



### FROM THE DEPARTMENT HEAD

Thomas E. Roche

The Department is steadily progressing in laying foundations for a new tomorrow. We are developing a biotechnology core facility and greatly increased capabilities for macromolecular structure investigations. These facilities will serve the entire University but should have a substantial impact on the Department of Biochemistry. Phase II of the Chemistry/Biochemistry building is contending with Phase III of Engineering as the next major construction project. Efforts to rebuild the faculty staffing of the Department continue with the hiring of a director of the biotechnology facility. John Tomich from the University of Southern California has accepted the position. He will have a 0.5 appointment in that position and 0.5 appointment as a biochemistry faculty member. The University, under the direction of the Board of Regents, is proceeding through a program review and analysis of roles and aspirations. That process will surely help recognize the central importance of Biochemistry in the future development of Kansas State University. All of the above are works in progress, but being an optimist, I expect success on all fronts.

I would like to comment further on the core facilities. The foundations for these developments were laid by grants--an NIH equipment grant in the case of the biotechnology core facility and a state-wide NSF-EPSCoR grant to acquire a high field NMR through the matching-funds portion of this multirequest proposal. Considerable additional support for development of the biotechnology core facility is coming from Central Administration, Agriculture Experiment Station, College of Arts and Sciences, College of Veterinary Medicine as well as the Department of Biochemistry. Regarding the NMR proposal, matching

funds have been appropriated at the State level but we are still awaiting the results of the NSF review. The University is committed to hiring a director who will oversee the operation of the NMR and analyze NMR data. Every laboratory in the Department is either directly engaged or indirectly linked to recombinant DNA technology for investigating protein functions. Thus, the protein sequencing, peptide synthesis and oligonucleotide synthesis being performed by the biotechnology core facility will greatly aid our efforts. Many of us are generating small protein structures (hydrolase inhibitors, regulatory subunits, or domains from larger proteins) whose three-dimensional structures are potentially solvable by multinuclear high field NMR studies. Also, NMR techniques are a powerful tool for studying dynamic changes in the structure of proteins and the interaction of smaller proteins with larger ones. The marriage between these biophysical studies and biotechnology approaches will allow the full potential of biotechnology to be implemented in doing intelligent (i.e. structurally guided) site-directed mutagenesis to elucidate and modify protein roles.

The anticipated effect of the Department faculty being reduced to 8 out of 14 in mid-1989 was felt in the last year as our extramural funding dipped. The good news is that the rebuilding effort, which affects everyone's ability to get the job done, is taking hold at a near optimal rate considering we still have three open positions. Ten faculty now have some form of extramural support and prospects for further support look promising. I am sure you recognize how critical that is for the Department to meet its primary research role (supported by the Agriculture Experiment Station). Furthermore, maintaining strong and modern research programs constitutes an essential component in graduate student education and enriches the insights faculty can transmit at all levels of undergraduate education.

I want to end this section by again giving you insight into the accomplishments of one of our faculty--Subbaratnam Muthukrishnan (Krishnan to all). Krishnan joined the Department in 1980 and introduced recombinant DNA technology. He operates a multifaceted research program. He is a leader in elucidating the role hormones play in influencing gene expression during seed germination. For instance, his laboratory is preparing individual barley aleurone cells (i.e. protoplasts) and investigating hormone regulation at the gene level with these cells. This involves introducing plasmids that are specifically engineered to uncover the control elements that influence expression of

the gene for  $\alpha$ -amylase ( $\alpha$ -amylase breaks down starch in the germinating seed). He is also investigating anti-insect and anti-fungal defenses in plants with a particular interest in plant chitinases. These enzymes attack the outer chitin structure of insects and fungi. Krishnan's extensive expertise has led to collaborations with many investigators. I will just mention a couple. He collaborates with Karl Kramer in studying enzyme induction by hormones (ecdysteroids) in association with molting stages in tobacco hornworm. He also collaborates with Jerry Reeck in studies on plant protease inhibitors. Krishnan's research has been steadily supported by NSF, USDA, and Rockefeller Foundation grants.

Krishnan received the Stamey teaching award for his efforts in Elementary Biochemistry. As in other courses, he received outstanding teaching evaluations in this course. That is a unique accomplishment as this course is not one of the favorites of the nutrition and dietetics students who take it. Krishnan advises a large group of undergraduates and, besides having his own large research group, he has been on so many graduate student advisory committees that he has lost count.

