

PROPOSAL FOR CREATION OF A DEPARTMENT
OF BIOCHEMISTRY AT THE UNIVERSITY OF GEORGIA

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SUMMARY

We, the undersigned, believe it is in the interest of The University of Georgia, the State and ourselves to organize on July 1, 1964 a Department of Biochemistry with temporary quarters in the Chemistry Building. The primary reasons for this are as follows:

- 1.) To take part in the rapid expansion of Biochemistry and its wide recognition as a separate discipline.
- 2.) To properly train graduate students to be professional and modern biochemists.
- 3.) To obtain additional training, research, and facility (including building) grants.
- 4.) To permit expansion of both the teaching and research programs and faculty.
- 5.) To maintain and develop our careers and reputations as professional research biochemists.

We believe that if a department is not created, a drastic change must be instituted in our means of conducting research. Since we feel we can no longer with clear conscience accept graduate students to be trained as biochemists, we would have to rely entirely on hired technicians, and all courses would have to be designed as service courses for students in Biology. This is undesirable because it is likely that the present group under these conditions would go backward rather than expand and progress.

M. J. Cormier

L. S. Dure

R. A. McRorie

W. L. Williams

I. DEFINITION AND SCOPE OF BIOCHEMISTRY

All growth, development and ageing of all living organisms, and every movement, every thought, every change in a living organism is carried out by physical or chemical reactions involving molecules. Study of these reactions between often very complex molecules is the domain of Biochemistry. Biochemistry, as indicated by the origin of the word from biological chemistry, is a hybrid science applying the precise methods of chemistry and physics to the complex, intriguing and exceedingly important problems of biology. What Biochemistry is can best be illustrated by the research problems that now concern biochemists. They are the major biological and medical problems of our times.

1.) The biochemical basis for heredity. Each fertilized human ovum, a single microscopic cell, contains concealed in its chemical composition all the detailed and complex information necessary to direct the development of millions of varied specialized cells that make up an adult person. Biochemists have found that the information resides in the molecular structure of a cell substance called deoxynucleic acid (DNA), but much of how DNA controls development and differentiation is still a mystery. One of us, Leon S. Dure, is studying how DNA operates in the development and differentiation of plants since it is quite likely DNA operates in the same general manner in all cells.

2.) Energy storage, transfer and utilization in living tissue. Much is still to be learned concerning the exact biochemical mechanisms for the conversion of chemical food energy to body chemical energy and then utilization of such energy for movement, synthesis of new body constituents, thought processes and the myriad of other processes. One of us, Milton J. Cormier, has made a number of discoveries in

this area by studying how certain marine organisms convert cellular chemical energy to light energy.

3.) Biochemical basis for reproduction and fertilization. Although much is known about the anatomical and cytological events that occur in the above processes, little is known about the biochemical events on a molecular scale. How does a sperm digest its way into an egg? How does the egg membrane change to shut out all other sperm cells after the first one enters? Why are sperm unable to fertilize eggs when first deposited in the female tract of higher animals? What happens during the several hours the sperm must reside in the uterus before it becomes capable of fertilizing the egg? These are just a few of the many Biochemical mysteries involving reproduction some of which are being investigated by biochemists here at Georgia, William L. Williams' group.

4.) Cause, cure and prevention of cancer. Literally hundreds of biochemists are engaged in research on this problem. They have discovered drugs and tissue extracts that markedly inhibit tumor growth. Viruses have been isolated which definitely cause certain types of cancer. Biochemical research at present in progress offers a definite hope of a real cure.

5.) Cause and prevention of circulatory diseases. Biochemists have isolated many components involved in blood clotting and devised two methods of preventing pathological blood clot formation (dicumarol and heparin) if administered in time. Atherosclerosis and heart disease are being vigorously investigated. Biochemical bases for circulatory diseases have been well established. The U. S. Public Health is seeking a location to establish a blood coagulation labora-

tory staffed by two well-known biochemists. They consider a new Biochemistry Department at Georgia as their first choice.

