

# Indians, Homesteaders and Molecular Biologists



A History of Biochemistry and the Department  
of Biochemistry & Molecular Biology of the  
University of Oklahoma Health Sciences Center

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## Preface

The University of Oklahoma Medical School is nearing its 100<sup>th</sup> anniversary as a separate program of the University and the Department of Biochemistry was founded just over 75 years ago. The science of biochemistry has assumed a central position in all of the biological sciences – even taxonomy. The time has come to document the history of Biochemistry at the Medical School before some of these memories are lost. Much of this history will include histories of Oklahoma, of the Norman campus of the University, politics of Oklahoma, history of the Medical School and some of the big picture of the science of biochemistry because all of these had an impact on the development of the Department. The Medical School began on the Norman Campus where Biochemistry (at that time called Physiological Chemistry) was taught by the Chemistry Department of the University.

Paul Weigel suggested the idea for a history of the Department. Without his support this treatise would not have been completed. I had no idea how interesting the project would turn out to be, but maybe Paul did which is why he made the suggestion. I would especially like to thank Joyce Anderson and Paul for their valuable service in editing the manuscript. I would also like to thank Joyce Anderson and Judith Britt who provided the administrative support needed.

When I started this work, I was aware that Oklahoma was a frontier state, but I was amazed to learn how much of a role this played in the development of the University and of the Department. A lot of the early information is contained in the outstanding Western History Collection of the University of Oklahoma, including many priceless photographs. The framers of the Oklahoma Constitution produced a lengthy document that gave a disproportional influence to the agrarian community, largely due to the influence of Alfalfa Bill Murray. This reflected a deep-seated distrust of urban life, big business and just about anything off the farm. This influence lasted well into the middle of the 20<sup>th</sup> century and was felt at the Health Sciences Center. We heard comments such as “Why are you wasting time doing research when you are paid to teach?” This came not only from the Capitol on 23<sup>rd</sup> street, but also from some of our own colleagues. Today the attitude is much different. Almost everyone appreciates the importance and promise of biotechnology to medicine and economic development. The passage of state questions 680 and 681 opened the way for scientists to share in the fruits of their intellectual creations. There is a technology transfer park near the Health Sciences Center with three buildings that have waiting lists to get in.

Looking at today’s magnificent 200-acre Oklahoma City campus, it is hard to appreciate the early turbulent history of the University and the Medical School. Money was hard to come by in the new Territory. Depending on how the heads are counted, pressure from Oklahoma Governors replaced at least two Medical School Deans and two University Presidents. There are also stories of religious and racial bigotry, passing out professorships as patronage and even the Ku Klux Klan played a role.

Happily, the “good guys” prevailed and Oklahoma began to mature as a State. One of the good guys was the third Governor of Oklahoma, Robert L. Williams. Governors Bellmon and Bartlett were instrumental in promoting the HERO bond issue which provided the seed money for the Master Plan for the Health Sciences Center. There were also Medical School Deans who kept the school moving forward when the young State of Oklahoma was having serious financial difficulties, such as LeRoy Long and Mark Reuben Everett. Without them, the Medical School would have faded away, as did many other Medical Schools after the publication of the Flexner report in 1910 (18). There were visionaries such as James L.

Dennis whose Master Plan was the basis for the present campus. His right arm in carrying out this vision was Robert M. Bird, for whom the Bird Library is named. I was privileged to know both and worked with Bob Bird as the Chairman of the planning committee for the Biomedical Sciences Building.

Credits for pictures used are given in the captions. Where no credit is given, the pictures are from my personal collection.

Oklahoma City, December 2001

## Chapter 1

### Indian and Oklahoma Territories

#### The Unassigned Lands of Oklahoma

In the early 1800's, European-Americans increasingly coveted the lands occupied by the Indian tribes in the Southeastern United States, frequently referred to as the "Five Civilized Tribes" - Cherokee, Seminole, Choctaw, Creek and Chickasaw. These were not Stone Age tribes; they had adopted many of the customs of the white man. They had their own cities, government, schools and many were successful farmers, doctors, and lawyers and kept slaves. Many Whites took Indian wives founding families with names such as Ross, Adair and Chisolm – names, which later became prominent in Oklahoma history. The end of the war of 1812 reduced the territories of the Five Civilized Tribes in the Southeast United States to shadows of lands they once occupied. Some, like the Choctaws, negotiated with the U.S. Government in 1820 to move to Oklahoma in return for their land in Mississippi. The Western Cherokees were already living in Northwest Arkansas and were later joined there by some of the Eastern Cherokees. The clamor by Anglos to take over Indian properties in the Southeast United States culminated in the Indian Removal Act of 1830 (21) which legislated removal of the five tribes to Oklahoma, known then as Indian Territory. The President at that time was Andrew Jackson who vigorously prosecuted the Act because he wanted the support of the Southerners to get elected. Jackson appointed the Stokes Commission, which was charged with implementing the act. This was a challenge, because roads did not exist and the resident Indians, especially the Osages, did not care to lose any more of their own territory. There was bad blood between the Osages and Cherokees with killings by both tribes. Planning for the moves, which began in the winter of 1830, was poorly carried out and resulted in the "Trail of Tears" which caused about a quarter of the Cherokees to lose their lives to cold and disease. By the late 1830's, the movement of the Five Civilized Tribes to Oklahoma had been completed. Other Indian Removals brought in Wichitas, Comanches, Kiowas and Apaches, mostly to Western Oklahoma. These tribes were placed on reservations in Indian Territory.

The alleged purpose of the Indian Removals was to provide a living space for the Indians in the Territory and Anglos were not allowed to own land in Indian Territory – at least yet. Whites could lease land from the Tribes and many did so such as the Miller brothers who ran the 101 Ranch in the northern part of the Cherokee Outlet. After the Civil War some estimated five to ten million longhorns were driven from Texas through Indian Territory over the Chisolm and Western Trails to railheads in Kansas and later to Wyoming and Montana (28). Professional cowboys such as "Teddy Blue" Abbot, referred to Indian Territory as "The Nations" (1), referring to the nations of the Five Civilized Tribes. Tribes were responsible for law and order among their own people, the thinly populated and rugged country made it a haven for such famous outlaws as the Daltons, the James boys, Cherokee Bill and Lucky Ned Christie, AKA Lucky Ned Pepper in *True Grit*. To keep order, the Federal Government hired Marshals to police the territory. Some of the most famous were Bill Tilghman, Chris Madsen, Heck Thomas, (who were known as the Three Guardsmen), Frank "Pistol Pete" Eaton and Bass Reeves. Reeves was a former slave who, according to legend, escaped from Texas to Arkansas after punching out his master during a card game. He was six feet two inches tall, very polite and killed 14 men during his career as a deputy

U.S. Marshal. U.S. Marshals covering Indian Territory worked for “Hanging Judge” Isaac Parker in Fort Smith.

By the 1880’s pressure was intense to open up Indian Territory to Whites. The fact that most of the Indians sided with the Confederacy during the Civil War was held against them. David L. Payne was the leader of a band of Whites who repeatedly tried to settle in Indian Territory and were called “Boomers” because they claimed they were going to boom out of Kansas into Oklahoma Territory (25). Payne died before he realized his dream and was replaced by William L. Couch as the leader of the Boomers. The tribes pled their case to the Federal Government and the 9<sup>th</sup> and 10<sup>th</sup> U.S. Cavalry, the black Buffalo Soldiers, were called out to remove the squatters. This was ironic because one of the original duties of the 9<sup>th</sup> and 10<sup>th</sup> Cavalry units was to protect White settlers from plains Indians. Whites focussed their interest on a piece of land in central Indian Territory, not given to any of the tribes, known as the Unassigned Lands.

Ultimately, Washington yielded to pressure and Congress passed, and President Grover Cleveland signed the land-opening bill in March of 1889. Surveyors laid out 160-acre plots (quarter sections) which could be claimed by homesteaders. Quarter sections could be combined and subdivided into plats to create townsites. The Unassigned Lands were opened in the Land Rush on noon of April 22, 1889. Every kind of conveyance was used to carry homesteaders into the Unassigned Lands where they staked out claims to the 160-acre farm plots or city lots. There were several that hid out in the territory before the 22<sup>nd</sup> and staked out their claim early – the “Sooners.” The Homestead Act provided that the land was theirs if the homesteaders made improvements and stayed for five years.

Oklahoma City was laid out by two townsite companies, the Seminole Land and Improvement Company, and the Oklahoma Colony Company (33). Overnight Oklahoma City became a town of 10,000 people living in tents. However, there was no legitimate government between the 1889 Run and the Oklahoma Organic Act of 1890, which was solved by electing interim mayors, city councils, and marshals.

In 1890, Congress passed the Oklahoma Organic Act of 1890, which provided a simple government for Oklahoma Territory (4). There was a Governor, three Supreme Court Justices and a Territorial Secretary, all appointed by the President. The Unassigned Lands were divided into six counties, Oklahoma, Cleveland, Payne, Logan, Canadian and Kingfisher counties. The voters of the district elected a bicameral legislature with twenty-six members in the Lower House and thirteen in the Upper House plus a Representative to Congress. The legislature was elected in August of 1890 and met in Guthrie that same month.

The Dawes Act of 1887 was just one of several Federal programs to end Indian sovereignty over the land that they had been given collectively. The Dawes Act directed the division of joint property owned by Indian Tribes. It was followed later by the Dawes Commission, which was a specialized Commission to deal with the Five Civilized Tribes. The Curtis Act of 1898, resulted in the abolishment of Tribal governments (4). Tribal townsites were auctioned off with the Tribes retaining token lands such as cemeteries. The Act gave allotments of land to individual Indians rather than Tribes and was the beginning of the end of Indian Territory. In theory at least, every Indian family had their own piece of land. The Tribes resented the allotment system and some members even refused to take their allotments. Others were swindled out of their land by unscrupulous Whites. Inevitably, Whites settled all over Indian Territory.

## Chapter 2

### Higher Education in the Indian and Oklahoma Territories

#### The University of Oklahoma and the Medical School

The Territorial Legislature decided that Oklahoma Territory should have a University in Norman, an Agricultural and Mechanical College in Stillwater and a Normal School for teachers in Edmond. Because Oklahoma Territory was a Jim Crow Territory there was no provision for Black Americans to attend a school of higher education. The citizens of Langston, an all black community just east of Guthrie, worked for many years to obtain a college. Finally in 1897, they were rewarded with House Bill 151, which established a Colored Agricultural and Normal University as a land grant college under the terms of the Morrill Act.

In 1891, Republican President Benjamin Harrison appointed Republican Abraham J. Seay as the second Territorial Governor of Oklahoma. Governor Seay appointed the first University Board of Regents in 1891 and this group selected David Ross Boyd, a Kansan, as the first President of the University. Boyd arrived in Norman by train on a hot August day in 1892, which must have been quite an introduction to Oklahoma. All he could see was prairie grass and buffalo wallows where grass would not grow (6). Cowboys from the Chickasaw Nation would come to visit Norman's 15 saloons on Saturday night because the Chickasaw Nation was dry. As part of the legislation creating the University, the citizens of Norman were obliged to raise \$10,000 which was not easy because the citizens were mostly homesteaders who were not required to pay taxes to Norman for another two years. They floated a bond issue for \$10,000, which was bought by M. L. Turner of Oklahoma City for \$8500. The citizens of Norman raised the remaining \$1500 in cash contributions from businessmen.

Boyd was not a popular choice with residents of East Norman because he was a Republican and most of the residents of East Norman were Democrats, Baptists and Southern Methodists (12). Northern Methodists, Presbyterians and some Episcopalians - mostly Republicans, occupied the West Side of Norman. This polarization would be a problem for Boyd later on. The first four members of the Faculty were Boyd, William N. Rice, French S. E. Amos and Edwin C. DeBarr. DeBarr played an important role in the early years of the Medical School and the School of Pharmacy and was one of the early members of the Medical School faculty. He earned a Pharmacy Bachelor degree and a Ph.D. in Chemistry, both from the University of Michigan. He founded the Department of Chemistry at the University of Oklahoma and served as its Head for many years. He also started the Chemical Engineering Department and the School of Pharmacy, and eventually was appointed a Vice President of the University. However, his career with the University of Oklahoma took a bizarre twist later when he became involved with the Ku Klux Klan, which cost him his position with the University.

