new tools cell biologists can begin to describe the molecular architecture of cells and their constituent parts and gain many new insights into subtle developmental and regulatory processes.

Considerable insight into biological problems has come through the efforts of physicists who have applied their special knowledge to some of the central problems of biology. The Laboratory plans to recruit biophysicists and cell physiologists interested, inter alia, in (1) the effects of electromagnetic irradiations (x-rays, ultraviolet, visible light) on living material; (2) the mechanisms of excitation (and conduction) in nerve, sense organs, and more generalized protoplasmic systems; (3) mechanism of contraction in muscle, etc.; (4) permeability and active transport of substances across biological barriers; (5) transmission of energy in organized molecular systems (this has some relation to solid-state physics).

All higher organisms start life as a seemingly simple cell, the fertilized egg. There immediately follows a rapid period of development, which leads by successive cell divisions and differentiation of daughter cells to an organism of incredible morphological complexity. We can observe and describe the

changes, and we have the conviction that the processes are under genetic control. The molecular events are still largely a mystery. Most biologists feel that we can shortly bring to bear the biochemical, biophysical and genetic insights which will lead to an impressive break-through in this area. Since this field of research is sure to become one of the most exciting in biology, the Laboratory plans an active thrust in this direction.

Probably developing more slowly because of their complexity are the scientific areas involving: the function of the central nervous system; the behavior of individuals; the interactions of individuals and species; and evolution. Although some of these fields of biology have had a long and distinguished history, much fundamental work must be done before our insights are more than descriptive. If there is to be ultimate hope of providing the vigorous interaction between the biological and social sciences so essential to the solution of the problems of modern mankind, we must move wisely in this area; speed is less critical.

In emphasizing the past and future developments in biology, the Laboratory will not lose sight of the sturdy growth and potentialities of the physical sciences, and the importance to the basic purpose of the Center of solid appointments in these areas.

VI. IMPLICATIONS OF BASIC RESEARCH IN BIOLOGY

A. Educational Implications

History shows that great universities and regional centers exert a profound impact on the educational, cultural and economic life of the region. There is every reason to believe that the Graduate Research Center and its constituent Laboratories will have a comparable influence. The educational

programs of the Laboratory which are one of the main vehicles for this influence are outlined in a foregoing section.

B. Implications for Agriculture

Basic research in biology has had profound implications on agriculture. For example, the application of the principles and methods of genetics to plant and animal breeding has led to new strains of higher yields, greater vigor, and disease-resistance. Research on soils and plant nutrition has led to extensive use of chemical supplements. Combined with technological advances of a high order, agricultural practice in the United States is now preeminent in the world. The consequent release of agricultural workers to commerce and industry has greatly increased our economic potential.

The new directions in biology will lead to comparable improvements. For example, new and ingenious methods for control of pests will be devised which will be far more selective and at least as effective as the generalized poisons now in use. Similarly, new methods will be found to increase the yield of forest and farm so that we can continue to use these biological resources without destroying irrevocably the natural heritage so essential to the well-being of our children.

C. Implications for Industry

Research in biology has had many direct and indirect implications for industry. The drug industry, chemical fertilizer industry and industrial microbiology are almost too obvious to mention. A much more general influence has been felt in chemical industry as a whole. This influence derives from the fact that chemistry and biology have benefited from mutual stimulation since 1828 when Wöhler first synthesized a biological (organic) compound. From this

experiment, the great development of organic chemistry and then the chemical industry began. The development of polymers such as nylon, synthetic rubber, and innumerable plastics are successful attempts to imitate biological products. Often the specific objectives and routes of synthesis were pointed by study of the structure of such biological polymers as proteins. Quite recently, organic chemists have learned to imitate nature still further by synthesis of polymers from assymetric molecules to produce plastics of unique properties.