6.) Origin of life on earth. After decades of discussion and argument on biochemical theories of the origin of life, this problem has been approached experimentally by biochemists such as Calvin and Fox. Dr. Sidney Fox and his associates at Florida State University have established that certain key biochemicals could be synthesized under the primitive conditions existing on the prebiological earth. They have multimillion dollar support from NASA for an Institute of Space Biological Sciences. Calvin demonstrated that simple biochemical molecules could evolve into molecules of more complex structure and function. Almost all research on this subject is being done by biochemists.

7.) Biochemical basis of memory. Recently biochemists found that a common cell constituent, ribonucleic acid, (RNA) is involved in learning and memory. Biochemical interest and research on the molecular reactions involved in memory have intensified in recent years.

8.) Biosynthesis of cell constituents. One of the most exciting and active areas of research is the biosynthesis of protein and how it is carried out, controlled and directed by nucleic acids (RNA and DNA). The biosynthesis of protein is of crucial importance because each protein has a unique structure, i.e., arrangement of only 20 subunits, the amino acids. Most proteins function as enzymes to synthesize all other constituents of the cell. Thus protein or enzyme synthesis is the expression of the genetic information contained in DNA which makes us what we are,

II. STATUS OF BIOCHEMISTRY AS A SEPARATE DISCIPLINE.

Thirty years ago there were only a few dozen Departments of Biochemistry in the nation. At present there are nearly as many Biochemistry (⁹¹97) as Chemistry Departments (¹⁴⁰128). Graduate study in Biochemistry is available in 146 different departments of all kinds. ¹⁵¹

Thirteen scientific journals are devoted entirely to Biochemistry and are international in scope. An additional 9 journals are predominantly biochemical.

Separation of Chemistry and Biochemistry is taking place within the American Chemical Society. In a study on the growth of the various chemical disciplines, they predicted, "----that the field of Biochemistry will show more advances than any other field of science over the next 25 years." Explaining to members why the Society removed all biochemical abstracts from the journal, Chemical Abstracts, and created a separate new journal, Chemical Abstracts, Biochemical Sections, they noted, "The answer lies in the present biochemical growth potential. In the past decade the number of abstracts of pure biochemical papers has almost tripled; the chemical approach to the problems of biological sciences is more important all the time." Observing in 1961 that nearly 1/3 of all chemical literature was biochemical the American Chemical Society introduced a new journal entitled Biochemistry. This journal is achieving rapid success.

The Federated Societies for Experimental Biology consists of 6 Societies. The Physiologists, Biochemists and Nutritionists who together represent over 85 per cent of the membership present predominantly biochemical papers at the annual meetings. In 1963 the

annual meeting was claimed to be the largest scientific meeting in the world and was attended by over 17,000 scientists. Every 3 years an International Congress of Biochemistry is held. The 6th congress will be held this year in New York City, and over 10,000 scientists are expected to attend.

With the existence of separate and distinct biochemical departments, journals, national and international meetings and societies (one in every country) it is apparent that Biochemistry is as separate a discipline as any. In fact, it appears to be one of the larger and more rapidly expanding scientific disciplines.

Historically, Departments of Biochemistry have developed in markedly different directions from Departments of Chemistry. In most academic institutions Biochemistry is more closely allied with certain departments in biology such as Bacteriology, Botany or Zoology or with Medicine or Agriculture than with Chemistry. Traditions developed that are markedly different from those of Chemistry Departments. Departments of Biochemistry in general require more varied courses for graduate degrees. More emphasis is placed on research and less on extensive comprehensive written examinations which usually require that the Chemistry student stop research for a year. Graduate students in Biochemistry come from almost all fields of biology, and hence the requirements for entrance into graduate work in Biochemistry are varied and flexible. In contrast, Chemistry requirements tend to be rigid and inflexible. Even in context Biochemistry is evolving in directions quite distinct from Chemistry. The unstable macromolecules and multimolecular subcellular structures with which Biochemists must work and with which most Chemists are

unfamiliar have led to the development of techniques and design of equipment unique with Biochemistry, and as yet quite apart from Chemistry. The same is true of the knowledge required for competency in Biochemistry. This knowledge is quite distinct from the knowledge required for competency in Chemistry.