The University of Oklahoma Medical School started out as a two year program in 1898 with four students and was actually named the Pre-Medical Department of the College of Arts, under the Department of Biology. Thus it was not a freestanding program and after completion of the two pre-clinical years, students would transfer to other Medical Schools with clinical facilities. Albert Heald Van Vleet, who was appointed the Head of the Biology Department in 1899, also headed the Pre-Medical Department for the first year of its existence. Lawrence N. Upjohn, who received his M.D. from the University of Michigan in

1900 was appointed Head of the Pre-Medical Department in 1900 – right out of Medical School himself. The first three members of the Pre-Medical Department, therefore, were Van Vleet, Upjohn and DeBarr. Upjohn was also appointed Head of the Department of Anatomy. Classes were taught on the Norman Campus by faculty of the Biology and Chemistry Departments and the School of Pharmacy. A wooden building was constructed on the Norman campus specifically for the teaching of anatomy. In the freshman year, students took five hours of general chemistry and five hours of qualitative analysis. In the sophomore year, they took five hours of organic chemistry, five hours of quantitative analysis and five hours of physiological chemistry. The reason for the beginning chemistry courses was that these students were right out of high school with little if any exposure to chemistry. Most of the chemistry courses were heavily laboratory oriented. Nevertheless, the curriculum was fairly rigorous in chemistry and biochemistry. The Chemistry Department taught chemistry and biochemistry and the School of Pharmacy taught *materia medica*, pharmacology and prescription writing so that Professor DeBarr played a major role in the education of these students.

Dr. Upjohn did not stay very long with the Pre-Medical Department, now called the School of Medicine in the University Catalog (15); he left in 1904 to join the newly launched family business, which became the successful pharmaceutical firm bearing the family name. Roy Philson Stoops, Instructor in Physiology, succeeded Upjohn as Director of the Medical School. Later, his title was changed to Acting Dean. Dr. Stoops was one of the first two graduates of the University of Oklahoma and was President of the very small Alumni Association in 1904-5. He earned his M.D. from the University of Illinois in 1903, so that he also joined the faculty right out of Medical School.

In 1906, the Oklahoma Enabling Act merged Oklahoma and Indian Territories forming the State of Oklahoma. There was a serious proposal to make Indian Territory into a state named Sequoyah and a constitution was developed for that purpose. However, the Republican Federal government did not want to add two Democratic states to the Union and decided that the twin territories were to be one state. The Enabling Act also provided for the election of delegates to the Oklahoma Constitutional Convention, which met in Guthrie in 1906, with William H. “Alfalfa Bill” Murray as the President of the Convention. Southern Democrats took control of the convention and squeezed out most Republican ideas. Many Oklahomans felt threatened by the big eastern businesses with their robber barons and the Constitution placed a number of strictures on their operations. The delegates developed a very long populist Constitution that even defined the flash point of kerosene! The Constitution also legislated a segregated Oklahoma, as did many Southern State constitutions at that time.

### **What was biochemical research like at the turn of the century?**

The biochemical literature of this period was descriptive because they needed to know the elements of what they were dealing with before they could understand how proteins, nucleic acids and lipids functioned. The published research emphasized methods for identification of biochemicals because these techniques were so successful in organic and analytical chemistry. Separation of biochemicals, formation of chemical derivatives and determining their elemental analysis and melting points were standard procedures in the biochemical literature. While these were cumbersome procedures, they yielded reliable data, many of which can still be cited. A good deal of early day biochemistry was focussed on the composition of body components – thymus nucleic acid (DNA), proteid (protein), amido (amino) acids and brain phospholipids. The distinction between DNA and RNA was not



clear, although all of the bases had been isolated by this time. There was also much interest in human diseases such as diabetes, the causes of which were mysteries. It was known that diabetes could be produced in animals by treatment with phlorizin and that somehow the pancreas was involved. Curiously, the research literature was conspicuous by its lack of detailed procedural information and it would have been difficult to reproduce many of these procedures without additional information.

Otto Folin and Christian A Herter founded *The Journal of Biological Chemistry* in 1905. The very first article of Volume 1 was by John J. Abel and R. DeM. Taveau "On the decomposition products of epinephrin hydrate." The gist of this article is that the analytical data that Abel had previously published on the composition of epinephrine hydrate were reputed to be incorrect because oxidation had occurred during the isolation. Therefore, Abel and Taveau carried out the purification under hydrogen gas to prevent oxidation. As one who has carried out procedures under hydrogen gas always wondering if I had had my last meal, I suffered with them. This report also contains the statement that "The details cannot be described here", which is an interesting comment because it was the method of isolation that had been challenged.

An article by Barker and Cohoe in Volume 1 on the nutritional value of various proteins reveals that they knew about glycine (glycollic acid), alanine, leucine, phenylalanine, proline, aspartic acid, glutamic acid, serine, hydroxyproline tyrosine, tryptophane, aminovaleric acid (valine) cystine, arginine and lysine. These amino acids were isolated as either crystalline derivatives from several kinds of proteins, or in cases like tyrosine, as the crystalline amino acid. This left threonine, isoleucine, methionine, asparagine and glutamine to be discovered. H.D. Dakin had a paper in Volume 1 entitled "The oxidation of amido-acids with the production of substances of biological importance", which was a report on the oxidation of amino acids by peroxide and ferrous sulphate to produce an aldehyde, carbon dioxide and ammonia. This was the "Dakin reaction" for degradation of amino acids used much later when isotopic labeling came into vogue.

It is interesting to look at the contents of Volume 3 of *The Journal of Biological Chemistry*, which was the 1907 issue, the year of Oklahoma statehood. The lead article was "On thymus nucleic acid", by Walter Jones and C.R. Austrian, who were attempting to determine if xanthine and hypoxanthine were products of thymus nucleic acid hydrolysis or artifacts of isolation. They came to the conclusion that xanthine and hypoxanthine were not native to thymus nucleic acid, but were degradation products of guanine formed during hydrolysis. Cytosine and thymine were not studied in this report but they were known to be components of thymus nucleic acid. An earlier paper in Volume 1 of *The Journal of Biological Chemistry* by J.A. Mandel and P.A. Levene reported that cytosine and uracil could be isolated from fish nucleic acid, but the fundamental difference between DNA and RNA was not yet appreciated. In fact, there was some thought that thymus nucleic acid was composed of four different species, one for each of the bases. Otto Folin, who made many contributions to analytical biochemistry, had three articles in Volume 3; "On the reduction of barium sulphate in ordinary gravimetric determinations", "On the occurrence and formation of alkyl ureas and alkyl amines" and "On the separate determination of acetone and diacetic acid in diabetic urines." Stanley R. Benedict had an article on "The detection and estimation of reducing sugars", which became the Benedict reaction used to measure sugars in urine.

### **Teaching of Biochemistry in Medical and Graduate Schools**

Biochemistry/physiological chemistry was taught as a laboratory course for many years, both in medical and graduate schools because of the descriptive nature of the science

at that time. The few biochemical textbooks of the early 1900's were really laboratory manuals. The book by Rockwood (31) was one of the earliest and was divided into sections on carbohydrates, fats, proteins, fermentation, saliva, gastric juice, pancreatic juice, blood, bile, connective tissue, bone, muscle, brain, milk and urine, including abnormal constituents of urine such as albumin and sugar. The experiments were simple spot and color tests, studies on the composition of gastric juice, simple experiments on pancreatic digestion and a large section on analysis of urine. There was an emphasis on keeping the cost down, because these were not affluent times. An experiment on preparation of lactic acid by fermentation is an amusing example. Students were instructed to dissolve 30 grams of cane sugar in boiling water and then add 30 milligrams of tartaric acid. After standing for two days, they then added 40 cubic centimeters of sour milk, a half a gram of old cheese, and 15 grams of zinc oxide. The mixture was kept at about 40-50 ° C for 10 days, boiled and zinc lactate crystallized out of solution.

There were occasional graduate students listed on the roles of the University of Oklahoma almost from its inception, but a separate Graduate School was not listed in the University catalog until 1909 (22) when Albert H. Van Vleet was named Dean of the Graduate School. Gittinger stated that the only other person considered for the position of Dean of the Graduate College was DeBarr, who became Vice President instead (22). Van Vleet received his Ph.D. from the University of Leipzig and joined the University of Oklahoma as the head of the Biology Department in 1898, and was therefore also one of the founding faculty of the School of Medicine. The Graduate School was not large, with only six graduate students in 1908-1909.

### **Statehood and the University of Oklahoma**

At the time of statehood, the population of Oklahoma was 1,414,177 (15). All the appointed governors of the Territory of Oklahoma, except one, were Republicans. Republicans at that time were thought of as the party of Lincoln, which still evoked memories of the Civil War. Most Oklahomans were Democrats and the elected Governors were Democrats until Henry Bellmon in 1962. The first elected Governor was Charles N. Haskell, who was sworn in on November 16, 1907 in Guthrie and on the same day, President Theodore Roosevelt signed the Oklahoma State Proclamation. The Governor and the State Legislature had to develop a State Government where none had existed before. The first State Legislature passed a number of progressive laws including a bank guaranty law, similar to the present Federal Reserve System, established the 77 Oklahoma counties, created the Oklahoma judicial system, established colleges for women (Chickasha) and the deaf (Sulfur), provided for a National Guard, prohibited the sale of alcoholic beverages, passed a state income tax and a 2% pipeline tax to finance State government. The Constitution also established a segregated society, which eventually deprived blacks of the vote. During Haskell's term the capital was moved from Guthrie to Oklahoma City.

Haskell was majority leader of the Democrats during the Constitutional Convention and played a prominent role in its development. Even then, Haskell had an eye on the Governor's chair and the Senator's seat, since the Governor could not succeed himself. He depended heavily on help from the Southern Methodists in the election for Governor. One of his supporters was Nathaniel Lee Linebaugh, pastor of the Southern Methodist Church in McAlester. Linebaugh was previously assigned to Norman where he met, but did not get along with Boyd. Haskell appointed Linebaugh to the University of Oklahoma Board of Regents as a reward for his service during the election. Linebaugh made his position clear from the start; namely that the entire faculty of the University of Oklahoma should be

replaced. One of the incidents, which created a problem for Boyd, was the dismissal of Ernest Taylor Bynum, Professor of German and French. Bynum was apparently a satisfactory instructor, but he repeatedly criticized the University for lax supervision of students, which allowed them to play cards and smoke cigarettes. He even hinted that one unnamed female student had had a baby in her room. Boyd felt that these statements were inappropriate and dismissed Bynum. Bynum then joined the faculty of Epworth University, a new Methodist school that later became Oklahoma City University. Somehow, Linebaugh was able to convince the Regents that all University positions should be vacant, the logic being that the present faculty had been appointed when Oklahoma was a Territory and now it was a State. Linebaugh also had his own candidate for President of the University, former Professor Bynum. The Board of Regents declared all University positions vacant, although incumbents could apply for reappointment if they so desired.

One of the moderate Regents was Arthur Grant Evans, President of Henry Kendall College in Muskogee, which later became the University of Tulsa. Evans had also supported Haskell's candidacy for Governor, but he argued for Boyd's retention because he believed that Boyd had done a good job and gave the University stature. Haskell was on the horns of a dilemma; he did not want to retain Boyd, who was regarded by Democrats as a Northerner, a Republican and an elitist, but he did not want to appoint Bynum, whom he regarded as a loose cannon. Haskell was afraid that the Regents favored Bynum so he did an end run around the University Regents by using the State Board of Education to pick the President. Haskell was one of the three members of the Board and, since he appointed the other two, it was no surprise when the Board selected Arthur Grant Evans as the President of the University. However, the University Regents objected and carried their protest to the State Supreme Court, which declared that the State Board of Education had no jurisdiction in University affairs.

