

History of the Department of Biochemistry and Molecular Biology at the University of Arkansas for Medical Sciences

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This chapter summarizes the history of the UAMS College of Medicine Department of Biochemistry and Molecular Biology. The material is divided into three time periods: from its beginning in 1946 through to 1990; the period from 1990-2009, with Dr. Alan Elbein as Chair; and from 2010 to the present, with Dr. Kevin Raney as Chair. This latter period is divided into two sections covering 2010-2014 and 2015-present. Emphasis is placed on the growth and development of the department over the years, the primary faculty and their accomplishments, research areas and core facilities, educational missions, and service activities.

1946-1990

What follows is a brief summary of the history of the department from its founding in 1946 to 1990. A more detailed history of these early years can be found in the **Historical Perspectives: The College of Medicine at the Sesquicentennial**, edited by Max L. Baker, Ph.D. (Chapter 5 by Wadkins, Peck and Hogan).

The current Department of Biochemistry and Molecular Biology grew out of what was initially the division of Chemistry and later known as the Department of Physiological Chemistry. In 1946, while under the leadership of Dr. Paul L. Day, the department's name was formally changed to the Department of Biochemistry. During Dr. Day's tenure as Chair, the department increased to as many as seven faculty and assistants. Research programs were emphasized and an M.S. degree program in Biochemistry, the first graduate program at Little Rock, was developed.

Dr. James S. Dinning became Chair in 1959. He continued the previous emphasis of the department on nutrition research and graduate student education. During this period 13 M.S. degrees and 2 Ph.D. degrees were awarded.

In 1963, Dr. Ezzat Younathan served as Acting-chair of the department until the appointment of Dr. Charles Wadkins in 1966. Under Dr. Wadkins, the faculty increased from 13 to 24 members and included two with primary appointments in the Department of Pediatrics, one in the Department of Pathology, four in the Veterans Administration Hospital, and eight in the newly formed National Center for Toxicological Research. This faculty developed and offered introductory courses for both graduate and medical students, and several advanced courses which were required of graduate students were also available as electives to medical students.

The curriculum was significantly retooled during the Wadkins years with an emphasis placed on a "problem solving" approach. For the freshman medical biochemistry course, for example, the lecture portion was reduced and structured to highlight concepts to be utilized to solve problems related to molecular pathology. The standard laboratory experience was replaced with individual research projects for each medical student. Shortly thereafter, a new problem solving approach was designed where students presented a series of 12 clinical correlation

topics during the semester. In developing this novel approach to learning, the Department of Biochemistry at UAMS led the nation in being the first program to incorporate a block of clinical correlation projects in the teaching of a biochemistry course.

The number of research programs also expanded during the Wadkins years and encompassed diverse areas which included the development of radioimmunoassay of various hormones; the study of hyperlipoproteinemia; neurochemical correlates of behavior; the mechanism of arsenate uncoupling of oxidative phosphorylation; fibrinogen structure; the enzymology of aspartokinase; structure function studies of Na^+, K^+ -ATPase; the subunit structure of human serum lipoproteins; the mechanism of biological calcification; and leucocyte and lipid metabolism. Many of the research programs of the department were carried out in collaboration with faculty from clinical departments and they provided the basis of instruction for an enlarging graduate student population. Twelve M.S. and 21 Ph.D. degrees were awarded between 1966 and 1976.

In 1980, Dr. Wadkins stepped down as Chair of Biochemistry and Dr. Grady Smith assumed the role of Acting-chair until the appointment of Dr. Ernest J. Peck, Jr. in December of 1981. One of Dr. Peck's first initiatives was to hold a faculty retreat at DeGray State Park Lodge to assess the current holdings and liabilities of the department. The results of that retreat included the creation and/or restructuring of three departmental committees (Executive, Graduate Education, and Medical Education), the formulation of a policy document for the department, and the initiation of new collaborative research efforts amongst the faculty.

During Dr. Peck's tenure as Chair, the major efforts of the department were in five areas: medical education, graduate education, faculty development, research, and physical plant renovation. Unique to its time, the freshman medical biochemistry course utilized computer-assisted self-assessment, self-instruction and small group interactions, with emphasis on recall and reasoning rather than memorization. The graduate program reached a steady-state of 12 students and new efforts including revision of graduate curriculum, increased recruiting, and improved graduate stipends, were initiated to continue growth of the program. By 1985 the faculty held or coauthored 27 grants from intra-and extra-mural sources with funding totaling \$1,083,479 for the year. That year, the combined primary and secondary faculty published 104 peer-reviewed articles, 34 book chapters or reviews, and 122 abstracts. The steadily growing productivity of the faculty and students improved the visibility and priority scores of the program.