Our new understanding of biological molecules which can direct their own replication may inspire chemists to similar achievements. The study of photosynthesis may give us clues about the transmission of energy through solids, or new ways of trapping solar energy for commercial use. The most exciting leads may come from a study of the mechanism of action of enzymes, those fantastically efficient biological catalysts. Once we understand the secrets of enzymatic catalysis, we surely will be able to create simpler substances which can serve a similar catalytic role in industry.

D. Medical Implications

In preceding generations, medicine was preoccupied with infectious diseases, malnutrition and acute malfunctions of bodily organs. In backward nations these are still the central problems. Fundamental research by bacteriologists led to the identification of disease-causing organisms and means of transmission. This led to development of rough but ready means of control through sanitation, antiseptics, and quarantine of the ill. More recently, the discovery by basic biologists of penicillin and a host of other antibiotics has led to efficient and effective treatment. Similar basic investigations have led to the control of many of the diseases caused by viruses. Research by biochemists

and nutritionists has established the basic information needed for establishment of proper diet. Only economic barriers prevent the total elimination of starvation and malnutrition. The investigations of physiologists and anatomists have led to development of many ways of solving medical problems by surgical intervention. With improvement in knowledge of immunology, substitution of organs is becoming possible.

Medicine in the future will be more and more concerned with diseases of metabolism: congenital diseases of children, chronic diseases of adults, cancer, neurological and muscular disorders, arthritis, and the problems of senescence, to name a few. Fundamental investigations of the type outlined in earlier sections are now underway in leading laboratories throughout the world. They will lead a rich harvest of basic information which will aid the physician in the identification of metabolic lesions and suggest rational means of therapy. For example, diabetes, cretinism, and the feeble-mindedness associated with phenylpyruvica can now be controlled. It surely will not be long before we can understand and control a host of other metabolic, hereditary, and chronic disorders. If we understood development and the reasons why some tissues and organs cease growth, we might ultimately find ways to cause regeneration of new limbs or vital organs. If we understood the biochemistry of brain, we might be able to improve the feeble-minded or increase the intellectual potential of mankind.

VII. SPACE NEEDS

The need for space to house the total faculty and supporting staff of 116 persons is demonstrated graphically in attached Table III, which shows the need for immediate space through January 1966. This space-utilization chart

includes faculty and staff for the Division of Genetics and future divisions in the research areas discussed in Section VB. It is based on the use of 250 square feet per worker, the size of the group specified by the scientists, and the space he requests. Scientists of the ability already recruited are surrounded by rather large groups of junior personnel supported by research grants under the personal control of the responsible investigators. Such men have to be guaranteed adequate space and this is done by all our competitors.

VIII. FINANCIAL NEEDS OF THE LABORATORY

A. To support the enterprise outlined above a large amount of venture capital is required. In all successful laboratories, scientists have generous space and substantial amounts of laboratory equipment to speed up analytical and other scientific work. Estimates of the financial requirements for building and operating expenses of the Laboratory during its first five years are shown in Table IV. This details projected size of faculty and supporting staff, salary, building, equipment, supplies, etc. This is simply to say that although the ultimate yields are enormously high, experiments are costly.

In established academic institutions, Federal research grants support as much as 70% of these total costs. Several research grant applications are being submitted by the Center to meet pending deadlines of Institutes of Health and the National Science Foundation; many other types of appeal for support from Federal or private agencies are envisaged or already in process. However, if institutions are to maintain their academic, intellectual and fiscal independence, they must find private support for the balance. This relationship is shown on Table V which projects estimated sources of income for the Laboratory during its

first five years. Fortunately, the basic purposes of the Graduate Research Center have tremendous intellectual appeal; and private foundations, industry, and individuals will want to contribute heavily.

B. It is apparent from Table III that the most critical need is laboratory space, almost 35,000 square feet by July 1965. The projected need for Molecular Sciences is a structure the size of the Founders Building, costing $4,000,000, including basic research equipment. There is no doubt that the National Science Foundation or National Institutes of Health will find it in the national interest to provide matching funds ($2,000,000) for "health-related" research facilities at the Center. A proposal has been forwarded to the National Science Foundation. One will be sent to the National Institutes of Health to meet their deadline of November 1st. Essential to the success of these proposals is their scientific merit - i.e. demonstrable growth, scientific and educational productivity, and proof of our serious purpose.