The final episode in this strange affair is right out of a Keystone cops comedy. A committee was constituted to interview members of the faculty, who wished to be rehired, with the objective of "smelling out" the charges made by Bynum and Linebaugh. The "smelling committee" consisted of Lee Cruce, who would later become Oklahoma's second Governor, Linebaugh and C.J. Pratt of Oklahoma City. John Hardie a friend of Linebaugh's and a member of the Southern Methodist Church of Norman, was also invited to appear before the committee. Hardie attacked the entire faculty fingered by Linebaugh. After the committee completed its work and left town, a maid discovered a letter in Linebaugh's hotel room from R. E. Morgan, Pastor of the Methodist Episcopal Church of Norman. In the letter, Morgan denounced several by name "who dance, play cards and are immoral in their lives." He called C. M. Jansky, a member of the medical faculty, "an infidel." The final paragraph began with "Do your best to get as many strong Southern Methodists in the faculty as possible." The letter was published in the *Outlook* and the *Norman Transcript* and a complete copy of the letter is printed in George Lynn Cross' book (12). The letter caused a furor, both locally and nationally and probably restrained the hand of the regents from making wholesale changes. One of the "immoral" individuals named in the letter was Ruby Givens, whose father appeared on Morgan's doorstep with a lawyer looking for blood. Morgan promptly retracted his statement and Ruby Givens was rehired – on the recommendation of Linebaugh.

However, Boyd was dismissed and Arthur Grant Evans was hired in his place. The fledgling Medical School was also affected. Dean Stoops was dismissed along with Edward M. Williams, Instructor in pathology and histology and Cyril Methodius Jansky, Professor of physics and engineering and the "infidel" referred to in Morgan's letter. Evidently being

named after two saints was not enough to protect Jansky. It's not clear why Stoops was dismissed, and the fact that he earned his Bachelor's degree from the University of Oklahoma was not enough to save him. DeBarr and Van Vleet were retained on the faculty. Charles S. Bobo, Head of the Department of Forensic Medicine, replaced Stoops as Dean in 1908. Bobo's license to practice medicine in Oklahoma, dated 1908, is on display in the Health Sciences Center Library on the third floor.

## Chapter 3

### The Flexner Report

#### Medical Education in the United States at the Turn of the Century

The Flexner Report of the Carnegie Foundation for the Advancement of Teaching in 1910 had a profound impact on medical education in the United States (18), which endures until today because it introduced the teaching of basic science subjects, including biochemistry, and scientific thinking to the medical curriculum.

The state of medical education in the U.S. during the 19<sup>th</sup> century and the start of the 20<sup>th</sup> century was appalling and far behind that of European Schools. The American Medical Association was concerned about this state of affairs and created the Council on Medical Education in 1904 to study the problem and make recommendations (5). The Council found that there were too many Medical Schools with weak curricula and poor facilities all across the country. Certain states were “hotspots” for the location of Medical Schools, including Illinois, with 15 Medical Schools in Chicago. Most of these were proprietary Medical Schools designed to make money for the owners.

The Council made a series of recommendations; students should have at least two years of college with a foundation in physics, chemistry and foreign languages, at least five years of Medical School, a one-year internship and should pass state licensing examinations. The Council on Medical Education suggested to the Carnegie Foundation for the Advancement of Teaching that the quality of medical education in the United States be the subject of a special report. The Carnegie Foundation accepted the Challenge in 1908 and commissioned Abraham Flexner to do the study and make recommendations. The result was *The Flexner Report on Medical Education in the United States and Canada*, published in 1910 (18).

Flexner was an interesting and probably perfect choice for the job. He was neither a scientist nor a physician, which is one of the reasons he was selected to write his report on medical education (19). He was born in Louisville and attended the Johns Hopkins University, earning a baccalaureate degree in two years studying classics. Interestingly, Louisville was one of those cities that was a hotspot for proprietary Medical Schools and in fact, his brother Simon went to one of those “wretched” schools to use Flexner’s quote. However, Simon rose above his early training and eventually became head of the Rockefeller Institute for Medical Research, but only after additional training at the Johns Hopkins and in Strasbourg. Abraham Flexner returned to Louisville, taught high school for a while and then opened his own private, and exclusive, high school, which gained an excellent reputation. The school was started as a prep school for children of wealthy parents; most of the children having had behavioral problems at other schools. However, he became dissatisfied with this life and began to study psychology at Harvard but became disillusioned with this also and left for Europe with his wife and young daughter. He spent some time in England visiting Oxford, Cambridge, Rugby and Eton and was pleasantly surprised to learn that he was known there. They then left to study at the University of Berlin where he savored the atmosphere left by famous scientists - Von Humboldt, Helmholtz, Virchow and Koch. He was greatly impressed by German scientists and philosophers, although critical of the Professor system. He felt that there were too many Professors (*Ordinarii*) with too much power and too few in the lower ranks. Growing German militarism also disturbed him. In the meantime he wrote *The American College*, a book which was critically acclaimed.

It was at this time (1908) that Henry S. Pritchett, President of the Carnegie Foundation for the Advancement of Teaching offered Flexner the job of studying medical education the United States and writing a report; Flexner, jumped at the chance (19). Pritchett asked Flexner if he wanted an advisory committee of medical professionals to assist him. After some thought, Flexner declined, because he did not want to feel inhibited, and his report was anything but timid. Flexner personally visited each Medical School in the U.S. and surveyed the entrance requirements, the faculty, curriculum, laboratory facilities and access to patients by students. Like the Council on Medical Education, Flexner found that there were too many Medical Schools, which had led to a serious oversupply of physicians. Many of the Medical Schools were commercial enterprises, where “chairs” were sold like stock in a company. Some schools had a curriculum of only seven months, not counting Christmas vacation. Admission standards in many cases were non-existent; many did not even require a high school education. Failures were rare. Teaching was almost entirely didactic with little or no exposure to patients and very few laboratory facilities. One Medical School in Chicago held only night classes.

Flexner recognized that the rapidly developing sciences of chemistry, biology and physics would have a significant impact on medicine. These disciplines would contribute not only science, but also training in critical thinking. For this reason, the report placed a high value on at least some pre-Medical School college education. The Council on Medical Education recommended courses in physics, chemistry, biology and modern languages. Flexner believed strongly that Medical Schools should be under the umbrella of Universities. Although some universities had associated Medical Schools, the association was in name only, with very little control by the University. Flexner felt that faculty should be full-time with no financial interest in the operation of the school. Library facilities were a necessity. In one case he found that a room marked **Library** held a single volume. The Flexner Report recommended a four-year Medical School curriculum with two years of pre-clinical sciences, the first year consisting of anatomy, histology, embryology and physiology, the latter including biochemistry. The second year would consist of pharmacology, pathology, bacteriology and physical diagnosis. The Flexner Report emphasized that the student should have laboratory experiences in these subjects.

Flexner’s Report had this to say about the University of Oklahoma Medical School which also summed up his philosophy about medical education.

“The new commonwealth of Oklahoma may, if wise, avoid most of the evils which this report has described; for though they have already appeared, they have not taken deep root. Immigration – of physicians, among others – has been so rapid that the state has easily three times as many doctors as it needs. They pour in from the schools of St. Louis, Kansas City, and Chicago. If, however, the state wishes a high-grade supply only, it must speedily define a standard such as will (1) suppress commercial schools, as for example, that now nominally belonging to Epworth University, - and (2) by the same action exclude inferior doctors trained elsewhere. Having done this, only an institution with considerable resources, derived either from taxes or from endowment, will even attempt to conduct a Medical School in the state: which is as it should be. The state university is of course marked out for the work. Its present modest beginning must be developed. Perhaps it will have at once to occupy Oklahoma City with a clinical department so as to obtain control of the field; though, if its sole right could be established without that, the project might well be delayed for a time. A good Medical School is so costly that a new university does not

want to anticipate the responsibility. Possible expenditures on such a department have in a way been crippled in advance by the absurd duplication of state institutions. There are 26 state-supported educational institutions in Oklahoma. In other respects the people of the state have been quick to profit by the experience of other sections. Oklahoma City has not in its building recapitulated the phases of growth elsewhere. Its streets are of asphalt, its large buildings are fire-proof, their plumbing modern; they have begun with enamel, not with tin or zinc bathtubs. Why do they not in the same way avoid the weary and costly errors in educational organization that the states about them have one after the other made? Ordinary intelligence, surveying the states of the Middle West to-day after their educational experience of the last thirty years, could reduce its lessons to a few simple propositions which would be universally accepted. No two judges would differ as to the principle that state institutions of higher learning should be concentrated in a town of assured future; that proprietary Medical Schools should be forbidden, etc. The older states are painfully correcting or paying for their blunders: should Oklahoma, to soothe the local pride of this little town or that, run up a bill of the same sort?"

The Council on Medical Education soon began evaluating Medical Schools and rated them as A = acceptable, B =borderline or probation and C = not acceptable. The University of Oklahoma Medical School was rated A. The pre-clinical curriculum actually looked pretty good and anticipated by 5-10 years the recommendations of the Flexner Report and the Council on Medical Education. Much of this should probably be attributed to DeBarr, who was a well-trained chemist. However, the fact that Oklahoma's was a two-year Medical School with no clinical facilities was now viewed as a serious deficiency, which needed correction.

Flexner added to his stature by studies of medical education in England, Germany and France and prostitution in Europe under the auspices of the General Education Board. Toward the end of his career, Flexner founded the Institute for Advanced Studies at Princeton University. One of his first hires was Albert Einstein, who was happy to escape the Nazis and start a new life.

Historians like to play the "What if?" game (11); What if we had lost the revolutionary war? The U.S would today be just another member of the English Commonwealth. What if the landing on Normandy on June 6, 1944 had failed? The Soviets would have taken over all of Europe. What if the Flexner Report had not been written? Would Medical Schools still be one-year trade schools with students serving apprenticeships? Probably not. The climate was ripe for change and there were others beside Flexner who recognized that changes were needed, although not with Flexner's stature and his bully pulpit of the Carnegie Foundation.

## Chapter 4

### A Turbulent Four Years

#### **OU becomes a four-year Medical School**

Epworth University, which later became Oklahoma City University, began in 1901 in Oklahoma City. Epworth University Medical School started in 1904, with about twenty students, as one of the proprietary Medical Schools that Flexner criticized so severely, although it at least had a four-year curriculum. Physicians taught both basic and clinical science courses. Several physicians purchased the Angelo Hotel, on the northwest corner of Sixth and North Broadway in 1907. However, Epworth could not comply with the conditions of the Flexner Report because they did not have the personnel to teach the basic sciences. Consequently, the Council on Medical Education gave Epworth a “C”, an unacceptable rating. With Dean Bobo negotiating the amalgamation, Epworth joined with the University of Oklahoma School of Medicine in 1910 and then ceased operations. This was a big hit with Epworth medical students who paraded in downtown Oklahoma City to demonstrate their approval (21). All of the students were allowed to transfer to the University of Oklahoma and many Epworth Faculty became volunteer teachers in the University of Oklahoma. The OU Medical School rented buildings at NW 10<sup>th</sup> and Lee Streets and later (1911) at 1005 N. Dewey, where St. Anthony’s Hospital is now located. The Dewey street location was used for classrooms, laboratories and libraries. Students and faculty used the clinical facilities of private hospitals in Oklahoma City, including St. Anthony’s Hospital, a better, but still not a perfect solution. Other hospitals included the Oklahoma Hospital for the Insane (Norman), Oklahoma City General Hospital, Oklahoma City Maternity Hospital, the Infectious Diseases Hospital, the Smallpox Hospital and the Tuberculosis Hospital (15).

#### **More Trouble for the little Harvard on the prairie**

Lee Cruce, formerly President of the University of Oklahoma Regents, was elected the second Governor of the State of Oklahoma in 1910. However, this did not mean smooth sailing for the University or the Medical School. The University Regents met once in Oklahoma City and then were dissolved by the Governor and the Legislature. The University Regents were replaced by the Board of Education, whose members were appointed by Cruce. The State Board of Education had supervision over the University of Oklahoma and the normal schools of the State. On the other hand, Oklahoma A & M and the other agricultural schools were exempt from this change, since they were under the jurisdiction of the Department of Agriculture (12).