III. NEED FOR A NEW DEPARTMENT

Biochemistry can be considered a kind of common meeting ground between the physical and biological sciences. This is true due to the very nature of the problems modern biochemists concern themselves with, i.e., an attempt to understand life itself in terms of chemistry and physics. With relatively large breakthroughs in recent years it is no surprise that the science of biochemistry is one of the two most rapidly advancing fields of science, the other being nuclear physics. This is due to the wide interest in the subject and relatively heavy financial support it is receiving from private and federal agencies.

Most universities we generally consider "top flight" have strong Biochemistry Departments due to the realization that students who are interested in life processes, whether they came from the physical or biological sciences, must be thoroughly indoctrinated in the disciplines of Biochemistry so that they may be properly equipped to pursue their interest.

We feel that a separate Biochemistry Department is badly needed for several reasons. First, under our present set-up it will be difficult to expand. This is most important since we in Biochemistry all realize that we are not sufficiently large and varied to give the kind of training to students that we feel is necessary and which is

offered in other Biochemistry Departments with which we are competing. Secondly, a separation would enable us to apply for larger amounts of federal grants for which we are not now eligible. Such grants would help to pay for a new building, new facilities, and additional staff positions. We have good reason to believe that a sizable training grant, for example, would be forthcoming in the event of a new department.

Considering the size of our group we have certainly not done badly as far as research support is concerned. This information is listed below:

	<u>Total Personal Grants 1959-Present</u>	<u>Facilities and Equipment Grants</u>	<u>Salary Awards</u>
1959	\$15,750	\$200,000	-
1960	46,200	12,000	-
1961	51,900	27,100	-
1962	108,200	-	\$111,500
1963	86,300	-	25,100

We do feel, however, that the number of grants and the total amount of federal and perhaps private support could be greatly increased by the creation of a new Department of Biochemistry.

IV. DEPARTMENTS OF BIOCHEMISTRY AT OTHER UNIVERSITIES

For the purpose of comparing the proposed Biochemistry Department at Georgia with other departments in both the North and South the departments at Louisiana State University and the University of Wisconsin are described. Neither of these departments are in Medical Schools.

1.) Louisiana State University. The Department of Biochemistry is well known for both its research and the students it produced. Below are listed the graduate courses. A list of undergraduate courses was not available at the time this was written.

Graduate Biochemistry Courses

Lipid Chemistry
 Carbohydrate Chemistry
 Enzymes
 Natural Products
 Plant Chemistry
 Physiological Chemistry I and II
 Physiological Chemistry I and II
 (Laboratory)
 Medical Biochemistry
 Vitamins
 Advanced Biochemistry
 Colloid Chemistry
 Proteins
 Selected Topics in Advanced
 Biochemistry

Faculty in Biochemistry

Jordan G. Lee
 Ernest A. Fieger
 Virginia R. Williams
 John F. Christman
 William H. James
 Socrates A. Kaloyeras
 Arthur F. Novak
 Joseph A. Liuzzo

2.) University of Wisconsin. This department is one of the best in the world having taken part in the early discovery of the vitamins. Below are listed the graduate courses and the faculty from this department only. In addition to the graduate courses listed there are five undergraduate courses. Biochemistry was early recognized at Wisconsin as a field of importance and rapid expansion. At the present time the University now has essentially five biochemical departments. Instead of expanding the existing Department of Biochemistry extensively new departments were created within somewhat more specialized branches of Biochemistry. The Enzyme Institute occupies a separate building adjacent to the original Department of Biochemistry. The study of enzymes is a major part of Biochemistry. The Department of Physiological Chemistry was created and has become famous for its biochemical research on urea formation. Physiological Chemistry is essentially synonymous with Biochemistry. For the purpose of studying the biochemistry of cancer the McArdle Research Laboratories were created. The most recent addition has been the Department of Molecular Biology. Molecular Biology is another phrase essentially synonymous with Biochemistry.