The years 1986-1989 saw several important milestones for the department under the continued leadership of Dr. Peck. In 1987, the name was modified to the Department of Biochemistry *and Molecular Biology*, to reflect a growing emphasis on investigation and instruction at the DNA as well as protein level. Coincident with this was the purchase of an oligonucleotide synthesizer and protein sequencing system as part of a newly formed Molecular Biology Core, a forerunner of the more sophisticated and comprehensive core facilities available at UAMS today. In 1988, a laboratory-based hands-on summer course in molecular biology was expanded to include faculty from other institutions to help familiarize them with this newly developing discipline.

From late 1988 to October 1989, Dr. Peck was on an off-campus assignment at the National Science Foundation and departmental activities were overseen by Vice-Chair Dr. Charles Winter. Soon after returning Dr. Peck submitted his resignation to accept a position at the University of Nevada and Dr. Winter assumed leadership duties as Interim Chair.

1990-2009



In August of 1990, Dr. Alan Elbein accepted the position of Chair, at first on a part-time basis and then in a full-time capacity effective January, 1991. Dr. Elbein set an agenda to strengthen research and education programs within the department through vigorous efforts in faculty recruitment, graduate student recruitment, reorganization of core courses, and improvements in infrastructure and facilities. The business manager during this time, Iva McKinnie, deserves special mention here, since her dedication and commitment to the department were central to the administration of the new Chair's mission. Highlights from these major areas of emphasis during the years of Dr. Elbein's tenure as Chair are provided below.

Dr. Alan D. Elbein, 1933-2009

Faculty Recruitment and Research Areas of Strength

In late 1990 the primary faculty members comprised Drs. Gary Bannon (protein and peptide structure); Helen Benes (insect gene expression); Ann Benson (carcinogenesis); Chidambaram Bhuvaneshwaran (metabolism and bioenergetics); Donald DeLuca (oxidation and metabolism); Alan Elbein (glycoproteins); Wai-Choi Leung (bioengineered proteins); William (Grady) Smith (enzyme kinetics); Charles Wadkins (mitochondrial function, calcification); Charles Winter (membrane ATPases); Yun-Chi Yeh (growth factors and oncogenes); and John (Lyndal) York (glutathione transferases). Dr. Barry Hurlburt (transcription factors) was also recruited that year and in 1992 joining the faculty were Dr. Richard Drake (gene therapy), Dr. Kamal Mehta (sterol regulation of gene expression) and Dr. Mark McCammon (ethanol and acetate metabolism). Additional recruiting efforts saw the following faculty members joining the department: Dr. Timothy Chambers, 1994 (cancer drug mechanisms); Dr. Kevin Raney, 1995 (DNA enzymology); Dr. Randy Haun, 1996 (transcriptional regulation); Dr. Anna Radomska, 1999 (drug metabolizing enzymes); Dr. Donald Mock, 1999 (biotin nutrition); and Dr. Edathara Abraham, 2000 (alpha-crystallins).

The academic year 2001-2002 saw several major changes in the composition of the primary faculty. Drs. Bannon, Drake, Hurlburt, and Mehta left for positions elsewhere and Dr. Benes transferred to Anatomy. In addition, Drs. Benson and York retired, and sadly, after serving for over 30 years on the faculty, Dr. Bhuvaneshwaran passed away. To honor his memory and

dedication to the department, the Bhuvane Award for Excellence in Biochemistry Research was established, given to the student who presented what was considered the best biochemistry-focused poster at the annual UAMS Student Research Day. Offsetting these losses, three new Assistant Professors were recruited in 2001-2002; Dr. Grover Miller (cytochrome P450s), Dr. Alan Diekman (galectins in cancer) and Dr. Fusun Kilic (serotonin transport). The academic year 2002-2003 saw the addition of Drs. Wayne Wahls and Mari Davidson with a research focus on meiotic chromosome dynamics, and in 2003-2004 Drs. Giulia Baldini (hormonal control of appetite), Masahiro Higuchi (prostate cancer and mitochondria) and Craig Cooney (longevity mechanisms) joined the primary faculty. Dr. Elbein's last faculty hire was Dr. Alan Tackett in 2005 (epigenetics, proteomics), distinguished as being the first departmental graduate student to rejoin as a faculty member.