The President of the State Board of Education was Robert N. Wilson, who did not like President Evans because he believed that Evans opposed his candidacy for the post of State Superintendent of Education in the Democratic Party Primary of 1910 – and there may have been some truth to this (12). The State Board ordered a reorganization of the Medical School giving as its reason, a desire to bring it into compliance with the Flexner Report. While the rating of the Medical School was still “A”, the handwriting was on the wall that changes were needed. The State Board fired President Evans, Dean Bobo and Dean Washburn of the College of Pharmacy. Law Dean J.C. Monnett, a thorn in the side of Evans, was named interim President of the University, but he did not want the job permanently (12). The State Board of Education made another appointment that caused



considerable furor. They replaced Professor of Mathematics, E.P. R. Duval with Frederick Kent, who was untrained in mathematics. This was clearly a political appointment, because Kent had given Wilson considerable financial support in his candidacy for the State Superintendent position – to the point of near personal bankruptcy (12). The press recognized it as a transparent patronage appointment, which was hooted locally and nationally. Cruce made a feeble attempt to stay the hand of the Regents, but Kent kept his job.

The uproar seemed to have a restraining effect on the State Board of Education, who hired an outside consultant to help select a new President. They identified Stratton D. Brooks, a highly qualified educator and lawyer, who was named President in 1912. One of Brook's earliest and most important achievements was to convince the Regents that faculty appointments were made by the President of the University, subject to the approval of the State Board of Regents and that such appointments were permanent. This was the precursor to tenure at the University and provided the some stability to University faculty, at least on the Norman campus.

The new Dean of the Medical School was R. Findlater Williams, an 1892 graduate of the Medical College of Virginia who assumed his office on September 1, 1911. Dean Williams negotiated a lease on two buildings owned by J.B. Rolater, a physician in private practice in Oklahoma City. Rolater was interesting in his own light since he made the run of 1889 and used a horse to make his early rounds (33). After remodeling, the Rolater building at 325 N.E. 4<sup>th</sup> Street became the University Hospital in January 17, 1912. The Hospital contained 9 beds each for white men and women and, because Oklahoma was segregated, 4 beds each for colored men and women. The building at 317 NE 4<sup>th</sup> housed the Dean's headquarters, classrooms and library.

Events were happening which foreshadowed the complete move of the Medical School to Oklahoma City including the pre-clinical courses, which were still taught on the Norman campus. On June 3, 1912, the rating of the Medical School was reduced to a "B", which caused considerable consternation. Dean Williams felt that drastic measures were necessary; he fired 10 members of the Medical School faculty, demoted four clinical professors and hired nine new faculty members. This was a very unpopular move and Williams was forced out in February 28, 1913. Later President Brooks reinstated the dismissed faculty without loss of tenure. The new, in this case, Acting Dean was William James Jolly, who was one of the founders of Epworth University Medical School and who joined the faculty of the University Medical School as a Professor of Surgery.

## Chapter 5

### At Last – Some Stability for the Medical School

#### Appointment of LeRoy Long as Dean

Mark R. Everett states in his book (15) that the Medical School was perilously close to being rated “C” by the Council on Medical Education and morale among the faculty was low. The Medical School was seriously under-funded with no x-ray equipment, no biochemistry laboratories and poor surgical facilities. Rolater maintained overall control of his hospital and his patients came first. At one point, Dean Jolly had to ask the faculty for extra funds to keep his secretary over the summer. On February 1, 1914, Jolly was replaced by Curtis P. Day as Dean of the Medical School, adding to the instability.

The third Governor of Oklahoma was Robert L. Williams, elected in 1914. One of Williams’s Democratic opponents was Al Jennings, who had just been released from Federal Prison for bank robbery. Jennings came in third in the primary, which did not help the image of the new State of Oklahoma (28). Jennings was a colorful character who made a movie about his arrest by Deputy Marshals, which played fast and loose with the truth. In rebuttal, Bill Tilghman, who arrested Jennings, also made a movie showing how the arrest actually took place. Such was the state of politics in Oklahoma in 1914.

Governor Williams took a serious interest in the Medical School, which he realized was in trouble. Williams presented the State Board of Regents with an ultimatum – either dismiss Dean Day and get a new Dean, or he would veto their appropriation. One of the influential members of the State Board of Regents was Francis B. Fite, who practiced medicine in Tahlequah. LeRoy Long, a successful surgeon in McAlester and active in medical affairs in the Territory and the State, was well known to Fite. Fite and the Regents had been after Long to become Dean for at least two years – he declined offers in 1913 and 1914 (24). He bluntly told the Regents that he did not want to leave his friends and practice to become Dean of a class “B” Medical School. Long was finally convinced to accept the position by the Regents and Governor and was named Dean on September 1, 1915. Long detailed to the Governor and the Regents what changes were needed to regain the “A” rating from the Council on Medical Education. Most importantly – a hospital controlled by the University. The President of the University, Stratton D. Brooks, was lukewarm about the whole situation. He felt that Long had been forced on him and was not that enthusiastic about medical education. However, after meeting with Long the two became friends and Brooks became a supporter of the Medical School (24).

Governor Williams had a lot on his plate; this was only eight years after statehood and Oklahoma was still in financial distress. Oklahoma was planning a capitol building in addition to the hospital and Governor Williams decided to leave the dome off the capitol building to save money (17). The University Hospital planned for Oklahoma City may have influenced the decision to leave off the dome. Interestingly, a dome is now being added to the capitol and is scheduled for completion in the last quarter of 2002. World War I had started in Europe, and after the U.S. entered the War, Williams vigorously supported the war effort – but again at a cost to the state. In 1916, Francisco “Pancho” Villa crossed the border from Mexico on raids into New Mexico and General John “Black Jack” Pershing was sent to invade Mexico to punish Villa. One of his military units was the Oklahoma National Guard and the training they got served them well when they were called up to serve in World War I. Pershing got his nickname in an interesting fashion. He was a lieutenant in the Buffalo

Soldiers 10<sup>th</sup> U.S. Cavalry when they charged up San Juan Hill. Service in the black military units was the fast track to promotion for White officers. In 1923, the Oklahoma National Guard became part of the 45<sup>th</sup> Infantry Division, which served with great distinction in World War II and the Korean Conflict. Their first shoulder patch was a swastika, considered to be a good luck sign, but this was changed to the thunderbird before World War II. The “Spanish Flu” epidemic hit Oklahoma hard in 1918 shutting down schools, hospitals, almost bringing the State to a halt. It cost the State an estimated \$15.5 million in lost revenue, money the state could ill afford (32).

From all accounts, Williams did an excellent job of keeping all these balls in the air (17) and still found time to champion the cause of the hospital. House Bill 366 (1917) appropriated \$200,000 for a University Hospital to be located on capitol lands in Oklahoma City. Included in the act was a provision that any citizen of Oklahoma could be a patient and would be charged only room and board – medical care was free (24). However, HB 366 generated a lot of opposition and received a “Do not pass” recommendation from the Senate Committee. Williams forever believed that organized medicine did not support the bill. Certainly, J.B. Rolater was unhappy with it, but offered to withdraw his opposition if his lease would not be terminated. He was given this assurance and he withdrew his opposition. Dean Long hit the travel circuit and changed a lot of minds among the medical community. The Tulsa County Medical Society was the first such organization to support the bill (10).

The bill was reconsidered and a meeting of the committee was held in the Senate Chambers for which all of the Medical School faculty and students turned out. Dean Long and other members of the faculty addressed the committee. Again Governor Williams threatened to veto the higher education appropriation if HB 366 was not approved. This time it passed handily.

Dean Long also addressed his administrative responsibilities needed to restore the rating. He met with A.D. Bevan of the Council on Medical Education to find out what Oklahoma needed to regain the “A” rating. The main stumbling block at this time was a requirement for two years of pre-medical education including one year of biology, one year of physics and one-half year of modern foreign language. These requirements for admission were added in 1917 bringing the University of Oklahoma Medical School into full compliance with recommendations of the Council on Medical Education.

Hospital construction was delayed because of the World War I, but the building was dedicated on November 13, 1919 with a ceremony in the House of Representatives Chamber. The final project cost of the hospital was \$350,000. The University of Oklahoma Regents were reconstituted in 1919 and formal control of the hospital passed to this board.

The “A” rating was restored to the University of Oklahoma Medical School by the Council on Medical Education on March 1, 1920. The only serious problem remaining was the location of the facilities for the first two years of Medical School in Norman. As Dean Long pointed out, it was becoming the practice in the best Medical Schools to expose the pre-clinical students to the clinical practice of medicine and the disparate geographic locations made this difficult (26).

## Chapter 6

### Edwin C. “Daddy” DeBarr

#### **The influence of the Klan in the University**

The story of the dismissal of Edwin C. DeBarr for his activities in the Ku Klux Klan is not only one of the strangest stories in the history of the University of Oklahoma, but had a direct bearing on the formation of an independent Department of Biochemistry. Undoubtedly DeBarr made major contributions to the University of Oklahoma and to the Medical School. He was one of the first four members of the OU Faculty with the responsibility to teach chemistry and biochemistry to medical students. At the time, these were infant sciences and were largely descriptive in nature. It has been pointed out that the first rating of the Medical Department by the Council on Medical Education was “A”, no doubt due in part to DeBarr’s rigorous curriculum in chemistry. DeBarr served as the Head of Chemistry from 1892-1923, founded the School of Pharmacy in 1893, started the School of Chemical Engineering and served as Vice President of the University from 1909 to 1923. DeBarr campaigned for a chemistry building, which was dedicated in 1917 and named for him. He was well liked by students who called him “Daddy”.

The Ku Klux Klan became very active in the United States and in Oklahoma in the 1920’s and DeBarr not only became a member of the Invisible Empire but rose in the organization to become the first Grand Dragon of Oklahoma. However, he had a problem keeping his Klan activities and academic responsibilities separate. He was censured on April 20<sup>th</sup> 1922 by the Regents who were upset with DeBarr because he and the Klan were working for the election of Democratic candidates. DeBarr was doing some of this while he was Acting President in the absence of Brooks. DeBarr did not offer any strong defense of his activities except to state that “I have been greatly misrepresented. If 30 years of living and doing in Norman and in Oklahoma are not a sufficient defense, than I have no other to make.” A year later, he gave a commencement address to high school students in Okmulgee in which he made inflammatory statements about Catholics. Some of the citizens of Okmulgee took offense and complained to the Regents. At the June 5, 1923 meeting of the Regents, the minutes state that: “It was moved, and unanimously carried, that Dr. Edwin DeBarr, Vice President, Director of the School of Chemical Engineering, Professor of Chemistry, be and is hereby removed from tenure appointment, and that he be given leave of absence without pay, for the term of one year from July 1, 1923... It was moved, and unanimously carried, that the Office of Vice President of the University of Oklahoma be abolished as of this date, - June 5, 1923.” Again, DeBarr rested on his record at the University and had very little to say in his defense. DeBarr had accepted large fees from some utility companies for his testimony during a rate increase hearing before the Corporation Commission, and this may have also played a role in his dismissal.

DeBarr was the Grand Dragon of the Oklahoma Klaverns, as the individual organizations were called. However, in 1923, he lost that job to N. C. Jewett. DeBarr was kicked upstairs in the Klan and became a member of the Klonecillium, which was a judicial body with 15 members, called Genii. The Imperial Nighthawk, a Klan magazine had this to

say about DeBarr<sup>1</sup>: “Klansman Edwin DeBarr Genii, Grand Giant, Klan Giant and Klansman, is hereby vested with authority to promulgate and communicate the Kloranic Mysteries of the Order of Knights Kamellia to all Genii, Imperial Representatives and Grand Dragons.” It went on to say: “All Imperial Representatives and Grand Dragons ...are hereby vested with authority to communicate them to all Hydras, Great Titans, Furies, Exalted Cyclops and Terrors, who are eligible and worthy for advancement under the prerequisites heretofore proclaimed.” In 1924, DeBarr was the Imperial Kludd, the KKK’s national chaplain. Although he did quite well as a chemical consultant after his dismissal, his troubles were not over. On October 10, 1950, he was attacked in his apartment by the husband of his granddaughter and died of his injuries on December 18, 1950.