If we wait for their consideration before providing the matching funds, we jeopardize the success of these proposals. Moreover, it will be a minimum of two years before a building can be financed and finished. Such delay would lead to an irretrievable loss of the group of scientists so carefully screened and assembled. There would be no second chance.

If we raise $2,000,000 from private sources <u>now</u>, we can provide the needed facilities in time to avert disaster. We will be able to sustain our present momentum and build a Research Center of distinction. It will be within our power to create an institution in which the entire nation can take pride.

September 23, 1964

DLH:ssc

MOLECULAR SCIENCES LABORATORY

CURRENT FACULTY

BRESCH, CARSTEN (DR.) (PROFESSOR & HEAD, DIVISION OF GENETICS)

Distinguished geneticist from the University of Köln, West Germany. He is the author of a recent text in Molecular Genetics and has made outstanding contributions to understanding of bacteriophage and pox virus.

CLOWES, ROYSTON (DR.) (PROFESSOR, DIVISION OF GENETICS)

Now at Hammersmith Hospital, London, England. He is a distinguished expert in microbial genetics. He specializes in the study of extrachromosomal DNA.

HARM, WALTER (DR.) (PROFESSOR, DIVISION OF GENETICS)

Resigned his Professorship at the University of Köln and was the first to accept appointment at the Center. He is one of the world's leading experts in the field of photobiology and is writing a definitive monograph on this subject.

HARRIS, DANIEL L. (DR.) (PROFESSOR, EXECUTIVE OFFICER, LABORATORY OF MOLECULAR SCIENCES)

Currently Associate Professor in the Department of Physiology at the University of Chicago. His contributions in cell physiology and biochemistry are widely cited as the pioneer efforts in their areas. He is the recipient of the Quantrell Award at the University of Chicago for his distinguished teaching.

CURRENT FACULTY (continued)
page 2

RUPERT, C. S. (DR.) (PROFESSOR, DIVISION OF GENETICS)

Associate Professor at the Johns Hopkins University and holds an United States Public Health Service Career Development Award. He has just been honored by the Award of the Finsen Medal for his outstanding contributions to the field of photobiology.

HEUMANN, WOLFRAM (DR.) (ASSOCIATE PROFESSOR, DIVISION OF GENETICS)

Chief Assistant in the School of Technology, Braunschweig, West Germany. He is the world's only expert on the genetics of free-living bacteria.

GUTZ, HERBERT (DR.) (ASSISTANT PROFESSOR, DIVISION OF GENETICS)

Now Privat Dozent at the Technical University of Berlin. He is an enormously productive worker in the field of the genetics of yeast, and we will greatly benefit from his most ambitious research program.

HAUSMANN, RUDOLPH L. (DR.) (ASSISTANT PROFESSOR, DIVISION OF GENETICS)

Now Rockefeller Fellow of Natural Sciences, Department of Molecular Biology, Albert Einstein College of Medicine, New York; has made significant contributions to the mechanism of the infection of host cells by bacterial viruses.

HERTEL, REINER (DR.) (ASSISTANT PROFESSOR, DIVISION OF GENETICS)

Now associated with Professor Carsten Bresch at the Institute of Genetics, University of Köln, West Germany; an expert in structure of bacterial viruses and gene function.

CURRENT FACULTY (continued)
page 3

LANG, DIMITRIJ (DR.) (ASSISTANT PROFESSOR, DIVISION OF GENETICS)

Is Wissenschaftliche Assistant at the Hygiene Institute in Frankfurt am Main. A physicist, he has become one of the world's most skilled electron microscopists. His interest lies in the quantitative morphology of macromolecules. One of his photographs is attached.

KRONE, WINFRIED (DR.) (ASSISTANT PROFESSOR, DIVISION OF GENETICS) VISITING?