Significant contributions to the research and education missions of the department during this time were also made by faculty with secondary appointment in Biochemistry. These included Drs. Robert Reis, Karl Straub, Mark Crew, Gur P. Kaushal, Piotr Zimniak, Timothy O'Brien, Richard Komoroski, James Hardin, Charlotte Peterson, and Samuel Goldstein.

During the Elbein era research accomplishments saw significant growth with increases in funding and publications. For example, total research funding (direct and indirect) for primary faculty was about \$1 million for the year 1993-1994, rising to a high of \$5.4 million in 2004-2005, a year where primary faculty held 18 NIH grants, mostly R01s, together with several other large extramural awards. Noteworthy also was the funding of a 10-year NIH MERIT award to Dr. Don Mock, covering the period 2002-2012, one of only five such awards to date to investigators at UAMS. The number of peer-reviewed papers by primary faculty also rose during this time span, with 27 in the academic year 2003-2004, to 48 in 2004-2005, to a high of 58 in 2007-2008, representing an average of nearly 4 papers per primary faculty member.

An important initiative of Dr. Elbein's was the formation of a faculty research seminar series. These were held weekly throughout the fall and spring semesters with as many as 30 seminars per year. Speakers were invited from UAMS as well as regionally and nationally. The program allowed departmental faculty, postdocs and students to meet with prominent scientists from around the country and provided national visibility for UAMS. During Dr. Elbein's tenure as Chair over 400 speakers presented their work and the program has continued to the present day.

Centers of Biomedical Research Excellence

The National Institutes of Health initiated a new program in 1999 to establish Centers of Biomedical Research Excellence (COBRE) in states that were deemed underfunded. The purpose of these centers was to fund junior investigators and establish research environments that fostered success of junior faculty in obtaining new funding from the NIH. Only one submission was allowed per state initially and the University of Arkansas Department of Chemistry and Biochemistry was chosen to submit a COBRE grant to create the Center for Protein Structure and Function. Dr. Frank Millet of the Department of Chemistry and Biochemistry at UAF was the Principal Investigator. The grant proposal included a collaborative component with the Department of Biochemistry and Molecular Biology at UAMS. Dr. Kevin Raney was co-leader of one of the projects. With successful funding of the \$9 million proposal,

the Center for Protein Structure and Function was established at the UA. At the time, this was the largest single grant for research obtained in the state of Arkansas. The COBRE grant also included funding for two new faculty positions in the department and this supported the hiring Dr. Grover Miller (2002) and Dr. Alan Tackett (2005). The Center for Protein Structure and Function had a profound positive impact on research at both the UA and UAMS and continues to serve as a hub of research excellence.

Expansion of the Graduate Program

One of the most important items on Dr. Elbein's agenda when he joined as Chair was to strengthen the graduate program. Key to this was renewed endeavors in student recruitment. A Graduate Student Recruiting Committee was formed and charged with making vigorous and intensive efforts to disseminate information about graduate education at UAMS. This was done in large part by having faculty travel to undergraduate institutions in the state and region to talk about their research and advertise our graduate program. From 1993 to 2002 the average number of trips made was 13 per year, and this personal contact had a large impact, with the number and quality of applications increasing dramatically. During the years 1991-2009, 91 students began studies in the department that resulted in successful completion of the Ph.D. degree (69 students) or M.S. degree (22 students). Ten of the 69 Ph.D. students graduated with combined M.D./Ph.D. degrees. As an additional recruiting tool the department initiated a summer research program to introduce undergraduate students to the excitement of biomedical research. A paid ten week program of research and training was offered under the mentorship of participating faculty members. From 1991 to 2002 (years for which accurate records are available), 94 students participated in the program, with 12 of these subsequently joining the department as Ph.D. (11) or M.S. (1) students. The summer program continues to this day under the direction of Dr. Grover Miller and has been highly successful and used as a model by other departments and divisions at UAMS.

