



BIOCHEMISTRY

The University of Georgia



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The Department of Biochemistry is one of six departments comprising the Division of Biological Sciences in the Franklin College of Arts and Sciences at The University of Georgia. The department was organized in 1965 and degree programs are offered presently with a major in biochemistry at the BS, MS and PhD levels. An active post-doctoral program is also maintained. A National Science Foundation "Center of Excellence" Science Development Award in 1967 made possible greatly accelerated growth with the addition of new faculty and programs to give the department a well balanced program in both course offerings and research areas. Research interests of the staff are briefly described in the following section with a listing of the faculty, and it may be seen that these interests are varied and present a well rounded program appropriate to a department in the College of Arts and Sciences.

Facilities

The Department of Biochemistry moved into the newly-completed Boyd Graduate Research Center, a 255,000 square foot facility, in 1968. The seventh floor contains 10 large biochemistry research laboratories and the eighth floor houses modern animal quarters with surgery suite, incinerator and other support facilities. Departmental offices for biochemistry are located on the sixth floor with administrative offices of the Vice President for Research. Lower floors in the building contain classrooms and administrative offices of the Graduate School plus the department of Mathematics and Statistics. The first floor houses the Computer Center. The Science Library, with approximately 425,000 volumes of the total university holdings of more than 2.1 million volumes, is conveniently located in a wing of the building occupying about 100,000 square feet in four floors of stacks, reading rooms, carrels and study areas.

Research facilities in the department include a Fermentation Plant, located in a nearby building, which contains two large research laboratories and houses

two 400 liter fermenters, one of which is programmable, and five smaller fermenters plus the necessary equipment for harvesting and processing kilogram quantities of microorganisms. Seven biochemistry research laboratories are located in nearby buildings, in Barrow Hall (across the street from Boyd) and two others are in the Biochemistry Annex, located in the same complex. A proposal is now pending for a new 32 million dollar building which would bring back together the various research groups.

Other specialized research equipment in the department includes an analytical ultracentrifuge with scanner, an atomic absorption spectrometer, a YAG laser, an absolute spectrofluorimeter, a CD spectrophotometer, an electron paramagnetic resonance spectrometer, a polarization of fluorescence fluorimeter, a stopped-flow spectrophotometer, microcalorimetry equipment, a Beckman Sequenator, a Sequemat Solid-Phase Sequenator, two HPLC systems with integrators, two amino acid analyzers, with digital integrators, a mass spectrometer, and four in-lab NOVA computers which have been interfaced for on-line data acquisition and control of many of the above instruments. A broad spectrum of other spectrophotometers, centrifuges, counters, fraction collectors and the other equipment needed for modern biochemical research is available within the department.

Supporting facilities available at the University, but not located in the department, include the Electron Microscopy Laboratory, which contains a high resolution scanning electron microscope and three transmissions microscopes plus EDAX, freeze-etch and other ancillary support equipment; The Computer Center, which houses a CYBER 70/74 and two IBM 370/158 computers, plus supporting facilities and services; Electronic Design and Maintenance Shop; Glassblowing Shop; Machine Shop; and Central Research Stores. The University also maintains a marine research station at Sapelo Island on the Georgia Coast. The biochemistry department has a research laboratory in this facility, which is utilized by a number of the staff for investigations into the biochemistry of selected marine organisms. Greenhouses and plant growth chambers are also available for plant biochemistry research.

Undergraduate Program

The undergraduate major in biochemistry is designed primarily for the student with superior aptitude and motivation who plans to continue his/her education past the baccalaureate degree either in medicine, dentistry, some other professional school, graduate school in biochemistry, or some closely related discipline in the life sciences. The curriculum is rigorous and is designed to give a good background in both the physical and the biological sciences. In the major, students take a one quarter introductory biochemistry course plus a two quarter sequence at the advanced undergraduate-beginning graduate level. At least one quarter of laboratory work is also required. This requirement may be satisfied either by taking a formal five hour laboratory techniques course or through independent research under the supervision of a faculty member in his laboratory. A number of students have prepared honors theses using results obtained in the independent research course. Frequently students become so intellectually involved in their apprentice-like projects that they elect to continue them for two additional quarters.