The above barely touches on Krishnan's activities and accomplishments. Krishnan additionally is one of the nicest and most generous faculty members that I have worked with on this campus. Indeed, his accomplishments are all the more amazing considering the great deal of time he puts into working with and helping others in their research endeavors. Yes, he's in the laboratory on Saturday and Sunday, but he is also missing award ceremonies so he can be off camping with his sons. We know what a jewel Krishnan is and just keep our fingers crossed that his career will be long, and all at KSU.

#### DEPARTMENT UPDATE

Ramaswamy Krishnamoorthi has been promoted to Associate Professor with tenure effective this fall.

Del Mueller spent the spring and summer on sabbatical at Washington University in St. Louis conducting NMR studies on ribulose biphosphate carboxylase.

The Department has established annual awards for graduate teaching assistants and graduate student research. This year's winners were Sheba Ignatius in teaching and Grace Lin in research. Subbaratnam Muthukrishnan and Owen Koeppel won College of Arts and Sciences teaching awards.

#### FACULTY ACTIVITIES

From Charlie Hedgcoth. While still doing research with nucleic acids, my emphasis has moved from structure/function studies of tRNA to explorations of plant genes in both the nucleus and mitochondria of wheat. Interspecies crosses yield wheat plants with nuclear-

mitochondrial incompatibility leading to aborted pollen production and male sterility. Studies involve characterizing mitochondrial genes, transcription of genes, and a protein produced only in the male sterile plants. Spin-off of these efforts led to a commercial collaboration to produce artificial male steriles to enhance hybrid wheat breeding. Cloning and sequencing of wheat nuclear genes for endosperm storage proteins provided some of the first insights into the structure of these proteins. The clones from this project also are of value as markers for fertility restoration of the male sterile state, as gliadin genes are located in the same chromosomal regions as genes for fertility restoration. Although tRNA studies are no longer a main emphasis, lysine tRNA genes are being cloned and characterized in order to understand differential expression of two isoaccepting species.

From Michael Kanost. My laboratory is investigating two types of proteins present in the hemolymph (blood) of insects. We are studying serine proteinase inhibitors from the serpin gene superfamily. Serpins in vertebrate serum regulate pathways involving cascades of serine proteinases such as blood clotting (antithrombin, antiplasmin) and complement activation (C1 inhibitor) as well as proteinases released from neutrophils ( $\alpha_1$ -antitrypsin,  $\alpha_1$ -antichymotrypsin). One goal of our research is to understand the biological functions of serpins in insects by identifying the enzymes they inhibit *in vivo* and characterizing their physiological roles. We also study the structure and regulation of the insect serpin genes through DNA cloning and sequencing. We have focused on larvae of the tobacco hornworm, *Manduca sexta*, as an experimental insect and are beginning studies of *Drosophila melanogaster* with the aim of genetic analysis of serpin function in insects.

We are also investigating an insect protein related to immunoglobulins whose synthesis is induced by bacterial infection. Its concentration in hemolymph increases forty-fold after injection of bacteria. This protein, named hemolin, is composed of four immunoglobulin domains. It appears to have a role in regulating the adhesive properties of hemocytes (blood cells) and may act as an opsonin to enhance phagocytosis of bacteria by hemocytes. We are studying the molecular interactions of hemolin with hemocyte cell surfaces and the regulation of the hemolin gene.

From Owen Koeppel. Since leaving central administration in 1987, I have had the privilege of working with an outstanding group of faculty and students in the Biochemistry Department. I did not attempt to reestablish a research program, but spent most of my time teaching in this department and doing a few things in Science Education. My treatment upon returning to the real world has been absolutely terrific, which is often not true for ex-administrators. The most fun and challenge was teaching General Biochemistry on several occasions. The classes were too big (over 100), but most of the students worked hard and seemed genuinely interested in the subject.

Having retired as of the end of May, my wife and I have made the difficult decision to move back to Columbia, Missouri where we lived for 25 years and have some family ties.