Graduate Biochemistry Courses

- 101 Principles of Animal Nutrition
- 103 Introduction to Biochemistry
- 105a. General Biochemistry I
- 105b. General Biochemistry II
- 106 General Biochemistry Laboratory
- 107 Biochemical Research Techniques
- 119 Plant Biochemistry
- 123 Biochemistry of Nutrition
- 124 Vitamins and Metabolism
- 125 Vitamins and Metabolism Laboratory
- 126 Modern views of Animal Nutrition
and Their Application
- 133 Seminar
- 180 Special Problems
- 200 Research
- 208 Nucleic Acids
- 209 Proteins
- 211 Biochemical Preparative
Techniques
- 224 Carbohydrates
- 227 Biochemistry of Microorganisms
- 229 Mechanisms of Enzyme Action
- 230 Isolation of Enzymes
- 233 Seminar in Nutrition
- 234 Seminar in Microbial Biochemistry
- 235 Seminar in Natural Products
- 248 Biochemistry of Macromolecules
- 249 The Physical Chemistry of the
Proteins

Faculty in Biochemistry

Anderson, L.
Baumann, C. A.
Bock, R. M.
Burris, R. H.
Cleland, W. W.
DeLuca, H. F.
Deutsch, H. F.
Garver, J. C.
Harper, A. E.
Hoekstra, W. G.
Johnson, M. J.
Kaesberg, P.
Kuby, S. A.
Lardy, H. A.
Link, K. P.
Phillips, P. H.
Potter, Van. R.
Stahmann, M. A.
Strong, F. M.
Williams, J. W.

Our neighboring state of Florida and Virginia are currently emphasizing Biochemistry. At Florida State University the Department of Chemistry headed by a biochemist is devoted largely to Biochemistry. Virginia Polytechnic Institute has recently built a new building to house the Department of Biochemistry and Nutrition.

V. DESCRIPTION OF PROPOSED NEW DEPARTMENT OF BIOCHEMISTRY**1.) Faculty**

<u>A. Present</u>	<u>Per Cent of 12 Months' Salary from Grants</u>
M. J. Cormier, Associate Professor	0
L. S. Dure, Assistant Professor	50
R. A. McRorie, Associate Professor	0
W. L. Williams, Professor	100

B. Desirable Increases

<u>Rank</u>	<u>Starting Date</u>	<u>Source of Funds</u>	<u>Approx. Amount</u>
Asst. or Assoc. Prof.	Sept. '64-July '65	Williams' Salary	\$13,000
Professor and Head of Dept.	July '65	Univ. of Georgia	19,000
Asst. Professor	July '65	U. of Ga. or Cormier's Salary*	10,000

*In anticipation of receiving a Career Award.

2.) Courses in BiochemistryA. Present

<u>Course</u>	<u>Instructor</u>
Biochemistry 451	Dr. Cormier)
Biochemistry 452	Dr. Cormier) Undergraduate
Elementary Biochemistry 351	Dr. Cormier)
General Biochemistry 851	Dr. Dure
Advanced Biochemistry 852	Dr. Dure
Phytochemistry 855.1	Dr. Dure
Biochemical Research Techniques 855.3	Dr. Williams
Biochemistry Seminar 811	Dr. Williams
Proteins 856	Dr. Hamdy (joint with Food Tech.)

B. Courses Approved But Without Instructors

<u>Course</u>	<u>Number</u>
Special Topics in Biochemistry	855
Enzymology	855.2
Introduction to Research	849

C. Future Courses Needed for an Adequate Graduate Program*

Biochemistry of Development and Differentiation

Nucleic Acid Chemistry

Carbohydrates

Lipids

Biochemistry of Macromolecules

Elementary Biochemical Laboratory Techniques (2 or 3 quarters)

*This will depend a great deal on the interests of new faculty members.

3.) Physical Facilities

Although initially it will be necessary for Biochemistry to occupy the present quarters in the Chemistry Building, upon obtaining departmental status immediate efforts will be made to obtain matching funds for a wing or building. The vacated quarters would result in added facilities for the Chemistry Department as well.

4.) Departmental Budget, July 1, 1964-June 30, 1965*

Departmental Secretary	\$ 3,000
Furniture*	300
Building Modifications*	150
Operating Supplies and Equipment	10,000**
Travel (to interview prospective dept. heads)	450
Teaching Assistant	2,200
Capital Outlay (from Contingency Fund)	2,500

*Nonrecurring.