Graduate Studies

The graduate curriculum emphasizes both academic scholarship and the acquisition of independent research skills with individual programs adjusted to meet the need and interest of each student. The minimal departmental core curriculum includes an advanced biochemistry sequence, the physical chemistry of macromolecules, enzymology, an introduction to research and nucleic acid metabolism. Electives in specialized fields are offered both by Biochemistry and other departments in the Division of Biological Sciences. Some of the courses offered include advanced enzymology, carbohydrate metabolism, reproductive biochemistry, phytochemistry, mammalian biochemistry, cellular biochemistry, molecular genetics, molecular genetics of the eukaryotes, plant physiology, plant molecular biology, electron microscopy, immunology and insect physiology. Many additional courses are offered by the Chemistry Department, the School of Pharmacy and the School of Veterinary Medicine.

Major emphasis is placed on research and an active seminar series. Students are encouraged to participate in research programs as soon as possible and many begin their training after their first quarter in the department. All students must demonstrate laboratory proficiency as partial fulfillment of degree requirements and Doctoral candidates must become competent, creative investigators. Students entering the department are placed in Masters or Doctoral tracked programs dependent on previous achievements and academic records. Students entering the MS program prepare a thesis after two or three years and may develop the same problem for a dissertation with approval of the department and their major professor.

An active postdoctoral program has also been developed in the department. Postdoctoral fellows have been supported by grants from a number of different state and federal agencies. Fellows participate in all laboratory activities and have become an integral part of the graduate training program. Their participation has become particularly significant in developing the research skills of prospective doctoral candidates.

Generous support from both the State of Georgia and various federal agencies has allowed the Department of Biochemistry to acquire creative and productive staff, adequate physical facilities, and most of the specialized equipment required for modern biochemical research. Federal research grants to faculty in Biochemistry are now approximately \$3 million per year. The undergraduate, graduate and post-graduate training programs are well established and are producing individuals well-trained in biochemistry at each level. In this environment the department has developed into an intellectually self-sustaining group who interact well and are now making significant academic and economic contributions to the University, the State and the Nation.

Visiting Professors

Appointment as visiting professor is available for persons on sabbatical leave who wish to collaborate on a research problem with faculty members in the department. These appointments have ranged from 3 months to a calendar year.

Graduate Students

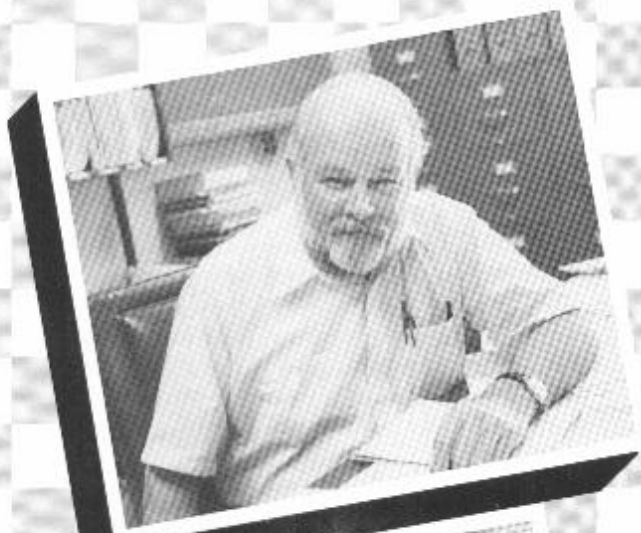
The number of graduate students enrolled in the department during the past few years has varied between 50 and 60. These students are recruited nationally, and to a lesser extent internationally, although the majority of the students continue to come from the southeast.

Graduate students making normal progress toward their degrees have been financially supported from a number of state, federal and private sources. Summer stipends are available for students on academic year appointments. Non-resident students pay only resident tuition fees when supported by a teaching or research assistantship.

Seminar Program

An active seminar series is supported by the department as an important part of the research and graduate teaching program, with all faculty, post-doctoral fellows and graduate students participating. Five interest groups have been organized for seminars to supplement the general interest seminars. Topics covered in the special seminars include developmental biochemistry, photobiology, reproductive biochemistry, intermediary metabolism and molecular genetics. Everyone participates in the Monday and Friday general seminars, with interest groups meeting at various times during the week. Guest speakers normally meet with the Monday or Friday noon general interest seminars.