Evolution of Courses and Educational Programs

Medical Biochemistry: From Dr. Elbein's arrival up to the 1999-2000 academic year, Medical Biochemistry was relatively stable in content and format, and included mainly standard lectures and clinical correlations in approximately a 4:1 ratio. In the 1999-2000 academic year, with Dr. Karl Straub as Course Director, significant changes took place, and in particular clinical correlates of biochemistry were expanded and emphasized. These lectures were designed to highlight the integration of biochemistry and medicine by presenting a clinical case and exploring the biochemical basis of the disease. Specific disease topics were coordinated with lecture material. For example, if cystic fibrosis was a disease focus, the students learned about chloride transport, and how specific mutations in a chloride transporting membrane protein caused defects in hydration of epithelial cells expressing the altered protein. In 2003 the course switched from the spring to the fall semester so it could be offered in coordination with the Medical Cell Biology course. In the fall of 2006 Dr. Alan Diekman took over as Course Director and he has continued in this role to the present (2019) overseeing major changes as it transitioned to Molecules to Cells (see 2010-2014 period below).

Graduate courses: Major biochemistry graduate courses during this period included a core course in General Biochemistry which was taken by the majority of graduate students in the

basic sciences. Biochemistry students were also required to take two semesters each of Biological Chemistry, Genetic Biochemistry and Methods in Biochemistry in the first year, plus Integrative Biochemistry and electives in the second or later years. In 2001, Genetic Biochemistry was replaced by a new graduate course, Gene Expression, organized by the Department of Physiology and taught by faculty from several basic science departments. With the introduction of the Interdisciplinary Biomedical Science (IBS) Graduate Program in 2005, courses evolved further, with all IBS students taking a core course in Biochemistry.

In addition to regularly scheduled courses, the department also offered Special Topics courses, given on a voluntary basis by faculty members on a focused topic of interest. Some of the areas covered included multidrug resistance, signal transduction, apoptosis, proteins and enzymes, proteomics, chromosome dynamics, drug metabolizing enzymes, heme proteins, posttranslational modifications, vitamin transporters, and genetics of aging.

Another important aspect of training and education for Biochemistry Ph.D. students initiated at this time was the requirement to present two seminars a year in a formal Student Seminar Program. Typically students presented a research paper one semester and their own research in the other semester. Presentations were subject to evaluation by faculty which provided important feedback and improved the student's skills in organizing and presenting complex material. This course, unique to the department, continues to this day and has been of great value in the professional development of our students.

Infrastructure and Core Facilities

Infrastructure: The department at the time of Dr. Elbein's arrival was housed in the Shorey building and the biggest problem was the insufficient research space and facilities. The electrical system, heating and cooling systems, and facilities for conducting hazardous procedures, were all considered inadequate and were clearly impediments to research productivity. Many of these problems were solved with the opening of the Biomedical Research Center (or Biomed 1). Biochemistry was assigned the entire fourth floor, and moved from Shorey in 1993. Dr. Elbein was particularly thrilled to occupy the floor that connected Biomed 1 to the rest of campus, as he believed it increased departmental exposure. The department also had labs in Barton (Dr. Drake) and in Arkansas Cancer Research Center (Dr. Benson). Space was also assigned to Biochemistry in Biomed 2 when it opened in 2004, with Dr. Raney moving his labs at that time.

Development of a New Core Facility: In 1999, Dr. Elbein viewed proteomics technology as necessary for UAMS to remain competitive for funded research programs, and he convinced UAMS leadership that investment in this area would facilitate biomedical research. The Proteomics Core Facility was started with a grant from the Arkansas Biosciences Institute with funds from the nationwide Tobacco Settlement. Strong support from Dr. Charles Winter (Associate Dean of Research) was instrumental in obtaining funding to establish the facility. Dr. Kevin Raney was the first director of the UAMS Proteomics Core Facility from 2002 to 2007, which was located on the 4th floor of Biomed 1. Dr. Cheryl Lichti was the Assistant Director and she oversaw day-to-day operation of the facility. Dr. Rick Edmonson, who worked at the National Center for Toxicological Research, was extremely helpful in working with Dr. Lichti to set up the first mass spectrometer for identification of peptides. Dr. Edmondson would later

join the faculty at UAMS in the Cancer Institute and lead the proteomics facility associated with the Myeloma Research Institute. Long-term support for the Proteomics facility was provided by the Arkansas INBRE grant, led by Dr. Larry Cornett. In 2005, Dr. Alan Tackett was recruited back to UAMS after a successful postdoctoral fellowship in the lab of Dr. Brian Chait, a pioneer in protein mass spectrometry. Part of the recruiting package for Dr. Tackett was for new proteomics instrumentation that would become part of the Proteomics Core Facility. Dr. Tackett took over as director of the facility in 2007 with Dr. Sam Mackintosh acting as Associate Director.