Is now at the Anthropology Institute of the University of Freiburg. He is a highly promising young scientist who is beginning to make outstanding contributions to the difficult field at the borderline between biochemistry and human genetics. These may have profound implications for medicine, particularly in the field of chronic diseases of children.

September 23, 1964

ssc

OUTSTANDING OFFERS AND PROSPECTS

I. Outstanding Offers

BAGLIONI, CORRADO (DR.) PROFESSOR, DIVISION OF GENETICS

Career Investigator, Italian Research Council, International Laboratory of Genetics and Biophysics, Naples, Italy; has done outstanding work in biochemistry of hemoglobin (red pigment of blood).

HENNING, ULF (DR.) PROFESSOR, DIVISION OF GENETICS

Now Professor at Max-Planck-Institute for Cell Chemistry, Munich, West Germany; an outstanding geneticist and biochemist specializing in gene functions and compound enzymes (the regulators of biological functions).

SYMONDS, NEVILLE (DR.) PROFESSOR, DIVISION OF GENETICS

Head of Microbial Genetics Research Unit, Medical Research Council, Hammersmith Hospital, London; outstanding theoretical physicist who has made contributions to genetics of bacteria and bacteriophage (the virus organisms which attack bacteria).

II. Prospects

GOODGAL, S. H. (DR.) PROFESSOR, DIVISION OF GENETICS

Now Associate Professor in Department of Biochemistry, University of Pennsylvania; a leader in work on bacterial transformation and radiation effects on genetics of microorganisms.

GROSS, PAUL (PROF.) PROFESSOR, DIVISION OF GENETICS

Associate Professor, Department of Biology, Brown University; one of the chief contributors to modern concepts of molecular genetics, specializing in cell differentiation and development and modern aspects of cell physiology.

JAGGER, JOHN (DR.) ASSOCIATE PROFESSOR, DIVISION OF GENETICS

Now Research Biophysicist, Biology Division, Oak Ridge National Laboratories, Oak Ridge, Tennessee, and Lecturer in Biology, University of Tennessee; an outstanding biophysicist who has made significant contributions in the effects of uv-radiation on bacteria and viruses, a recognized world leader in this field.

KOZLOFF, LLOYD (DR.) PROFESSOR, DIVISION OF GENETICS

Was formally Professor of Biochemistry at the University of Chicago and is now at the University of Colorado; he is the world's greatest expert on the biochemical structure of bacteriophage.

McCLINTOCK, BARBARA (DR.) DISTINGUISHED PROFESSOR, DIVISION OF GENETICS; JOINT APPOINTMENT -- UNIVERSITY OF TEXAS & GRCSW

Investigator, Department of Genetics, Carnegie Institution, Cold Spring Harbor, New York; most widely recognized and respected world leader in the field of cytogenetics, specializing in maize (Indian corn).

RADDING, CHARLES M. (PROF.) ASSOCIATE PROFESSOR, DIVISION OF GENETICS

Assistant Professor, Department of Human Genetics, University of Michigan Medical School; an active worker in biochemistry and the physical chemistry of nucleic acids and proteins; brought to University of Michigan from Stanford to establish work on the biochemistry of macromolecules.