For the last three years the Faculty have sponsored a Winter Seminar Series with invited outside speakers discussing a different topic each year of intense biochemical interest.



Harry D. Peck, Jr.

Professor and Head of Biochemistry
B.S., M.A., Wesleyan University
Ph.D. (1956) Western Reserve University

The biochemistry, bioenergetics and ecology of strictly anaerobic bacteria involved in the conversion of biopolymers such as cellulose to carbon dioxide and methane is the main area of Dr. Peck's research interest. He is particularly interested in the interactions between the sulfate reducing bacteria and the methanogenic bacteria in these complex microbial associations responsible for methane production. Current research projects supported by NSF and DOE include the enzymatic mechanisms of hydrogenase and sulfite reductase, the utilization of pyrophosphate as a source of energy for the growth of anaerobic bacteria, the genetics of the sulfate reducing bacteria and the role of hydrogenase in the generation of a proton gradient by the sulfate reducing bacteria. Dr. Peck has served on the editorial boards of the *Journal of Bacteriology* and *Biochimica et Biophysica Acta*, been a Foundation for Microbiology Lecturer, received awards for advanced study from the NSF, NIH and DOE. Full publications: 93

Clanton C. Black, Jr.

Research Professor of Biochemistry
B.S., M.S., Ph.D. (1960) University of Florida

Dr. Black's research now is centered around understanding the biochemistry of carbon, nitrogen, sulfur, phosphorus, and calcium assimilation in plants. Emphasis is placed upon the C_4 pathway of photosynthetic metabolism and the diurnal regulation of Crassulacean acid metabolism in higher plants. His research is regularly supported by the NSF and his laboratory of 5 to 10 persons normally is staffed by graduate students, postdoctoral students and visiting scholars with a decided international emphasis.

He has served as President and in other national and regional offices of the American Society of Plant Physiologists, as an Editor of *Plant Physiology* and *Weeds*, and on study sections of NSF. In 1982 he was chairman of the Gordon Research Conference on " CO_2 Fixation by Green Plants". He is a Fellow of the AAAS and in 1981 he was the recipient of the Merit Award from the Botanical Society of America in recognition of distinguished achievement in and contributions to the advancement of botanical science.

Full Publications: 140



John M. Brewer

Professor of Biochemistry
B.A., Ph.D. (1963) Johns Hopkins University

His research is in the areas of protein structure and function, particularly the mechanism of activation of enzymes by metal ions. He is currently using high field NMR of ^{31}P and $^{115}\text{Cd}^{2+}$ laser-excited lanthanide luminescence (Tb^{3+} and Eu^{3+}) and chemical modification techniques in his work.

Full Publications: 44

Milton J. Cormier

Research Professor of Biochemistry
B.S., Southwestern University
M.S., University of Texas
Ph.D. (1956) University of Tennessee

Dr. Cormier was a Research Associate with Dr. G. David Novelli at the Biology Division of the Oak Ridge National Laboratory from 1956 until 1958. He came to The University of Georgia in 1958. From 1964 to 1974 he held an NIH Career Development Award. His current research interests include studies on the role of calcium and calmodulin in cellular function in plants and fungi, the molecular biology of plant calmodulin, the molecular biology of coelenterate bioluminescence, and the enzymology of Ca^{++} -dependent regulation of coelenterate bioluminescence. He holds multiple patents, acts as a consultant for private industry, and has excellent research support from NSF, DOE and industry. He has also served as Associate Editor for *Photochemistry and Photobiology*.

Full Publications: 117

Richard D. Cummings

Assistant Professor
B.S. University of Montevallo
Ph.D. (1980) The Johns Hopkins University

Dr. Cummings is primarily interested in the biosynthesis, structure and function of glycoproteins in animal cells. Glycoproteins on the cell surface have many functions, such as receptors for hormones and other macromolecules, and are involved in many intercellular recognition phenomena, including tumorigenesis and embryogenesis. Dr. Cummings, whose work is supported by the NIH, is currently studying the carbohydrate moieties of several different cell surface receptors in human cells and is additionally analyzing the glycosylation of proteins in various normal and malignant human and mouse cells and in chicken embryos. To aid in the analyses of the carbohydrates in glycoproteins, Dr. Cummings is purifying and studying a number of different plant proteins, called lectins, which display high affinity binding to certain types of carbohydrate side chains in animal cell glycoproteins, and he has been instrumental in establishing the technique of serial lectin affinity chromatography.