From the cat bird seat of the early 21<sup>st</sup> century, it is difficult to see how someone as well educated and accomplished as DeBarr could take seriously an organization where his title was Imperial Kludd. In the early 1920’s the Klan was resurgent in Oklahoma and in many northern and southern states (9). Estimates of the numbers of Klan members in Oklahoma are a guess, but Clark (9) suggested about 150,000 at its peak membership. The Klan liked to think of itself as promoting Victorian values and was particularly hard on bootleggers and homewreckers, the latter being anyone suspected of being unfaithful to his wife or even delinquent in mortgage payments. The Klan was also hard on Catholics, Negroes and immigrants who did not speak English well. Many legislators, doctors, lawyers, businessmen, police, sheriffs and deputies were Klansmen, which made law enforcement problematical. The Klan had “Whipping Squads” that kidnapped an offender, took him, or sometimes her, to a field to be whipped. The members of the whipping squads wore hoods to prevent recognition. As the Grand Dragon, DeBarr must have known about the whipping squads. In 1921, the Tulsa Race riot took place when a black man, Dick Rowland, was arrested and charged with molesting a white girl. The papers inflamed the situation (4) and a mob gathered around the jail to lynch Rowland. A black mob also gathered to defend him and the riot started. By the time it was over, the black section of Tulsa had been burned to the ground with an estimated 30 fatalities. The Klan probably did not start the riot, but used it to support its message.

The Klan’s flower died almost as quickly as it blossomed. Citizens protested the whippings and ridiculed the hoods and secret ceremonies. By the middle 1920s the Klan lost many of its members and went out of business in Oklahoma in 1944 during a dispute with the IRS.

In spite of all this controversy, DeBarr was widely respected, even after leaving the University. In fact a portrait of DeBarr was presented to the University by Alpha Chi Sigma, the honorary chemical fraternity in 1931<sup>2</sup>. Among the dignitaries on hand was the then University President, William B. Bizzell. There was no mention of DeBarr’s association with the KKK at this event. However, times change and in 1988 his role in the KKK again became an issue, this time with respect to the name of the DeBarr Chemistry building. The Regents voted to change the name to the Chemistry Building and his name was removed<sup>3</sup>.

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<sup>1</sup>*Imperial Night-Hawk*, Feb. 27, 1924

<sup>2</sup>The Sooner Magazine, Volume 4, page 333 (1931)

<sup>3</sup>Oklahoma Daily, July 21, 1988. Daily Oklahoman, July 21, 1988

## Chapter 7

### A Separate Department of Biochemistry (and Pharmacology)

#### Basic science departments in 1924

Full-time faculty headed the basic science departments of the Medical School in 1924, in contrast to clinical science faculty Heads, who were mostly unpaid volunteers (15). The immediate ancestor of the future Department of Biochemistry and Pharmacology was the Chemistry Department, headed by DeBarr from 1906 until 1923. Other basic science departments were Anatomy, originally headed by Upjohn beginning in 1900, then Stoops and several others. Edward M. Williams headed the Department of Pathology and Bacteriology. Bacteriology was split out as the Department of Bacteriology and Hygiene in 1912, with Gayfree Ellison, M.D. as the Head. The Department of Physiology was formed in 1906, but there was no head until 1908, when John Dice Maclaren, M.D. was appointed. The Department of Physiology also taught pharmacology until 1924, when it was shifted to the new Department of Biochemistry and Pharmacology. In 1935, a separate Department of Pharmacology was formed with Harold Shoemaker as the Head.

#### Mark R. Everett, the first Head of the Department of Biochemistry

Long repeatedly made clear his desire to bring students and basic science faculty to Oklahoma City to unify the school (26) and, while DeBarr was an excellent chemist and teacher, it was highly unlikely that he would have moved to Oklahoma City. His removal made this problem moot. The decision was made to form a separate Department of Biochemistry and Pharmacology and the choice for the Head of this new Department was Mark Reuben Everett, who had just earned his Ph.D. from Harvard Medical School. Everett was born in Slatington, Pennsylvania in 1899, went to high school there, and served as a private in the Army in World War I before attending Bucknell University, where he earned a B.S. in Chemical Engineering in 1920. He then attended Harvard for his graduate studies and earned his Ph.D. in Medical Sciences in 1924, with an emphasis in Biochemistry. He listed Otto Folin, Walter B. Cannon, Joseph C. Aub and Cyrus H. Fiske as his tutors at Harvard (14). His first two years of graduate school were actually the first two years of Harvard Medical School – something common at the time. 1924 was a good year for young Dr. Everett. He married Alice Allen of Holden, Massachusetts, and a graduate of Simmons College, earned his Ph.D. and was named Professor and Chairman of the Department of Biochemistry and Pharmacology at the University of Oklahoma School of Medicine. This was pretty heady stuff for a young man of 24.

The Everetts arrived in Norman on a hot August day in 1924 after a long train trip from Cambridge Massachusetts. When Mrs. Everett was interviewed for this history, she recalled that she spotted a man wearing a wide brimmed hat in the New York train station and, guessing that he was from these parts, asked him if there were trees in Oklahoma. He said “Yes Ma’am. They’re between each house.” She also added that it was a wonderful life.

Everett’s research career moved quickly, probably supported by Medical School funds, since extramural support was almost unknown then. He was an analytical biochemist with a specialty in carbohydrate structure and identification and, later, carbohydrate metabolism. This reflected his Harvard Education, where Otto Folin was one of his teachers. His earliest papers were methods for the determination of hydrolyzable carbohydrates (polysaccharides) and non-hydrolyzable carbohydrates, mostly glucose, in

urine and blood. These were in collaboration with Harold Shoemaker Ph.C., (Pharmaceutical Chemist) who was hired as an Assistant Professor of Biochemistry and Pharmacology in 1925, and Fay Sheppard, M.S. who was appointed Assistant in Biochemistry and Pharmacology in 1926. The next year, she earned her Master's degree doing research with Mark Everett. Some later papers included student authors. Shoemaker became the Head of the Department of Pharmacology in 1935, when it split out from Biochemistry & Pharmacology.

Everett went on to have a distinguished career at Oklahoma in research, administration and writing. He is best known for his administrative role as Dean of the Medical School where he hired the first full-time Heads of Clinical Departments and for his role in starting the Oklahoma Medical Research Foundation. He published a textbook of biochemistry (13), two books on the history of the Health Sciences Center, one with his wife Alice (15,16), and a history of the Oklahoma Medical Research Foundation, which he was instrumental in founding (14). The Oklahoma Medical Research Foundation played an important role in the history of the Biochemistry Department, which will be covered later. Dean Everett received many honors, including election to the Oklahoma Hall of Fame in 1946, an honorary D. Sc. from Bucknell University in 1948, and was named a Pennsylvania Ambassador. He served on many important commissions during his career including the Council of the Association of American Medical Colleges.

### **Biochemical research – 1924**

In 1924, the beginning of the Biochemistry Department, biochemical research was still analytical and descriptive but the technology was better than it had been twenty years earlier. Volume 1 of *The Journal of Biological Chemistry* covered two years, 1905-1906, but it took four volumes to cover 1924. In addition, methodology sections of these reports were much more detailed so that it became easier to reproduce results. Metabolism and the formation of chemical energy in the form of high-energy phosphate would become the first biochemical field to leave the descriptive phase. But at this time, all that was known of glycolysis was that muscle could convert glycogen anaerobically to lactic acid and that phosphate was needed for this process (31). I've been unable to find a record of which biochemical manual Oklahoma medical students used. However, Otto Folin, a hard-nosed analytical biochemist, was on the faculty at Harvard while Everett was a graduate student there and had published a biochemical text used by medical students at Harvard (20). Furthermore, Everett's text on *Medical Biochemistry* (13) was dedicated to Folin, so it seems likely that this was the manual they used in the 1920's. There is a copy of the 1922 edition of Folin's book in the Health Sciences Center library, which was apparently owned by L. E. Diamond, who became a member of the Biochemistry faculty in 1941.

### **Graduate education on the Oklahoma City campus- 1924**

The 1924 Catalog of the University of Oklahoma listed graduate courses in anatomy, bacteriology, histology, pathology, physiological chemistry and physiology. A graduate course in pharmacology was added in 1925. Later, Everett would add graduate courses in *Clinical Biochemistry* and *Biochemical Preparation and Research*<sup>4</sup>. The instructors listed for these courses were Everett, Meyers and Sheppard. The first Master of Science degree from the University of Oklahoma was awarded in 1922 to a student in a basic science department of

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<sup>4</sup>Bulletin of the University of Oklahoma, 1928-29

the Medical School. She was Julia Elizabeth Steele, of the Department of Pathology and her thesis title was “Multiple miliary adenomata of the kidney cortex: with special references to histogenesis.” The first graduate degree in Biochemistry was awarded to Fay Sheppard who earned her Master’s degree with Mark Everett in 1927. The title of her thesis was “Hexosediphosphate an intermediate biochemical in the Embden-Meyerhof pathway of glycolysis.” The first Ph.D. from the Graduate School of the University of Oklahoma was conferred in 1929 on Mary Jane Brown<sup>5</sup> for “Comparative studies in the animal ecology of oak-hickory forests in Missouri and Oklahoma.”

### **Expansion of the University of Oklahoma**

The middle to late 1920’s were prosperous times in the United States and Oklahoma; in fact, Gittinger referred to 1923-1931 as “Eight Years of Expansion” for the University of Oklahoma (22). The overall number of Medical School faculty increased from 58 in 1914, to 77 in 1922 and then to 147 in 1931 (15). Many of the faculty added to the basic science departments of the Medical School were at the Instructor level in order to carry the heavy teaching load required of laboratory courses. The only professorial positions filled during this period, other than Everett’s, were Assistant Professorships to Harold Shoemaker, Ph.C. (Pharmaceutical Chemist) and William Meyers, M.D. Most of the clinical faculty added were volunteers who donated their time to the Medical School.

Perhaps the most noticeable changes were to the physical plant of the Medical School. After the consolidation with Epworth, all of the facilities in Oklahoma City were rented. But at the end of the 1920’s there were three buildings in Oklahoma City that belonged to the Medical School – the Medical School building, University Hospital and the Crippled Children’s Hospital - signifying the consolidation of the Medical School in Oklahoma City.

Long’s plan to move the pre-clinical faculty to Oklahoma City did not sit well with some of the citizens of Norman. They campaigned successfully for a Medical School building on the Norman Campus, the hope being that this would put an end to the idea of moving the pre-clinical students and faculty to Oklahoma City. The 1923 legislature appropriated \$100,000 for a Medical building to house the pre-clinical students and faculty on the Norman Campus. 1923 was another strange year in Oklahoma politics. The Governor was John C.”Jack” Walton who lasted nine months in office before he was impeached and forced out of office. He became famous for appointing political hacks to patronage positions including University appointments. His actions convinced Stratton D. Brooks President of the University of Oklahoma and J. B. Eskridge, President of Oklahoma A & M to leave their positions. He was also famous for his crusade against the KKK, although he himself was a member of the Invisible Empire.

In spite of the addition of the Medical School building to the Norman campus, the 1927-29 biennial legislature appropriated \$250,000 for a Medical School building in Oklahoma City. This was completed in 1928 at 801 N.E. 13<sup>th</sup> Street (15,22). The same year, the Crippled Children’s Hospital was opened in Oklahoma City at N.E. 13<sup>th</sup> and Kelley. The Medical School building contained lecture rooms, research laboratories, a library and offices

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<sup>5</sup>Sooner Magazine, Volume 1, page 327, (1928)



for the faculty and staff. Both buildings were dedicated on November 1, 1928, during a clinical meeting, with speeches by Jabez N. Jackson, former president of the American Medical Association, Governor Henry S. Johnson and Dean LeRoy Long. After the basic science faculty moved from Norman to Oklahoma City, the College of Pharmacy occupied the former Medical Building in Norman. I remember the College of Pharmacy Building very well because I was the Interim Dean of the College of Pharmacy in 1976 when it was planning to move to Oklahoma City and spent many hours in the building. The old Medical/Pharmacy Building is now Sutton Hall named after George Miksch Sutton, the famous ornithologist and bird painter of the University of Oklahoma. Sutton Hall is now home to faculty and graduate students of the Department of Zoology.