Transition from 2009-2010

Very sadly Dr. Elbein passed away unexpectedly on November 30, 2009, following a brief illness. An obituary written by former faculty member Dr. Richard Drake can be found in *Glycobiology*, Vol. 20, pgs. 404–405 (2010). To honor his memory and especially his unwavering dedication and commitment to student education, the Alan D. Elbein Award for Extraordinary Performance in Research was established. This is awarded infrequently to departmental graduate students who have shown extraordinary research performance in their graduate career. Areas of evaluation include but are not limited to fellowships, manuscripts, and presentations. Following the death of Dr. Elbein, the Vice-Chair of the department, Dr. Chambers, served as Interim Chair while a search committee was put in place to identify a new Chair.

2010-2014

Effective July, 2010, then College of Medicine Dean Debra Fiser appointed Dr. Kevin D. Raney as Chair of the department. Dr. Raney had started his career in the department as an Assistant Professor in 1995. He was promoted to Associate Professor with tenure in 2001, then promoted to Full Professor in 2007. Dr. Raney was charged with maintaining a strong program that was in place as a result of the leadership from Dr. Elbein. Emphasis in cancer biology research was desired based on the campus-wide goal of establishing an NCI-designated Cancer Institute. Growth in this direction was aided by creating a strong tie to the Arkansas Cancer Institute which was led by Dr. Peter Emanuel. Dr. Emanuel provided part of the start-up packages for several of the planned new hires via funds available from the Cancer Center. Another area of growth sought by Dr. Raney was in the research area of Proteomics. Funds from the Cancer Center were also designated towards the purchase of new instrumentation to upgrade the proteomics core facility. The department has utilized this support to create and maintain strong ties to the Cancer Center, now named the Winthrop P. Rockefeller Cancer Institute.

Faculty and Research Areas

Faculty members at this time included Drs. Giulia Baldini (hormonal control of appetite); Timothy Chambers (cancer drug mechanisms); Mari Davidson (chromosome dynamics); Donald DeLuca (oxidation and metabolism); Alan Diekman (galectins in cancer); Masahiro Higuchi (prostate cancer and mitochondria); Fusun Kilic (serotonin transporter); Sam Mackintosh (proteomics); Grover Miller (drug metabolism and cytochromes P450); Don Mock (biotin nutrition); Anna Radomska-Pandya (drug metabolizing enzymes); Kevin Raney (nucleic acid

enzymology); William Grady Smith (enzyme kinetics); Alan Tackett (epigenetics, proteomics in melanoma); and Wayne Wahls (meiotic recombination). Dr. Smith retired in 2010 after 46 years on the faculty. One note of interest regarding Dr. Smith's career is that he was mentor to Dr. Jocelyn Elders, who received a Master's degree working in Dr. Smith's lab. Dr. Elders went on to become Surgeon General of the US during the Clinton Administration.

New faculty hired during this period were Drs. Robert Eoff in 2011 and Karen Abbott in 2014. Dr. Eoff's research was focused on a type of DNA polymerase called translesion polymerases which is important in carcinogenesis. Dr. Abbott was focused on discovering biomarkers for ovarian cancer based on her expertise in glycobiology. Dr. Eoff's lab was located in the Biomedical Research Building I while Dr. Abbott became the first member of the department to occupy newly constructed research space in the new tower of the Winthrop P. Rockefeller Cancer Institute.

Research

In 2010, the department was well-supported with 10 out of 13 faculty being funded and the total costs were just under 4 million. This was despite the fact that NIH pay lines had fallen well below typical levels. In order to maintain grant quality, the department hosted an internal grant review process that any faculty member could utilize. Pilot grant funding was also evident. UAMS received a large NIH grant to fund the Center for Clinical and Translational Research which would later become the Translational Research Institute. Campus-wide, researchers were encouraged to develop translational research projects through a pilot grant program from the CCTR. Three faculty in the department received these awards (Drs. Chambers, Mock, and Radominska) illustrating the commitment towards translational research within the department. Dr. Stephanie Byrum, a postdoctoral fellow in Dr. Tackett's lab, received an NIH postdoctoral fellowship, one of the first NRSA awards for the department. Publication of approximately 40 primary articles per year was typical during this period. Common journals in which faculty published were the *Journal of Biological Chemistry*, *Biochemistry*, *Cancer Research*, and *Nucleic Acids Research*.