September 23, 1964

ssc

MOLECULAR SCIENCES LABORATORY

PROJECTED STAFF GROWTH, 1965-1969

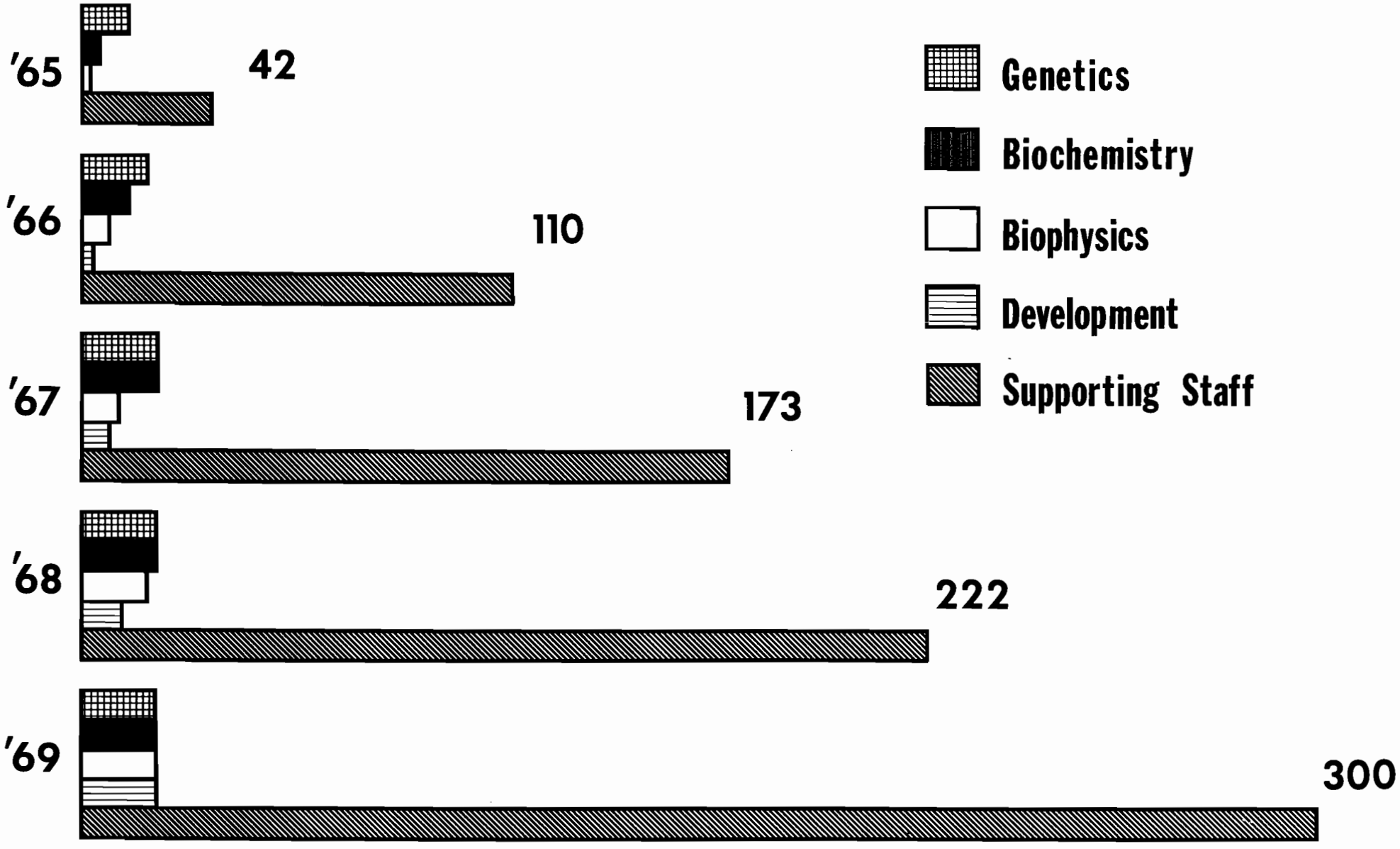
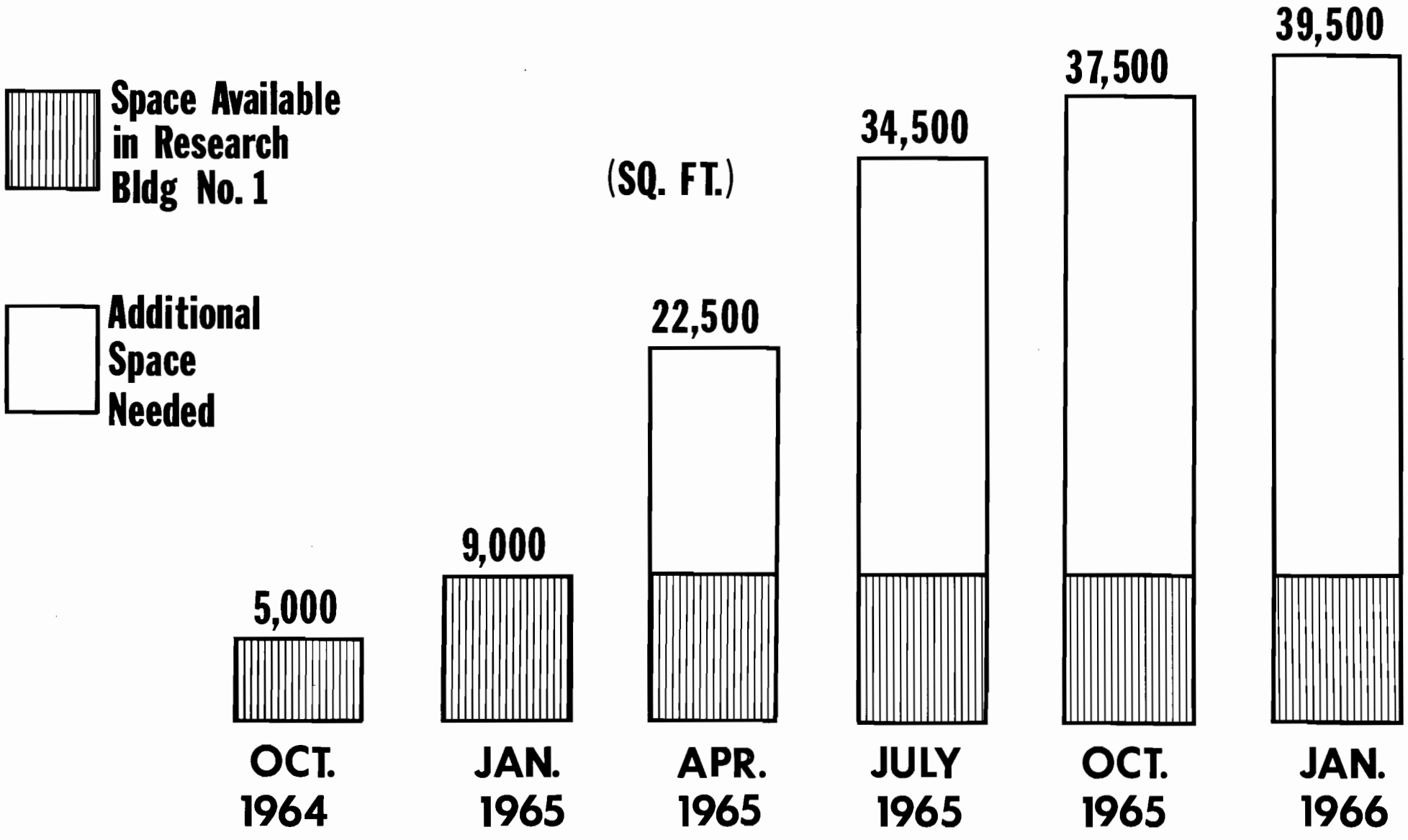