Full publications: 12





Daniel V. DerVartanian

Professor of Biochemistry and Microbiology

B.A., Boston University

D.Sc. (1965) University of Amsterdam

His research interests center on the role of the respiratory chain (in particular iron-containing redox proteins) in the mechanism of oxidative phosphorylation, on the biosynthesis of c-type cytochromes, and on the role of redox-active metals such as nickel, iron, tungstate, molybdenum, etc. in the function of key biological enzymes such as hydrogenase, carbon monoxide dehydrogenase, nitrite reductase, formate dehydrogenase, sulfite reductase, etc., as studied by electron-spin resonance spectroscopy. He held an NIH Career Development Award from 1971 until 1976, has served on an NIH Special Study Section, and on the Editorial Boards of the *Journal of Bioenergetics and Biomembranes* and the *Journal of Bacteriology*. His research has been supported by NIH and NSF. He has received awards from the French Government, Netherlands Government and NATO for advanced study.

Full Publications: 60

Leon Dure III

Professor of Biochemistry

B.A., M.A., University of Virginia

Ph.D., University of Texas (1960)

Dr. Dure's research interests center on: Molecular Biology of Higher Plant Development. Specifically, regulation of expression of genes during seed embryogenesis; sequence analysis of developmentally regulated genes and their flanking regions; role of post-transcriptional regulation in mRNA abundance changes; function of abscisic acid induced proteins. Dr. Dure was a NIH Career Development Awardee, has served as President, International Society for Plant Molecular Biology and has been a member of the NSF panel for Developmental Biology. He was Co-Director, NATO Advanced Study Institute on Structure and Function of Plant Genomes, Pato Portese, Italy, 1982 and has research support from NIH, NSF and industry. Dr. Dure has also served on the editorial boards of *Plant Physiology*, *Planta* and *Plant Molecular Biology*. Dr. Dure is also Director of the Center for Plant Molecular Biology.

Full Publications: 60



Richard V. Eck

Associate Professor of Biochemistry
B.S. (1943) University of Maryland

Mr. Eck is especially interested in theoretical biology and the application of mathematics to biological information. From 1954 to 1963 he worked on the evolution of protein molecules and the cryptogrammic approach to biochemical data. He joined The University of Georgia in 1968 and has been Biochemistry Undergraduate Advisor since 1979. He is currently writing a book for students and the general public, which interprets biology in terms of our current biochemical understanding.

Full Publications: 17

Claiborne V.C. Glover III

Assistant Professor of Biochemistry and Genetics
B.A., Duke University
Ph.D., (1979) University of Rochester

Dr. Glover's research interests are concerned with the phosphorylation of chromosomal proteins. His laboratory is currently focusing on casein kinase II, a protein kinase which phosphorylates a variety of nuclear proteins, including all three eukaryotic RNA polymerases. This enzyme has been purified to homogeneity from *Drosophila melanogaster* and characterized in detail. Antibodies raised against the *Drosophila* enzyme are currently being used to screen a variety of cDNA and genomic expression libraries in an attempt to isolate both the *Drosophila* and the yeast genes coding for the two enzyme subunits. *In vitro* mutagenesis and transformation will then be used to generate null and conditional mutations in these genes in order to analyze the function of casein kinase II *in vivo*. Dr. Glover's research is supported by NIH.

Full Publications: 14

John W. Lee

Professor of Biochemistry
B.S., Ph.D. (1960) University of New South Wales

His research interests are centered on the mechanism of bioluminescence in the luminous bacteria, and applications of laser spectroscopy to biochemical problems including fluorescence lifetimes, polarization, and Raman spectra. Collaborative research with the Department of Biochemistry, Agricultural University, Wageningen, The Netherlands, involves measurements of fast lifetimes of fluorescent proteins isolated from luminous bacteria. Study of luciferase reaction mechanism is being done by 360 MHz-NMR. Work on structure and sequence of some of these proteins is supported by NIH, and NSF. Calibration of underwater photometers for measurement of bioluminescence has been carried out with support from the Office of Naval Research. Dr. Lee has served as Associate Editor of *Photochemistry and Photobiology*.