Graduate Program Curriculum and Teaching

The director of the Graduate Program and the Graduate Education Committee were charged with the responsibility of formulating and executing policies and practices dealing with the graduate education in the department. Dr. Wayne Wahls (2010-2012) followed by Dr. Alan Tackett (2013-2015) served as director during this period. At this time graduate students could enter via our departmental graduate program or via the IBS program. Students took two major courses in the fall semester including the Biochemistry course along with Gene Expression, which focused on molecular biology. A major expectation for students was in the area of research rotations, in which students worked in labs for an eight week period for at least 20 hours per week. The department highly valued the research rotations and students were required to present an oral summary of their work at the end of the semester in Temporary Advisor Committee meetings. Students received a formal grade for the research rotations which was dependent on the evaluation by faculty of the student's performance and effort in the lab as well as the oral presentation. The curriculum included two courses in the spring semester including Methods in Biochemistry and Molecular Biology, and Biological Chemistry.

Students also participated in two Research Rotations during the spring semester and typically selected their permanent advisor by the end of the spring semester. However, additional research rotations could be arranged if students were unsure of their laboratory preference.

During this period, 8 students earned Ph.D. degrees, 5 students earned M.S. degrees, and 5 students earned M.D./Ph.D. degrees. The doctorates obtained postdoctoral or residency positions at UAMS, Cincinnati Children's Hospital, the University of Cologne, St. Jude Research Hospital, University of Missouri, Temple University, UA Pine Bluff Aquaculture Department, Dartmouth College, Johns Hopkins University, and Washington University. Regarding pre-doctoral fellowships during this period, Jessica Hartman (Miller lab) obtained a National Science Foundation award which was a first for UAMS. Another student, Yicong Li (Kilic lab), obtained a pre-doctoral award from the American Heart Association.

Medical Student Curriculum and Teaching

In 2013, the Medical Biochemistry course was transformed into the "Molecules to Cells Module" under the excellent leadership of Dr. Alan Diekman. Medical students taking the course performed well as determined by the average NBME score which was in the 65th percentile nationwide, the highest score in memory. The performance of faculty was also strong as judged by the high marks given to the course by student evaluators. Dr. Alan Diekman was awarded the Golden Apple award for his teaching and efforts as co-course director. The Golden Apple is awarded by vote of the medical students to the faculty member who makes the strongest positive impact on the students' education.

SURF program

Dr. Grover Miller continued to oversee the Summer Undergraduate Research Fellowship (SURF) program. Typically 4- 8 undergraduates participated in the program. The SURF program began working more closely with the Arkansas INBRE program, which served to build and support undergraduate research around the state of Arkansas. Arkansas INBRE sponsored a number of undergraduates to perform summer research at UAMS and members of the department frequently served as mentors for SURF students and INBRE students. The SURF program therefore remained robust despite dwindling funds available for its support.

Central Arkansas Undergraduate Student Research Symposium

In 2012, Dr. Raney, Dr. Miller, and Dr. Tom Goodwin of Hendrix College organized the first Central Arkansas Undergraduate Student Research Symposium. The goal of the symposium was to showcase undergraduate research in Arkansas. Undergraduate researchers and their mentors were invited to present their research in posters or oral presentations. The event was held in late July at the Clinton Presidential Library and was entirely funded by the Department of Biochemistry and Molecular Biology. The symposium, which brought together approximately 80 undergraduate researchers along with their mentors, was highly successful and has continued in following years. Each year, the number of participants increased. In 2014, the symposium outgrew the space available at the Clinton Presidential Library, so the event was moved to the I. Dodd Wilson building on the UAMS campus. The symposium has grown steadily (greater than 100 students) and has been held each year, through 2019. The UAMS Graduate School and the Arkansas INBRE grant have supplied financial support as well as

assistance in organization. Dr. Grover Miller has provided the department leadership and organization of the symposium with assistance from Dr. Mari Davidson and Dr. Robert Eoff. All members of the department faculty participate by judging posters or oral presentations.