TABLE II

MOLECULAR SCIENCES LABORATORY

IMMEDIATE SPACE NEEDS



(BASED ON 250 SQ. FT. PER WORKER)

TABLE III

MOLECULAR SCIENCES LABORATORY

FINANCIAL REQUIREMENTS, 1965-69

(THOUSANDS OF DOLLARS)

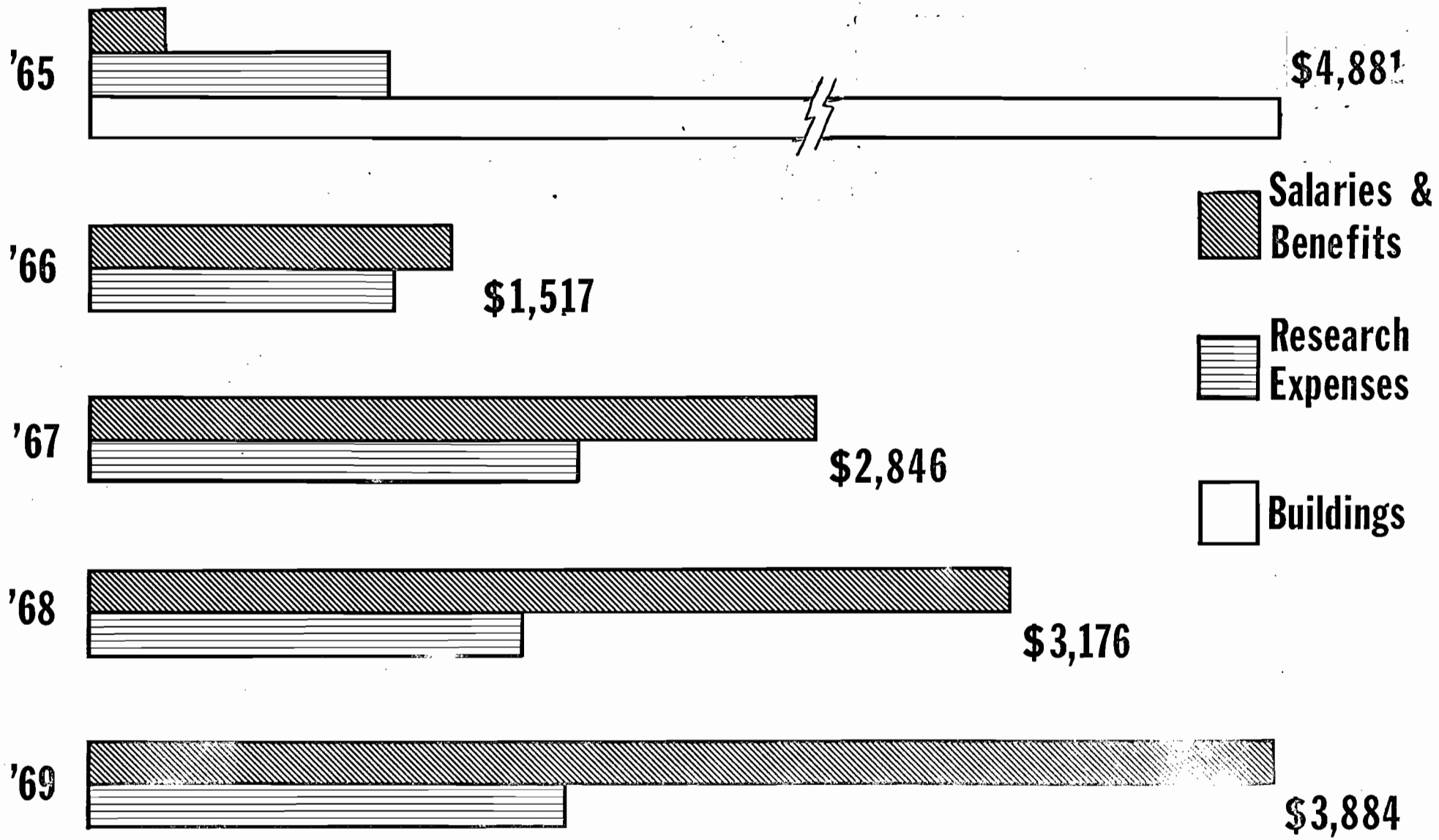
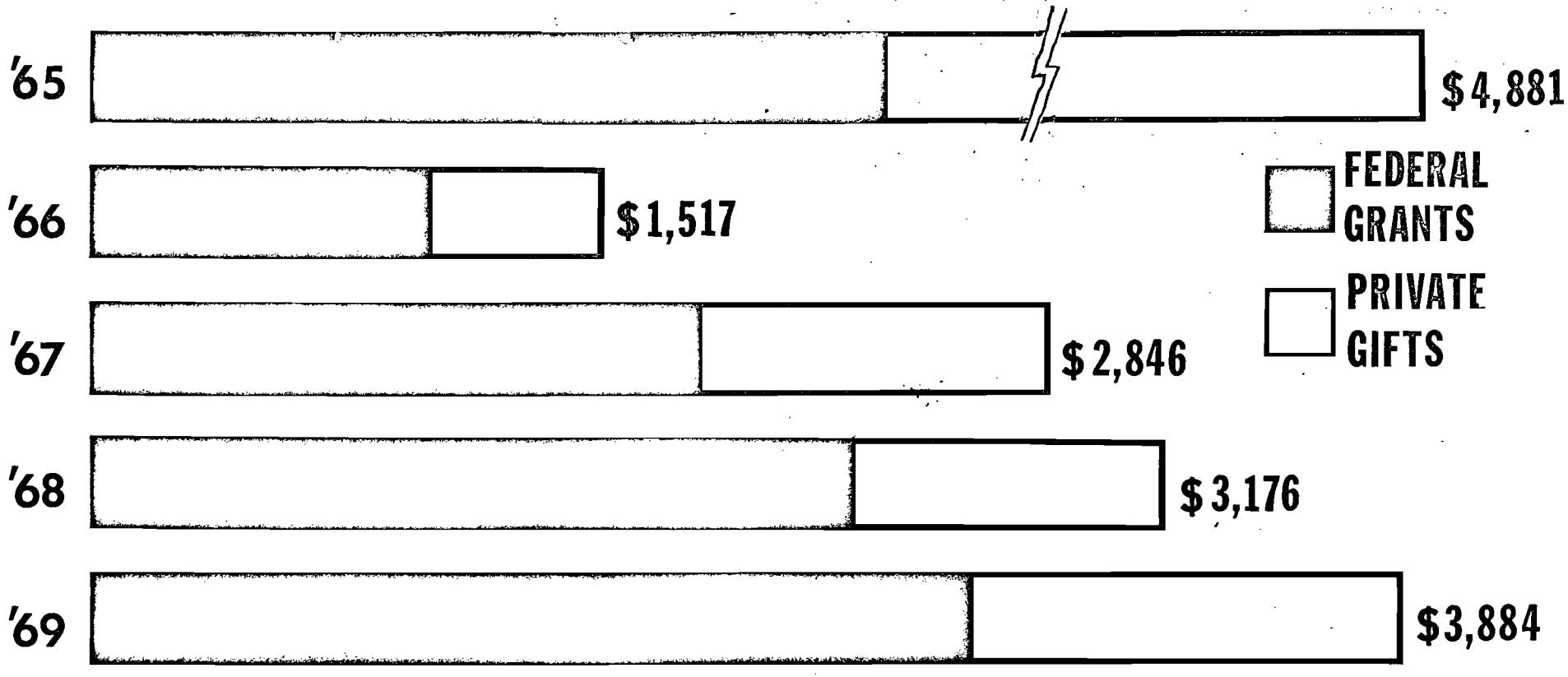


TABLE IV

MOLECULAR SCIENCES LABORATORY

SOURCE OF INCOME 1965-69

(THOUSANDS OF DOLLARS)



RECAP

FEDERAL $8,935 (58.5%)

PRIVATE $6,369 (41.5%)

TABLE V

MOLECULAR SCIENCES LABORATORY

FINANCING A BUILDING

1. IT WILL TAKE A MINIMUM OF TWO YEARS TO PROVIDE A BUILDING FROM FEDERAL FUNDS.

2. $1,500,000 TO $2,000,000 IN PRIVATE FUNDS COULD PROVIDE SUFFICIENT BUILDING SPACE IN ONE YEAR.

3. WITHOUT THIS SPACE WE WILL LOSE THE DISTINGUISHED FACULTY WE HAVE RECRUITED.

4. BY PROVIDING FACILITIES NOW, WE CAN SUSTAIN MOMENTUM AND CREATE AN INSTITUTION OF DISTINCTION.

TABLE VI