From Jerry Reeck. Last August, after a little more than two years as associate dean of the graduate school, I returned to the department on a full-time basis. I soon discovered what I should have known all along: it's hard to find a better job than that of a professor. The opportunity to interact with students, from first-year undergraduates to Ph.D. candidates, and the freedom to pursue one's own interests as a researcher are really extraordinary privileges. I spent the fall semester getting reacquainted with the members of my laboratory, working with several of them to chart a course for finishing their degrees, and trying to reestablish a feeling for the directions that our projects should take in the next several years. I hope to make inhibitors of  $\alpha$ -amylase a major emphasis, to continue our work with inhibitors of activated Hageman factor, and to find a niche in the suddenly explosive area of HMG1 DNA-binding molecules. In the latter work, we will collaborate closely with Dr. Kirk Clark, a (relatively) recent graduate from my laboratory, who is now at Rockefeller University learning X-ray crystallography. In the spring semester I greatly enjoyed my first classroom teaching assignments for some time: a seminar course in the Arts and Sciences honors program and the proteins course (BIOCH 930). The highlight of the spring was the retirement dinner for Owen Koeppel. Several lost points were provided by some ineffectual sessions on the golf course. (But as long as your partners are not too much better, it's still fun! The aforementioned partners will, of course, remain unidentified.)

From Sam Wang. My main research interest is the biochemical and molecular mechanisms by which plants respond to environmental constraints. My current studies focus on the role and regulation of phospholipases in cellular metabolism. Phospholipases are a group of enzymes hydrolyzing glycerol phospholipids at different positions of ester linkage, and their activities may generate chemical messengers which transduce hormonal and external signals into physiological responses. One major aspect of my present program is to carry out molecular characterization of these enzymes by using antibodies and gene cloning and manipulation. Another aspect is to identify the cellular processes which are mediated by these enzymes and their reaction products. Various experimental approaches ranging from whole plant physiology and enzyme biochemistry to molecular biology are being used in these studies. Two graduate students joined my laboratory: James Dyer is working on the isolation and characterization of a membrane-bound phospholipase, and Yao Zhang is cloning and sequencing a gene encoding a soluble form of this enzyme.

## RECENT GRADUATE DEGREES

1991

Beiqian (Betty) Shi (MS, Davis) "Physiological Studies of Nitrogenase nif H Mutations in *Klebsiella Pneumoniae*." She is working in industry in New Jersey.

Wenxia Song (PhD, Rintoul) "Physical Properties and Biological Functions of Glycosphingolipids." She is a postdoctoral student at University of California, San Francisco.

1992

Marilyn Baguion (PhD, Davis) "Amplification, Cloning and Sequencing of the nif H Gene from *Klebsiella Pneumoniae* and the Characterization of the Iron Protein." She is working with Brad Fenwick in the KSU College of Veterinary Medicine.

Chan-Lan Sun (Grace) Lin (PhD, Krishnamoorthi) "A Proton NMR Study of Trypsin Inhibitors from Pumpkin Seeds."

## NOTES FROM ALUMS

Doug Brandt (PhD '81) is the Research and Development Manager in the Thyroid, Metabolism, Cardiovascular Section of Abbott Laboratories. This large division has been successful in bringing several products to market.

Rich Cate (PhD '79) is continuing as a Section Leader at Biogen, Inc. He has developed new bioassays for and understanding of the action of the Mullarian-Inhibiting Substance which prevents development of female reproductive organs in males.

Kirk Clark (PhD '91) is at Rockefeller University in New York City learning the art of crystal growing using DNA-protein mixtures. Specifically, he uses a transcription factor and short pieces of defined binding site DNA. He, Brenda and Nicole enjoy the big city and a place to spend a little time, but aim to go elsewhere in a year or so.

Kevin Conricode (PhD '90) is working with J. Exton, a Howard Hughes investigator, in Nashville. He is looking at signal transduction pathways in fibroblasts. His specific interest is in phospholipases and their action on phosphatidyl choline.

Jim Fishback (MS '79) is in the Pathology Department at KU Medical School. He does a lot of autopsies, especially for infectious diseases, and heads the teaching of the pathology course. His research focuses on toxoplasmosis, a major killer in AIDS.

Subramanian Gopalakrishnan (PhD '90) and Bhuvana Gopalakrishnan have postdoctoral research appointments in the KSU Division of Biology and Biochemistry, respectively.

Kirk Hayenga (MS '82) is on the west coast in the process development division of Genentech. He is working on the expression of proteins in *E. Coli* and human cell cultures, and the purification of the expressed products. Brian Lawless, who was a post-doctoral fellow with Tom Roche, is head of that division.

Jack Huang lives in Macomb, Illinois and commutes to Peoria, where he works for USDA.

Elaine Jacobson (PhD '70) has moved from North Texas University to the University of Kentucky School of Medicine where she is in the Department of Clinical Sciences.