### **The dark ages**

The economic depression that affected the United States from 1929 to the late 30's affected Oklahoma deeply. To make matters worse, this was the time of the dust bowl in Oklahoma and other plains states and morale throughout the state was low. On April 14, 1935, the dust was so thick near Woodward that the sky was black (30). The eighth governor of Oklahoma was William H. "Alfalfa Bill" Murray and to say he was the most colorful governor is a considerable understatement. He was immediately faced with a \$5 million deficit in the state budget because the citizens were unable to pay their taxes. He formed the Oklahoma Tax Commission, which addressed the problem of tax evaders (21). Some of his solutions were extreme. He called out the National Guard to shut down production of oil wells in an effort to drive up the price of oil. He also pardoned a large number of prison inmates, which did not endear him to his neighboring governors. He hated Franklin Delano Roosevelt and the New Deal, and in fact, managed to get himself nominated for President at the Democratic Convention to run against Roosevelt, an effort that went nowhere. James J. Farley, who directed Roosevelt's campaign, referred to Alfalfa Bill as "crazy as a bedbug." (7).

Murray hated institutions of higher education, in particular the University of Oklahoma. The draft for his memoirs (29) is in the Carl Albert Collection in Norman and there is a very interesting *Postlogue*, which apparently never appeared in the final publication. It begins "The University of Oklahoma stands in the greatest need of reformation of any State Institution of the State." He goes on to claim that there was bootlegging in Norman (where wasn't there?), that faculty were "philandering with girls in their private rooms" and something suspicious was going on with the football tickets. In fact, he called out the National Guard to collect tickets at an OU - Nebraska game but nothing came of it. He asked for an investigation of the University, the report being that "Nothing was found." He felt vilified by the press for these actions and was still bitter about it in 1945. He was also a bigot and racist. He stated that the Slavic races were of limited intelligence, that Negroes did fine as servants and manual laborers, but it did not pay to educate them. He also believed in sterilization of the "feeble-minded", using an analogy to culling of cattle to improve the breed. Finally, there are several letters in his file from the *America First Committee* thanking him for his support of their positions. The America First Committee was an extreme right wing, isolationist organization, which parroted Hitler's policies with the objective of keeping America out of World War II because the U.S. would almost certainly side with Great Britain, at war with Germany.

In light of this, it is not surprising that Murray was responsible for the resignation of Dean Long. A friend of Murray's had entered University Hospital and wanted to be treated by a chiropractor. Dean Long was horrified and would have none of it. Murray issued an

executive order directing University Hospital to admit chiropractors to treat Mrs. Burgett. This order is printed in its entirety in Everett's book (15). The chiropractor came and ministered to Mrs. Burgett, but this aroused a firestorm locally and nationally. Eventually Murray bowed to the wishes of the regents who ruled against the chiropractor (15).

There was very little growth in the University and the Medical School during the depression years, until the middle to late 1930's. In 1935, Pharmacology was made a separate Department with Harold A. Shoemaker as its first Chairman (16). Some money was now budgeted for research, approximately \$20,000 to be spent at the discretion of the Dean. On the other hand, there were significant budget reductions during some years, sometimes 15-20%.

### **Confidential Probation**

Probably the darkest moment in this period came in 1936 when the Council on Medical Education placed the University of Oklahoma School of Medicine on confidential probation. The first requirement that the Council proposed was complete freedom from political interference. In addition to the long history of interference by Murray and Walton, there was pressure from the legislature to add osteopaths and chiropractors to the faculty, allegedly as a reward for political support (16). There was also a continuing struggle to make the hospital self-sufficient even though the expenses of indigent patients were not being covered by the state. The Council also recommended a reduction in the number of students until sufficient clinical facilities were available.

### **World War II**

During World War II, the entire effort of the Medical School was focussed on training physicians for the war effort. The Medical School curriculum was accelerated to produce two classes per year. In the 1945 edition of the Sooner Medic, 66 out of 80 members of the senior class are in Uniform, either the Army Specialized Training Program (ASTP) or the Navy V12. After completion of Medical School, these young men took nine months to complete their internship and then they were off to war. Except that those graduating in 1945 had no war to go to.

## Chapter 8

### Things Start Looking up for Research

#### The Oklahoma Medical Research Foundation

Even before the conclusion of World War II, it was apparent that the University of Oklahoma Medical School would need research programs to become a nationally recognized institution. Biochemistry was leaving the descriptive phase; the study of metabolism was in full bloom and the reactions of anaerobic glycolysis and aerobic pyruvate oxidation were focus topics. Fritz Lipmann and Sir Hans Krebs would share the Nobel Prize in Physiology and Medicine in 1953 for their concepts of high-energy phosphate and the Krebs citric acid cycle, respectively. Next would come the field of molecular biology. Avery, MacCleod and McCarty published the proof that DNA carried the genetic code in 1944 (3). Even though this was one of the most important discoveries in biology, they were never awarded the Nobel Prize. The double helix structure of DNA was just around the corner (35) along with its important implications for genetics (34).

While there was a small amount of State money available for research in the Medical School, anything else had to be bootlegged from departmental funds. In 1944, Coyne H. Campbell, M.D. established the John Archer Hatchett Fund for medical research for the Department of Biochemistry (14) which may have been the first significant gift for research in the Medical School. Because it was unlikely that the state budget would support medical research to any significant extent, members of the Medical School Alumni Association, prominent businessmen in Oklahoma City and Tulsa, and faculty of the Medical School developed the concept of a free-standing research foundation, but with close ties to the Medical School. Mark R. Everett played a key role in this project. I've often heard it said that it was the intent that the Oklahoma Medical Research Foundation was to be the research arm of the Medical School and the role played by the Alumni Association supports this idea. In April of 1944, at a meeting of the Alumni Association, a committee was established to make plans to secure endowments for the Medical School. Dean Tom H. Lowry appointed a committee of Alumni Association members including John H. Lamb, Secretary of the Alumni Association, Ray M. Balyeat, John F. Burton, and Tullos O. Coston. Mark R. Everett, who was Chairman of the research committee of the Medical School, was also appointed to this committee. The committee moved quickly to develop plans and to survey the needs of the school. In fact, the Alumni Association raised their dues to finance this survey.

In August of 1946, the articles of incorporation of the Oklahoma Medical Research Foundation were signed at a meeting of the temporary Board of Trustees of the Foundation, with John H. Lamb as the temporary Chairman and Mark R. Everett as the temporary secretary. The purpose of the Foundation stated in the Articles of Incorporation were: "To promote educational objectives by encouraging, fostering and conducting scientific investigations in medicine in cooperation with or independently of the School of Medicine of the University of Oklahoma and in cooperation with the faculty, staff and students thereof and those associated therewith, or independent of such faculty, staff and students" (14). More plainly speaking, the Foundation was to accept gifts to be used for research and to provide research laboratories to its own members and to Medical School faculty as needed. The organizational structure included a forty-member board of directors consisting of twenty laymen, six members of the Alumni Association, six members of the Oklahoma

State Medical Association and three members of the Faculty of the Medical School. In addition, thirty Incorporators of the Foundation signed the Articles of Incorporation including Mark Everett and George L. Cross, President of the University. The Incorporators and Laymen of the Board included many now historical names in Oklahoma History such as C.A. Vose, Robert S. Kerr, C.R. Anthony and Ancel Earp. In addition to the Board and Incorporators, the President of the University, Dean of the School of Medicine, President of the Alumni Association, Director of the Research Institute and superintendents of allied hospitals supported by the foundation were *ex-officio* members of the Board of Directors. The by-laws were later amended to sever the connection of the Alumni Association and University officials with the Board (14). The fund-raising was very successful, the land was purchased, and the original building constructed on this present site and completed in 1950. The construction site was dedicated on July 3, 1949, the principal speaker being Sir Alexander Fleming, the discoverer of penicillin.

## Chapter 9

### The Biochemistry Department Begins its First Expansion

#### Everett becomes Dean of the Medical School

While the Oklahoma Medical Research Foundation was being launched, an interesting event occurred, namely the appointment of Mark R. Everett as Dean of the Medical School. Dean Lowry died while in office in 1945 and Wann Langston M.D. was appointed Dean at the age of 63. In 1947, Mark R. Everett was appointed Dean of the School of Medicine and shortly thereafter, Langston retired to become Professor Emeritus. The fact that Everett, a Ph.D., not a M.D. was appointed Dean, was a remarkable event for the time. Dean Everett would have some very difficult problems to solve during his tenure but then, “that goes with the uniform.”

One of the immediate needs was to hire full-time Chairmen of clinical departments. Probably his biggest catch was Stewart Wolf, who became Chairman of the Department of Medicine in 1952. Not only was he a national figure in medicine, but he recruited people to his Department such as Robert M. (Bob) Bird, and John Colmore, which in turn made it easier to recruit other full-time clinical chairmen. Bob Bird was responsible for developing the Master Plan for the Health Sciences Center, and was later Dean of the Medical School; John Colmore became Acting Provost of the Health Sciences Center. Other important catches were John Schilling, hired as Chairman of the Department of Surgery (1956) and Louis Jolyon (Jolly) West (1954) hired as Chairman of the Department of Psychiatry and Neurology. Jolly West built a very strong Department of Psychiatry, including a nationally recognized Division of Biological Sciences. He also became something of a legend as the one who was responsible for killing an elephant with a dose of LSD, that was too great even for an elephant (23).

#### The start of graduate education on the Medical Center campus

Advanced graduate education began on the Medical Center campus in 1951 with the introduction of a Ph.D. program in Medical Sciences. This was a general curriculum in which graduate credit was given for some of the Medical School courses such as medical biochemistry, and courses approved for graduate credit offered in each of the seven basic sciences departments – Anatomy, Bacteriology, Biochemistry, Histology, Pathology, Pharmacology, Physiology and Preventative Medicine and Public Health. In 1951, there were 32 candidates enrolled in this program leading to the Ph.D. degree in Medical Sciences. However, it was not until 1956 when the first Ph.D. was awarded to a graduate student in the Department of Biochemistry, – to Jorge Pardon, whose major professor was Marvin Shetlar. The second Ph.D. from the Department was awarded in 1958 to Robert Schoenfeld, whose major professor was Arley Bever.

Everett was successful in getting state money to enlarge the School of Medicine building, doubling its size and providing for more research space. This would allow the enrollment in the Medical School to go from 280 to 361. Everett was particularly proud of the increase in space for the library (16). In 1956, the Medical Center got an Associate Dean for the Graduate College, Philip E. Smith, who was also Associate Professor of Preventive Medicine and Public Health.

### **The Biochemistry Department gets a Vice-Chairman**

After becoming Dean, Everett retained the Chairmanship of the Biochemistry Department, which was the practice with his predecessors, but he could not do justice to both positions. To help with the administrative load of the Department, Everett hired Arley T. Bever, Ph.D. from his postdoctoral position at Harvard University. Arley Bever was hired as an Assistant Professor of Biochemistry in 1955, but soon became Associate Professor and Vice Chairman of the Department. His research interests were in reproductive and dermatological biochemistry. His administrative responsibilities were to plan the biochemistry courses for medical and graduate students. However, he stayed at the University of Oklahoma only until 1963 when he left to join the National Institutes of Health as Special Assistant to the Associate Director of Extramural Programs.

### **The beginnings of extramural research support for the Biochemistry Department**

By the 1950's the National Institutes of Health was a force in support of research and training programs in the United States, particularly in Medical Schools. In 1956, research grants on the Medical School campus totaled \$225,000, of which \$12,000 was awarded to Marvin Shetlar, of the Biochemistry Department by the National Institutes of Health as a research fellowship (16). While \$225,000 is a pittance in today's environment, it was much better than \$25,000 given by the state in earlier years. Also in 1956, the Oklahoma City campus was designated as the University of Oklahoma Medical Center in recognition of the Hospitals, School of Nursing and the School of Medicine and in anticipation of new programs coming on line.

### **The Research Building**

One of the plans for expansion included additional research laboratories for the faculty. A grant was awarded by the National Institutes of Health to the School of Medicine for \$400,000, providing the school could match it with another \$400,000. In 1959, State Representative Bryce Baggett, a supporter of the medical center in the State Legislature, introduced House Bill 589, which provided for an emergency appropriation of \$400,000 in state funds to match the federal grant. The bill passed and was signed by Governor J. Howard Edmonson. The five story building was completed in 1961 at 800 NE 13<sup>th</sup> street, directly across from the Medical School building. There was not enough money to complete the top floor, but Carl Nau, newly appointed Director of the Institute of Environmental Health, obtained a grant from the Surgeon General and contributions from industry to complete the floor. This was really the first modern research space for the Medical School, with modular laboratories and shared facilities such as animal quarters and a dark room. It was proposed that the Research Building be named after Mark R. Everett, but the University Regents ruled against naming any tax-supported buildings after living individuals (16).