Full Publications: 71



Jean LeGall

Research Professor of Biochemistry and Microbiology
B.S., M.S., Ph.D. (1967) University of Aix-Marseille

The central theme of Dr. LeGall's research is the study of structure/function relationships of electron transfer proteins and enzymes from strictly anaerobic bacteria such as the sulfate reducing and methanogenic bacteria. The electron transfer proteins include rubredoxin, flavodoxin, multiheme c-type cytochromes and ferredoxin; the enzymes include hydrogenase, sulfite reductase and nitrite reductase. Current research projects, well supported by NSF and NIH, include the role of nickel in the catalytic site of hydrogenase, the biological interconversion of three and four non-heme iron centers, the mechanism of nitrite reductase and the determination of the three dimensional structures of sulfite reductase and a new type of rubredoxin. Dr. LeGall has served on the editorial board of *Biochimie*, *Annales de Microbiologie*, has received the Pasteur Award from the French Academy of Sciences and serves several study sections for the French Government.

Full Publications: 127

Lars G. Ljungdahl

Georgia Power Distinguished
Professor of Biochemistry and Microbiology
B.S., Stockholm Technical Institute
Ph.D., (1964) Case Western Reserve University

Dr. Ljungdahl's research concerns the enzymology of the net formation of acetate from carbon dioxide involving folate and vitamin B₁₂ and the biochemistry and physiology of new types of thermophilic bacteria capable of degrading biopolymers such as starch and cellulose to products such as ethanol or acetate. Current research projects include catalytic roles of iron, selenium and tungsten in formate dehydrogenase, purification and characterization of the folate requiring enzymes involved in acetate-formation, the role of nickel in carbon monoxide dehydrogenase, the bioenergetics of net acetate formation, isolation of new strains of thermophilic bacteria from the hot springs of Iceland and the selection of new thermophilic strains for ethanol formation. Dr. Ljungdahl received a Von Humbolt Award from the German Government (1974-75) for advanced study at the University of Gottingen and an award from the Swedish Government for advanced study at the Swedish Forestry Products Research Laboratory (1982-83) and is a Foundation for Microbiology Lecturer. He has served on study sections of DOE, has extensive research support from NIH, DOE, DOT and serves as Director of the Center for Biological Resource Recovery.

Full Publications: 84



Joseph F. Mendicino

Professor of Biochemistry
B.S., Case Institute of Technology
Ph.D. (1958) Western Reserve University

Dr. Mendicino's research is concerned with the hormonal regulation of carbohydrate metabolism and the biosynthesis and function of cell surface glycoproteins. Current studies include cultivation of carcinoma and mucus secreting cells and the isolation and translation of mRNA and cDNA coding for tumor antigen and mucin glycoproteins. His research programs receive strong funding from the NIH. The primary emphasis of his teaching program is to provide students with an in depth multidisciplinary background in cell and molecular biology. He participated in the editing, writing and reviewing of numerous papers and grants and is serving on a study section of NIH.

Full Publications: 71



Alan E. Przybyla

Associate Professor of Biochemistry
B.S., University of California at Berkeley
Ph.D., (1973) University of California at Berkeley

The regulation of gene expression in eukaryotic cells is the major emphasis of this laboratory. Cultured mammalian cells are used to study the induction of genes coding for heat shock or stress proteins as well as the induction of exogenously acquired Murine Mammary Tumor Provirus. In both cases, the interaction of effectors such as steroid hormones, heavy metals, toxic reagents and physiological stressors with the nuclear genome are being investigated. Rat genomic and cDNA clones are being used to examine the role of non-coding flanking sequences in effector recognition and tissue-specific gene expression. The role of DNA methylation in the overall expression of these gene systems is yet another line of research being pursued. Dr. Przybyla is currently serving as the Graduate Coordinator of the Department of Biochemistry.

Full Publications: 19



Norman G. Sansing

Associate Professor of Biochemistry
B.S., M.S., Auburn University
Ph.D., (1962) Iowa State University

Dr. Sansing spent 1962 to 1964 as a Research Associate at the Biology Division of the Oak Ridge National Lab with Dr. E. Volkin. He came to The University of Georgia in 1964 where he has been largely concerned with development of the undergraduate instructional program in biochemistry and student advising. He presently serves as Chief Health Professions Advisor for the College of Arts and Sciences and has served as President of the *National Association of Advisors for the Health Professions*.