Myron Jacobson (PhD '69) has also moved from North Texas University to the University of Kentucky School of Pharmacy where he is Chair of the Division of Medicinal Chemistry and Pharmaceutics.

Joe Jilka (MS '72) worked three years at Monsanto searching for new mechanisms of plant virus resistance working in a group headed by Bob Fraley. He has now assumed a position in related research at Pioneer Hybrids.

Wade Leitner (BS ) is in Tucson as an electrical engineer studying biogeography. His wife, Pat, is a CPA.

Melissa McMurray (MS '82) has made a career change. She teaches painting in Colorado while raising a family.

Debra Montgomery (MS '87) continues her research at Abbott labs (Chicago) studying topoisomerase function. She also does a lot of running to girl scouts, cub scouts etc.

Dan Morrison (PhD '88), working at the University of Illinois-Chicago, has NIH support for his work on the palmitoylation of rhodopsin and the effects of this on its interaction with G proteins.

Ernie Pitts (MS '88) is in California where he is a flight instructor, hoping to get into a major airline soon. He has two children, the younger boy being about a year old.

Rownak Rahmatullah (PhD '88) is at Auburn researching gene expression in plants.

Harold Rathburn (PhD '89) has been at USDA in Beltsville, MD, but will be moving to the University of Oklahoma.

Maureen Rider (BS81) works in Pathology at the KSU Vet School, commuting from Westmoreland.

Wolfgang Schaller (BS '89) is in his third year at the University of Iowa studying the interaction of calcium with calmodulin.

Behrooz Sharifi (PhD'84) spent a year at Cetus after leaving KSU. He is now an Associate Professor at UCLA Medical School and a researcher at Cedars Sinai Medical Center. He is working on causes of reocclusion of arteries after balloon angioplasty, a major problem in cardiology.

Basil Shorosh (PhD '89) is still at the Noble Foundation in Ardmore, OK, and is beginning to move into the job market.

Paula Ostrovsky deSpicer (BS ) is completing her PhD in microbiology at the University of Illinois this summer.

Dan Stoops (MS '78) continues work in Animal Sciences at the University of Missouri-Columbia.

Beth Strifler (MS '84) is doing research in cardiology, isolating a 15 kD protein that likely forms channels in

membranes. Her second baby girl arrived early this year, and they have been doing house construction to add needed space.

Carol Dziadik Turner (PhD '81) is in the Kansas City area. She took last year off from teaching to spend more time with sick, first grade twins.

Lisa Wen (PhD '83) is at Western Illinois University, cloning and expressing trypsin inhibitors.

Mark Wetzel (BS ) is a physician in an internal medicine group practice here in Manhattan.

Don Wright (PhD '75) is involved in environmental testing with Pace Industries in the Kansas City area.

## OLD FRIENDS

Bob Clegg continues living in Manhattan, between trips to interesting parts of the world. Last year he was in Indonesia, traveling with a friend who had business there. He has made several trips to Europe where his son works at the Max Planck institute in Gottengen, Germany. He reports that he gets together about once a month with the other biochemistry retirees living in Manhattan: Burkhard, Mitchell, Nordin, Parrish, and Ruliffson.

Howard and Leola Mitchell are well and still living in Manhattan. They celebrated their 50th wedding anniversary last year. They travelled in Texas and Mexico last winter. They have sold their trailer, but are planning to continue travelling without a trailer to pull.

Phil and Norma Nordin have been on trips to Arizona and the west coast. Phil has relatives in British Columbia. Their son changed from being an engineer to a minister in the Lutheran church. He is currently serving a church in West Union, Iowa.

Bill and Ruby Ruliffson continue to travel a great deal. They drove to Oregon this spring visiting relatives, Timberline Lodge on Mt. Hood, Portland, and many others. Last year they were in the San Francisco area. At the writing of this news item, Ruby reported that Bill was in the middle of a bike trip across Georgia. He has made the trans-Iowa trip eight consecutive years.

## WEST CENTRAL STATES BIOCHEMISTRY CONFERENCE

The Department will be hosting the 35th West Central States Biochemistry Conference on October 30-31, 1992. The Keynote speaker will be Professor Jacqueline Barton of the Division of Chemistry at Cal Tech. She will discuss her work on the recognition of nucleotide sequences in DNA by chemical agents and proteins. This would be a good time for alums to visit Manhattan. You can get more details about the conference by calling the Department.