**Calculated as proportional part of Chemistry operating expenses.

It is assumed that the research and teaching supplies and equipment now used entirely by Biochemistry will be transferred from Chemistry to Biochemistry.

VI. BENEFITS TO THE STATE OF GEORGIA

Any increase in the scope of scientific activity at the University of Georgia may be considered ultimately beneficial to the state as a whole, and this is especially true with regard to Biochemistry. These benefits can be seen from four viewpoints.

1.) The primary function of a university is that of instructing undergraduates, and Biochemistry being primarily a research discipline would at first glance appear to offer little that would enhance undergraduate education. This is not necessarily the case. Today's undergraduate, regardless of his field of interest, finds himself in an increasingly sophisticated world; and, hence, his preparation must become more and more sophisticated. Scientific development is now so dynamic a force as to demand that any man considering himself educated must understand its fundamentals. For these fundamentals are obligatory if one is to comprehend and participate in mid-twentieth century life. An undergraduate's knowledge of the findings of Biochemistry is becoming requisite to his awareness of himself and his fellow man. In ten years anyone unacquainted with the concepts of enzymes, DNA, and vitamins will not be considered a roundly educated individual, just as today anyone ignorant of the atomic theory would be so considered. Such concepts are routinely discussed in current news publications such as Time, Newsweek, and Life. It is felt that Biochemistry can contribute to the effort in developing Georgia undergraduates into broadly knowledgeable citizens. An increase in such citizens is, needless to say, most beneficial to any state for it is axiomatic that a broadly educated citizen benefits society as well as himself. It is felt that undergraduate Biochemistry

available to nontechnically oriented undergraduates, as well as to the scientifically oriented, would prove popular and rewarding.

2.) Of more obvious and tangible benefit to the State of Georgia would be the enhanced production of Ph.D. research scientists. The demand for Biochemists in nonacademic endeavors has increased by staggering proportions in the past ten years. Private industries in Georgia such as the pharmaceutical, fermentation, food, Naval stores, and animal feed industries generate an increasing demand for research Biochemists. Regular requests are received for graduates that cannot be provided without expansion of the present program in both depth and scope. Governmental services and their laboratories, likewise, are finding an increasing need for Biochemists. The Public Health Service, the Department of Agriculture, the Fish and Wildlife Services, and the Forestry Service are some of these services whose projects require Biochemists -- for ultimately the answer to chronic respiratory disease in chickens, fungal diseases in trees, insecticide and fertility problems in agriculture, etc., will be answers in terms of Biochemistry. Many of these Federal projects are moving south as evidenced by the new Federal laboratories in the Athens area itself. Up to now, the research personnel to staff these laboratories have been brought in from elsewhere, whereas in the future they should be largely products of the State University System.

Along these lines, a strong program in Biochemistry at the University would without doubt have an effect in the rapid and successful development of the University's proposed research park. A competent and vigorous Biochemical group at the University would constitute a real attraction for pharmaceutical firms considering

establishing a research laboratory in the research park -- both from the standpoint of having competent graduates to employ and from the mutual advantages of professional association.

3.) A further benefit to the State stemming from the creation of a Department of Biochemistry would be the Biochemists' ability to raise research funds from outside the State budget. All branches of the Federal scientific supporting agencies have biochemically oriented granting divisions. This includes such diverse agencies as the NASA, Air Force and the AEC, in addition to the more obvious NIH and NSF. Dollars invested by the State in Biochemistry have had and would continue to have an autocatalytic effect in increasing the productivity, equipment and facilities of Biochemistry at the University. This benefit is amplified in other sections of this proposal.

4.) The fourth benefit to the State is an intangible benefit that may superficially be classified as "prestige." The citizenry of this State undoubtedly take pride in the fact that they, through their University, contribute to human knowledge -- that they tangibly support pure basic research that allows mankind to know more of himself and his world. The citizenry of Georgia in all likelihood had rather be among the leaders in this support and not among the laggards. To be among the leaders a strong program in Biochemistry, one of the most dynamic and fruitful fields of investigation today, is a primary requisite.