### **The search for a new Chairman**

By then, Everett had almost 40 years of service with the University of Oklahoma School of Medicine and was looking forward to retirement; therefore, a new Chairman would be needed for Biochemistry. The dearth of resources in the Medical School made it difficult to support an expanded program not only in Biochemistry, but also across the board. The Biochemistry faculty were spread too thin to handle their teaching responsibilities, particularly of the graduate program, which was now beginning to attract graduate students. Fortunately, the Biochemistry Section of the OMRF had many excellent

biochemists by this time and they also handled a major share of the graduate teaching. Looking at a picture of the Biochemistry full-time and adjunct Faculty taken in the early 1960's shows the extent of the participation of OMRF biochemists in Medical School programs. According to Mark and Alice Everett (16), Marvin Shetlar was to be appointed to the position of Chairman of the Department for 1964-65. However apparently he never assumed the position. Instead, H. Neil Kirkman M.D., a pediatrician was appointed Chairman for that period. Kirkman was an excellent biochemical geneticist who studied glucose-6-phosphate dehydrogenase variants and their role in human hemolytic anemias.

Everett retired from the University in 1964, becoming Dean Emeritus and Regents Professor and would devote himself to writing the history of the Medical School and the Oklahoma Medical Research Foundation. James L. (Jim) Dennis, M.D., a graduate of the School of Medicine in 1940, replaced Everett. Jim Dennis would become the visionary who changed the Medical Center from a four or five building campus into the modern 200-acre campus that it is today. Chapter 10 is devoted to Jim Dennis and the Master Plan.

At first it was difficult to interest candidates in the position of Chairman, one of the major reasons being the shortage of research laboratories. Finally, Leonard Eliel, who was Vice President and Scientific Director of the Oklahoma Medical Research Foundation, and Jim Dennis put their resources together and developed a package that would allow the new Chairman of Biochemistry to also be Head of the Biochemistry Section at the Foundation. The Oklahoma Medical Research Foundation offered to provide partial salary for the Chairman and laboratory space for the faculty recruits. Other laboratories would be available in the newly opened Research Building.

What made this possible, was the departure of the Head of the Division of Biochemistry at the OMRF, Ranwell Caputto. Caputto was an Argentine who left the country in disgust over Peron. Caputto was a first-rate, internationally recognized biochemist, who was a colleague of Leloir, the Nobel Prize Winner from Argentina. Leloir will be remembered as the discoverer of uridine diphosphate glucose (UDP-Glc), an important biochemical intermediate in the metabolism of carbohydrates and a model compound for all the other nucleotide diphosphate sugars. In fact, Caputto was a member of the team that reported the discovery of UDP-Glc and its biochemical role. Caputto's colleague was Raul Trucco, who left Argentina for the same reasons. I had the pleasure of knowing both of these excellent scientists and enjoyed their stimulating company while they were here. After Peron was ousted, both Caputto and Trucco returned to Argentina, which left the position of Head of the Biochemistry Section at the OMRF open.

## **B. Connor Johnson, the second Chairman of the Biochemistry Department**

The second Chairman of the Department of Biochemistry was B. Connor Johnson, who was hired from the University of Illinois in 1965. Connor Johnson was born in Regina, Saskatchewan in 1911 and earned his B.A. in Chemistry and M.A. in Organic Chemistry from McMaster University in 1933 and 1934, respectively. He worked for a while in industry and then returned to school to earn a Ph.D. in Biochemistry from the University of Wisconsin in 1940. After a postdoctoral fellowship at the University of Illinois, Department of Animal Nutrition, and a year at the Golden State Company in San Francisco, he became Assistant Professor of Animal Biochemistry at the University of Illinois in Urbana. It says something for the University of Illinois to be able to attract someone from San Francisco to Urbana. Supposedly, there is a hill in Urbana, but all I've ever seen is a berm on a golf course. Connor is something of a Frankophile, and spent sabbatical leaves at Gif sur Yvette and Strasbourg and speaks French very well. His research interests have long been in animal

nutrition, and the biochemistry of vitamin A and vitamin K. He was a prolific scientist, with over 340 publications, many in *The Journal of Biological Chemistry*.

### **What was the state of biochemistry in 1965?**

In that year, *The Journal of Biological Chemistry* consisted of 4,825 printed pages. The number of publications was rising rapidly and in the December issue of that year, papers were divided by topics; *Chemistry and Metabolism of Macromolecules*, *Chemistry and Metabolism of Low Molecular Weight Substances*, *Oxidation-Reduction and Bioenergetics*, *Enzymology and Control Mechanisms and Biochemical Genetics*. Papers were mostly classical biochemistry with surprisingly little molecular biology, which was scattered through the various topics. Many members of the American Society for Biochemistry regarded molecular biology as something of an upstart science and it was a while before molecular biologists were accepted into the society.

Connor Johnson states that in 1965 he was promised a total of 15 faculty in the department<sup>6</sup>. He provided them with laboratories in either the OMRF or the Research Building. The new faculty came from Universities all over the U.S. rather than from Oklahoma or the bordering states (Table 1).

In 1966, he hired Albert Chandler, who earned his Ph.D. from Wayne State University in 1962. His research interests were in plasma glycoprotein biosynthesis. Later, he became Interim Chairman, between Paul Weigel and myself. He was also an excellent teacher of medical students, who nicknamed him “Mr. Metabolic Pathways”, Robert Delaney, also hired in 1966 earned his Ph.D. in 1963 from Albany Medical College of Union University. His research interests were in protein structure and sequence homology. His teaching strengths were in graduate education. The third person hired in 1966 was Leon Unger, who earned his Ph.D. from the University of Illinois in 1961. His strength was in medical student education, for which he won many awards and became a master teacher. He won the Aesculapian Award in Basic Sciences in 1991, followed by the prestigious Master Teacher Award, given by Stanton L. Young, in 1993. In 1994 he won the Oklahoma Medal for Excellence in Teaching at a College/University, a program sponsored by the Oklahoma Foundation for Excellence. David L. Boren, former Governor, Senator and now President of the University of Oklahoma was the presenter at this ceremony.

In 1967, Johnson hired Creed Abell, who earned his Ph.D. from the University of Wisconsin in 1962 and who came here from a postdoctoral fellowship at the NIH. His research interests were in regulation of cell division in lymphocytes, DNA and RNA biosynthesis and carcinogenesis. Abell was one of the most successful scientists hired by Johnson in terms of grant support and research productivity and was well liked by students and faculty. However, according to Connor Johnson, Abell tried something of a palace revolt, which failed, while Johnson was on sabbatical leave in Strasburg<sup>7</sup>. Creed Abell left the Department for the University of Texas Medical Branch at Galveston. Another person hired in 1967 was Thomas A. Briggs, who earned his Ph.D. from the University of Pennsylvania in 1960. He was an excellent teacher, particularly of medical students, however Professor. Daniel S. Hodgins, also hired in 1967, earned his Ph.D. from the University of Delaware in 1966. His research interests were in enzyme mechanisms and amino acid requirements of normal and neoplastic tissues. He became disillusioned with academic life,

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<sup>6</sup> Brief History of the Department of Biochemistry & Molecular Biology by B. Connor Johnson

<sup>7</sup> Brief History of the Department of Biochemistry & Molecular Biology by B. Connor Johnson



went to law school and became a successful patent lawyer. Jary S. Mayes, the fourth person hired in 1967, earned his Ph.D. from Michigan State University in 1965. His research interests were in inborn errors of metabolism but he left the Department to join the staff of a hospital in Tulsa in 1983. The last person hired in 1967 was Bernard Rabinovitch, who earned his Ph.D. from Cambridge University in 1948. His research interests were in the biochemistry of vision.

In an interesting set of coincidences, Creed Abell hired Paul Weigel, at the University of Texas Medical Branch at Galveston as an Assistant Professor in 1978. Weigel later became the fourth Chairman of the Department of Biochemistry & Molecular Biology (Chapter 13). Moreover, Daniel Hodgins practiced patent law in Austin, Texas and handled Weigel's first three patents.

In 1969, Connor Johnson hired A. Chadwick Cox, who earned his Ph.D. from Duke University. His research interests were in mode of action of snake venoms. He is remembered as the major professor of Shannon Lucid.

In 1973, Peter Gray filled the vacancy created by the departure of Creed Abell in 1972. Peter Gray earned his Ph.D. from the University of Texas School of Biomedical Sciences in Houston in 1970. His research was on the 'biochemical and genetic nature of Huntington's Disease. Peter Gray rapidly developed an excellent research program in the Department.

In 1976, Johnson hired Martin Levine who was a Scottish-trained dentist (B.D.S) with a Ph.D. in Biochemistry from Glasgow in 1973. The College of Dentistry provided Levine's salary and his responsibility was to teach biochemistry to dental students and to do dental research.

In 1977, Johnson hired Robert A Broyles, who earned his Ph.D in Biochemistry from Wake Forest in 1970. His research interests were in hemoglobin switching. Later he directed an excellent seminar series that brought many Nobel laureates and members of the National Academy of Sciences to the OUHSC campus. These included Arthur Kornberg, Paul Berg, Maxine Singer, C. Thomas Caskey, Stuart Kornfeld and Hamilton Smith. Students were able to meet with the speakers and discuss science and their careers with these "movers and shakers" in biochemistry. This was an expensive program, which was funded variously by the Presbyterian Health Foundation, the Provost's Office and the Department of Biochemistry & Molecular Biology.

### **The Graduate curriculum in Biochemistry & Molecular Biology**

Connor Johnson emphasized graduate education, and quickly developed a Ph.D. curriculum in Biochemistry, rather than Medical Sciences, first announced in the Graduate Bulletin in 1967. In 1969, he changed the name of the department to Biochemistry & Molecular Biology, first announced in the 1970 Graduate College Bulletin. The core curriculum consisted of a four-hour course in *Introductory Biochemistry*, including a laboratory. Prior to this, graduate students took the course in medical biochemistry. Other courses added were a course in *Intermediary Metabolism*, stressing metabolic pathways and their regulation and a course in *Macromolecules and Biochemical Genetics*<sup>8</sup>. The Department was very successful in attracting graduate students and had a high total enrollment of 44 in 1969-70. There were nearly 60 doctoral degrees granted during the time that Connor Johnson was Chairman, with a high of 12 Ph.D. graduates in 1973 (Table 2).

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<sup>8</sup>Application to the U.S. Public Health Service for the Biomedical Sciences Building

Without a doubt, the most famous graduate of the Ph.D. program in Biochemistry & Molecular Biology was Shannon Wells Lucid, who earned her Ph.D. in 1973 with A.C. Cox. The title of her thesis was “Effect of cholera toxin on phosphorylation and kinase activity of intestinal epithelial cells and their brush borders.” She was born in Shanghai in 1943 of missionary parents, who still live in Bethany, Oklahoma. She was always interested in aviation and now holds commercial, instrument and multiengine airman ratings. Her interest in aviation led to an interest in aerospace exploration and she was accepted into the astronaut program in 1974. Her current biography from her home page lists a total of 223 days in space, including many on the Mir. She has numerous awards for her aerospace activities; two of the highest are the Congressional Space Medal of Honor, given to her by President Clinton and the Order of Friendship, bestowed by Russian President Boris Yeltsin.

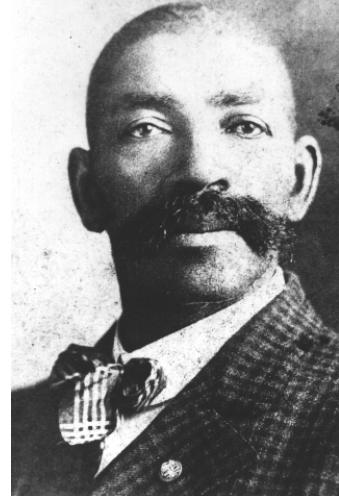
### **Colin MacLeod and the OMRF graduate fellowships**

In 1970, Colin MacLeod was appointed President of the Oklahoma Medical Research Foundation. He was the middle author on the famous paper identifying DNA as the genetic material (3), and was a tremendous catch for Oklahoma. He was convinced of the importance of graduate education to biological science and shortly after his arrival, set in motion a program of competitive fellowships for graduate students in the basic sciences supported by the OMRF. At that time, I was the Associate Dean of the Graduate College at the Health Sciences Center and together we worked out the details. Prior to this program, the OMRF had supported graduate students, but only those working with OMRF scientists, and almost only graduate students in the Department of Biochemistry & Molecular Biology. These fellowships were known as the Oklahoma Medical Research Foundation Fellowships and were awarded on a competitive basis to any student in the basic sciences, for a total of six annually. The first awards were in 1971 and most went to graduate students in Biological Psychology. The first award to a graduate student in Biochemistry & Molecular Biology was to Cydney Thorlton. Unfortunately she became very ill with cancer and died before she could finish her Ph.D. There is a plaque outside the 9<sup>th</sup> floor library dedicated to her. For awhile there was a seminar program in Biochemistry in her name supported by contributions, mainly from her family.