Full Publications: 2



Prakash N. Srivastava

Professor of Biochemistry
B.S., M.S., Lucknow University
Ph.D. (1965) Cambridge University

His research interest centers on: Enzymology of sperm and of the female reproductive organs; Isolation of sperm membranes and lysosomal enzymes; Hormonal regulation of lysosomal enzymes in female reproductive tract; Role of sperm acrosomal enzymes in the penetration of the ovum and fertilization. He has served in the Special Study Section of NIH, was a World Health Organization fellow at Cambridge in 1975, and his research is supported by NIH.
Full Publications: 48



James Travis

Professor of Biochemistry
B.S., University of Manitoba
Ph.D. (1964) University of Minnesota

Dr. Travis' current research involves the determination of the biochemical basis for the development of pulmonary emphysema, including the role of plasma proteinase inhibitors, neutrophil and mast cell proteinases, and connective tissue proteins in abnormal lung turnover. In addition, projects are also being continued which involve the role of proteolytic enzymes and inhibitors in the development of rheumatoid arthritis and muscular dystrophy. Dr. Travis has served on Study Sections of NIH and his research is supported by NIH, Council for Tobacco Research and Industry and he has been a Career Development Awardee of the NIH.

Full Publications: 88



John E. Wampler

Professor of Biochemistry
B.S., Ph.D. (1969) University of Tennessee

Trained in the molecular spectroscopy of biological compounds at the University of Tennessee, Dr. Wampler's research interests are in the roles and uses of the electronic excited states of biological molecules with regard to basic research on the mechanisms of annelid bioluminescence and with applied research using luminescence and other sensitive analytical techniques. Dr. Wampler also directs the efforts of the Instrument Design Group in developing computer controlled instrument systems for biochemical research using minicomputers, microcomputers, and modern spectroscopic and video techniques. Instrument Systems and software designed by this group are now in use in over 25 major laboratories worldwide. His research is supported by NIH and he served as Executive Editor of *Analytical Instrumentation*.

Full Publications: 44



Jointly Staffed Faculty

Joe L. Key

Research Professor of Botany
On Leave, Vice-President for Research, Agrigenetics, Inc.
B.S., University of Tennessee (Martin)
M.S., Ph.D., (1959), University of Illinois
Research interests—protein and nucleic acid synthesis and regulation in plants.

Gordhan L. Patel

Professor and Head of Zoology
A.B., Ph.D., (1964), Washington University
Research interests—enzymology of acidic nuclear proteins.

James J. Peifer

Associate Professor of Nutrition and Biochemistry
B.S., Ursinus College
Ph.D., (1954), Rutgers
Research interests—metabolism of polyunsaturated fatty acids.

Dr. B.H. Vincent Huynh

Assistant Professor of Physics, Emory University and Adjunct Assistant Professor of Biochemistry
Research interests—applications of Mossbauer spectroscopy to obtain structural and functional information about metalloproteins and related synthetic model compounds. The proteins of interest are hydrogenase, sulfite reductase, nitrite reductase, rubredoxin, ferredoxin and heme-compounds.

Dr. Antonio Xavier

Professor, New University of Lisbon and Adjunct Professor of Biochemistry.
Research interests—Study of Magnetic techniques (NMR, Mossbauer, EPR) to structure and function of metalloproteins from the sulfate-reducing bacteria.

Dr. Jose Moura

Associate Professor, New University of Lisbon and Adjunct Associate Professor of Biochemistry
Research interests—use of NMR, EPR and Mossbauer spectroscopy to study the electron transfer proteins of the sulfate-reducing bacteria with particular emphasis on the iron-sulfur cluster conversion in ferredoxins, hydrogenase, etc.

Dr. Isabel Moura

Assistant Professor, New University of Lisbon and Adjunct Assistant Professor of Biochemistry
Research interests—Study of redox proteins from different bacterial strains of the sulfate-reducing bacteria by use of nuclear magnetic and electron paramagnetic resonance spectroscopy; with particular interest on heme and molybdenum containing redox centers.

Emeritus Research Professor of Biochemistry

William L. Williams

B.S., Univ. of Minnesota
M.S., Ph.D. (1949), University of Wisconsin