Service

Major department or campus-wide service duties at this time were College of Medicine P&T committee (Dr. Radomska), Research Council (Dr. Wahls), Graduate Council (Dr. Davidson), Department Faculty Seminar program (Dr. Kilic), College of Medicine Curriculum Committee (Dr. Diekman), and Graduate Education Committee (Drs. Tackett and Baldini).

Expansion of the Proteomics Core Facility

When Dr. Raney was named Chair in 2010, one of his first actions was to purchase a state-of-the-art mass spectrometer for identification of peptides in order to upgrade the Proteomics Core Facility. Under Dr. Alan Tackett's leadership, with assistance from Dr. Sam Mackintosh, addition of new instrumentation led to improved scientific capabilities that aided UAMS investigators and led directly to new research funding. The Proteomics Core Facility continued to expand with new instrumentation purchased with funds from successful NIH Shared Instrumentation Grants prepared by Drs. Mackintosh and Tackett.

2015-2019

Faculty

Faculty at the start of this period were Drs. Karen Abbott (cancer biomarkers), Giulia Baldini (obesity and neuronal signaling), Timothy Chambers (mechanisms of anti-cancer drugs), Mari Davidson (mechanisms of chromosomal segregation in meiosis), Alan Diekman (GPI-anchored glycoproteins and spermatazoa maturation), Robert Eoff (translesion DNA polymerases in cancer), Fusun Kilic (serotonin transporter), Sam Mackintosh (proteomics), Grover Miller (drug metabolism), Donald Mock (biotin deficiency in pregnancy), Anna Radomska-Pandya (natural and synthetic cannabinoids), Kevin Raney (helicases and G-quadruplex DNA), Alan Tackett (immunotherapy of metastatic melanoma), and Wayne Wahls (meiotic chromosome dynamics in fission yeast). New faculty hired during this period included Drs. Boris Zybailov (2016, proteomics of the microbiome), Samantha Kendrick (2017, lymphomagenesis and the role of DNA secondary structures), Isabelle Racine-Miousse (2018, methionine and epigenetics), Alicia Byrd (2019, DNA damage response), and Stephanie Byrum (2019, bioinformatics of breast cancer).

Research

In 2016, the UAMS Proteomics Core Facility was recognized as an IDeA National Resource for Proteomics. The Facility continues to expand and offer the latest technological advantages for identifying and quantifying proteins in cells, tissues, and organisms.

Dr. Alan Tackett led investigators in the department along with faculty in Pediatrics to prepare a Center of Biomedical Research Excellence (COBRE) grant proposal entitled "Center in Translational Pediatric Research", which was submitted through the Arkansas Children's

Research Institute at the Arkansas Children's Hospital. The \$11 million grant, awarded in 2017, funded four projects from junior investigators, one of whom, Dr. Boris Zybilov, was in the department. This new COBRE has led to creation of new core facilities in Bioinformatics that enable UAMS researchers to have easy access to outstanding, cutting-edge data analysis for experiments in systems biology. These new approaches have helped department faculty move into research areas that utilize genomics and proteomics tools. The CTPR has funded numerous junior faculty through pilot awards as well. Drs. Baldini, Chambers, Eoff, and Raney serve on mentoring teams funded through the Center.

The department faculty continued to publish an average of 45 primary articles per year. Funding for department faculty has remained at \$3 – 4 million in total costs during this period, however that does not include the funding for the CTPR COBRE award led by Dr. Tackett which officially passes through Arkansas Children's Hospital.

In 2016, Dr. Alan Tackett was invested as the Scharlau Family Endowed Chair in Cancer Research. This is the first endowed chair bestowed on a member of the Department of Biochemistry and Molecular Biology. It is one of the only such awards held by a faculty member in the Basic Sciences. In 2019, Dr. Tackett was named as the Associate Director for Basic Research at the Winthrop P. Rockefeller Cancer Institute. This position further strengthened ties between the department and the Cancer Institute.

Major New Funding Initiatives

UAMS received a renewal grant from the NIH for the Clinical and Translational Science Award (CTSA) in 2019. This \$24.2 million five-year award funds the UAMS Translational Research Institute (TRI). The TRI promotes statewide research designed to accelerate research that addresses Arkansas' health challenges. Dr. Donald Mock, professor of Biochemistry and Molecular Biology, played a major role in preparing the proposal.

Drs. Robert Eoff, Mari Davidson, and Alan Tackett are working together to prepare the first submission of an NIH T32 Training Grant from the department. The title of the proposal "Molecular Systems Biology Predoctoral Training Program" focuses on training students to utilize and appreciate data intensive approaches such as "omics" alongside traditional approaches to solve biomedical research problems. This grant will have a major positive impact on recruitment of highly qualified graduate students.

A new funding initiative during this period was the submission of an R24 grant to the NIH for support of core facilities, primarily the Proteomics Core. Dr. Alan Tackett spearheaded this approximately \$12 million grant proposal with assistance from faculty members Drs. Sam Mackintosh, Stephanie Byrum, and Rick Edmondson. The grant is the largest ever to originate from the Department of Biochemistry and Molecular Biology and was submitted in fall of 2019.

Graduate Program Curriculum and Teaching

In 2016 the graduate programs in various departments including Biochemistry and Molecular Biology were combined into a single entry path termed the Graduate Program in Biomedical Sciences (GPIBS). Dr. Robert Eoff was Chair of the Department Graduate Education Committee and he became the director of the newly formed Biochemistry Track. Faculty from all areas of

the campus who utilized biochemical approaches were encouraged to join this track. The GPIBS program required re-writing the department's graduate education policy document. Drs. Timothy Chambers, Robert Eoff, and Mari Davidson contributed to the revision of the document which was adopted by faculty in 2017.

Graduate students in the GPIBS program take three core courses in the fall semester. One of the courses is Biochemistry which is directed by Dr. Mari Davidson. Dr. Davidson has introduced several new teaching modes including team based learning and other active learning exercises. These innovations in teaching have improved the course, which is well-received by the students based on evaluations. The curriculum of the GPIBS program reduced the emphasis on research rotations. This change in research rotations was a departure from the previous department-based curriculum which relied more heavily on research during the first year rotations.

Dr. Davidson also continued oversight of the Interprofessional Education (IPE) program for graduate students. The IPE provides required curriculum development for all graduate and professional students across all five UAMS colleges in order to foster a collaborative environment. Dr. Davidson ensured that IPE activities were planned that would be valuable to graduate students in the basic sciences.

During this period, 19 students earned Ph.D. degrees, 4 students earned M.S. degrees, and 1 student earned the M.D./Ph.D. degree. Students obtained postdoctoral positions at UAMS, University of Texas Southwestern, Emory University, Baylor University, Vanderbilt University, Arkansas Children's Research Institute, Arkansas State University, Pennsylvania State University, St. Jude Children's Research Hospital, Duke University, Indiana University Law School, University of California at San Francisco, and Johns Hopkins University.

Medical Student Curriculum and Teaching

Dr. Alan Diekman continued in his role as module director for the "Molecules to Cells" module in the medical student curriculum. Dr. Diekman received the Golden Apple award five out of the past six years. The department continued to score highly in medical student evaluations during this period and in some years, was the highest ranked module in the basic sciences.

Service

The department has had outstanding support staff over the years. Ms. Sharon Sipe, who provides expertise in the area of procurement, announced her retirement (effective September, 2020) after 23 years of service to the department. Ms. Kahla Robinson has served as executive assistant for 11 years. Faculty members served on a number of campus-wide committees including the Graduate Council (Drs. Mari Davidson and Boris Zybailov), the Academic Senate (Dr. Grover Miller), and Research Council (Drs. Wayne Wahls and Giulia Baldini). Department Vice-Chair Dr. Timothy Chambers was appointed to the College of Medicine Promotion and Tenure Committee for four years (2015-2019) and served as Chair during his last year of service. Dr. Giulia Baldini and Dr. Alan Diekman accepted invitations to join the P&T committee in 2019.



Department of Biochemistry and Molecular Biology, 2019

Conclusion

New hires and acquisition of new equipment has enabled the Department of Biochemistry and Molecular Biology to remain competitive in biomedical research. Growth in the direction of systems biology, DNA damage response, and epigenetics will likely continue based on campus-wide plans. Financial support for core facilities from the campus has also had a major positive impact on maintaining the research enterprise at UAMS. In the short term, UAMS is committed to providing resources to ensure that the Winthrop P. Rockefeller Cancer Institute becomes a National Cancer Institute designated cancer center. The department's existing close ties to the Cancer Institute should ensure steady growth into the future.

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Footnote: ¹These authors contributed equally.