Unfortunately, Colin MacLeod died in London in 1972 while on his way to Pakistan for the World Health Organization. The Fellowships were renamed the Colin MacLeod Fellowships, but there was not the same enthusiastic support for the program after he died and it was discontinued after a few years.



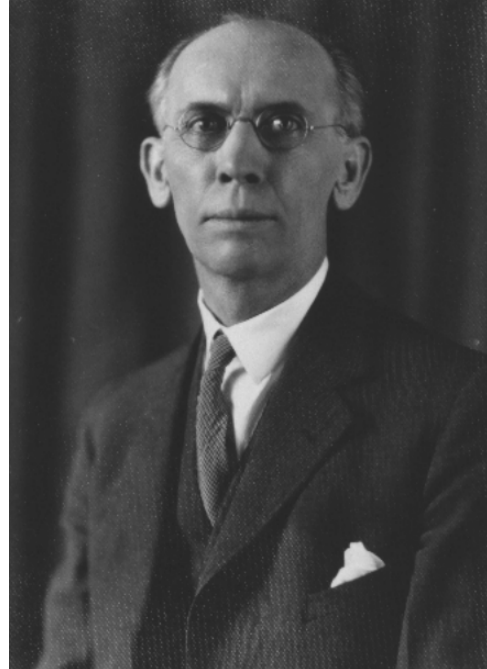
Four mounted Choctaw Lighthorsemen, 1893. Behind them are citizens of the Choctaw Nation, also heavily armed. Courtesy of the Western History Collection of the University of Oklahoma.



Famed lawman, Deputy U.S. Marshall Baz (Bass) Reeves. Courtesy of the Western History Collection of the University of Oklahoma.



Edwin C. DeBarr, taken while he was Vice President of the University. Courtesy of the Western History Collection of the University of Oklahoma.



Dean LeRoy Long. Courtesy of the Long archives in the R.M. Bird Library History of Medicine Collection.



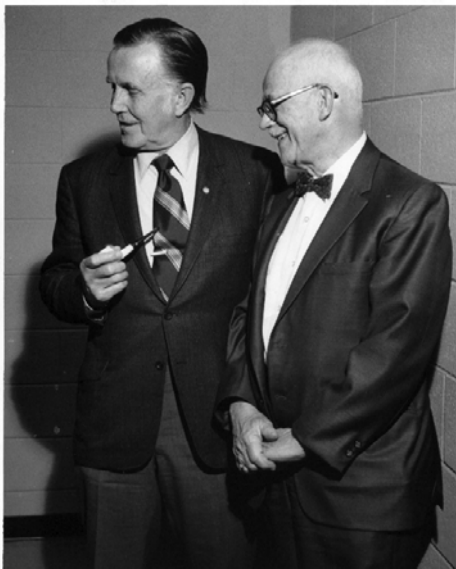
Rolater Hospital, in 1909. Courtesy of the Office of Photographic Services, OUHSC.



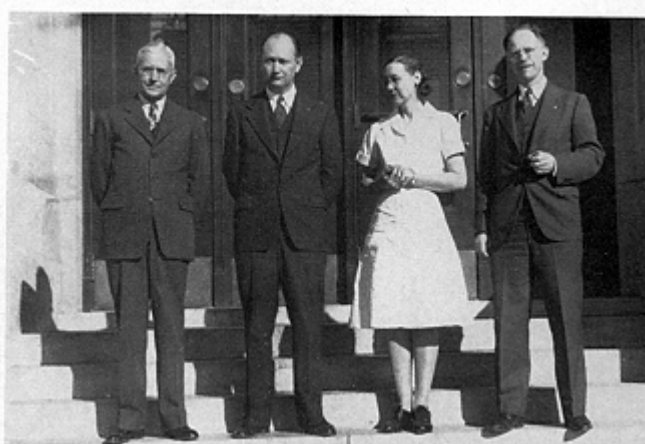
The first Medical School Building on the Norman campus, later the Pharmacy Building and now Sutton Hall.



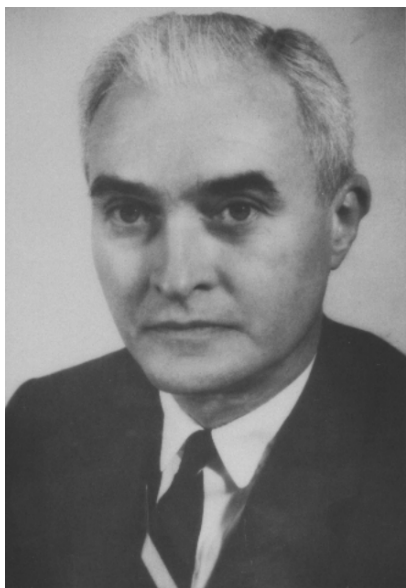
The Medical School Building at 801 NE 13<sup>th</sup> Street, taken just after it was built in 1928. It is now the College of Health Building. The building was enlarged and doubled in size in the 1950's. Courtesy of the Office of Photographic Services, OUHSC.



George Lynn Cross and Mark Reuben Everett. Taken at a Faculty meeting in 1971 and contributed by Mark Allen Everett.



Faculty of the Department of Biochemistry, taken from the 1945 Sooner Medic. Left to right, Louis E. Diamond M.S., Instructor, Alton C. Kurtz Ph.D., Assistant Professor, Fay Sheppard, M.S. Instructor, Mark R. Everett Ph.D, Professor and Chairman, 1924-64.



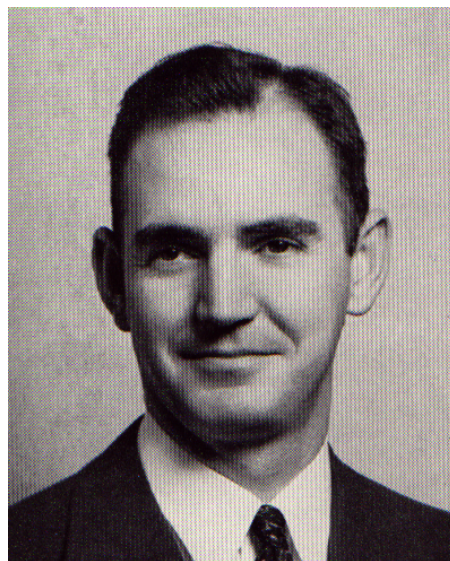
Robert M. Bird, courtesy of the History of Medicine Collection of the R.M. Bird Library. Dean of the Medical School, 1970-74.



James L. Dennis, courtesy of the History of Medicine Collection of the R.M. Bird Library.



Arley T. Bever, Vice  
Chairman of Biochemistry,  
1955-63. Picture supplied  
by Renate Bever.



H. N. Kirkman, Interim  
Chairman of the Department of  
Biochemistry. 1964-65. Courtesy  
of the 1965 Sooner Medic.



The Research Building, 800 N.E. 13<sup>th</sup> Street, as it  
looked in 2000.



B. Connor Johnson, Ph.D.  
Chairman of Biochemistry &  
Molecular Biology, 1965-78.  
Courtesy of the 1970 Sooner  
Medic.





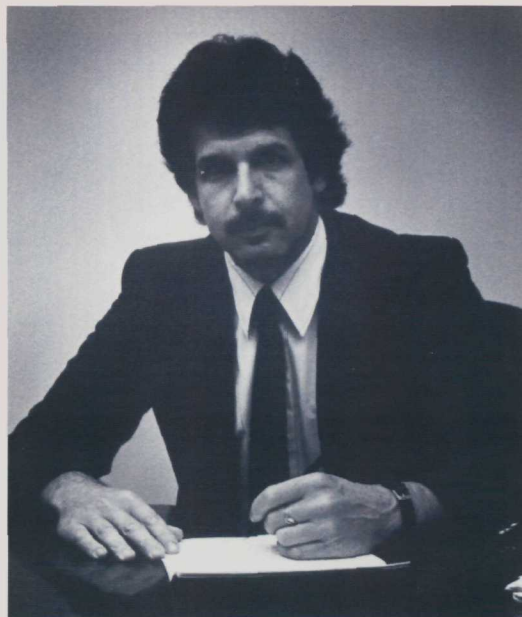
Faculty of the Department of Biochemistry about 1960, including both Medical School and Oklahoma Medical Research Foundation Faculty. From left to right they are: Alton Kurtz, Paul Wigler (OMRF), Paul McCay (OMRF), Boyd Houchin (OMRF), Earl Larsen, Petar Alaupovic (OMRF), Arley Bever, Marvin Shetlar, Fay Sheppard, Paul Condit (OMRF), Ranwell Caputto (OMRF) Raul Trucco (OMRF), H. Neil Kirkman, (Pediatrics) and Mark R. Everett. From the Departmental archives.



The full time faculty of the Department of Biochemistry and Molecular Biology, in 1981. From left to right, Albert Chandler, Robert Delaney, Peter Gray, Leon Unger, Earl Larsen, Robert Broyles, Jary Mayes, A. Chadwick Cox and J Anglin. Albert Chandler was Interim Chairman from 1992-94. Not shown are Creed Abell, Daniel Hodgins, Tom Briggs and Martin Levine. From Departmental archives.



Astronaut Shannon Lucid, the most famous graduate of the Department of Biochemistry & Molecular Biology. Taken from her web page.



Peter N. Gray Interim Chairman of the Department of Biochemistry & Molecular Biology, 1979-83. Taken from the Departmental Archives.

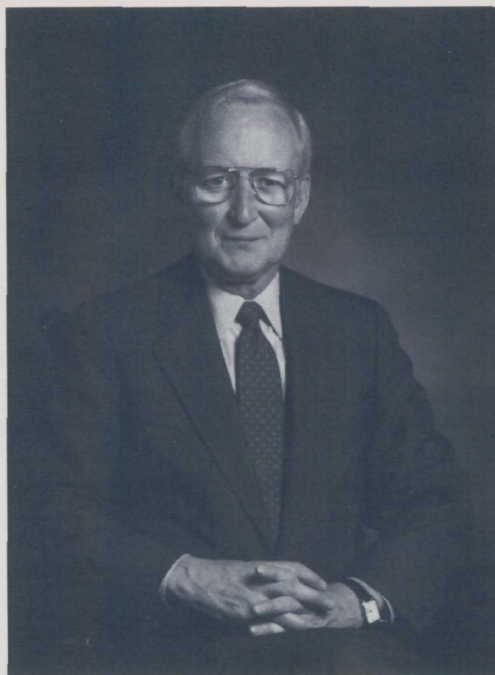


The Biomedical Sciences Building at dusk, looking southwest towards downtown Oklahoma City. The crosswalk leads to the Basic Sciences Education Building. Courtesy of the Office of Photographic Services, OUSHC. Taken about 1978.





John R. Sokatch, Chairman of the Department of Biochemistry & Molecular Biology, 1984-1992.



Ed Miller, the first President of the Presbyterian Health Foundation. Picture provided by his daughter, Beverly Jobe.



The first four faculty hired by the author. It took a free lunch to get them together for a picture in front of the Faculty House in 2001. From left to right they are Hiro Matsumoto, Jay Hanas, Bryan Fuller and Robert Steinberg.



Richard Cummings, Ed Miller Chair in Molecular Biology, 1992. Taken from the Departmental archives.



Paul Weigel, Chairman of the Department of Biochemistry & Molecular Biology, 1994 to present.



The X-ray crystallography core facility and directors in 1998. From left to right, they are Paul Weigel, Karla Rodgers, Adam Zlotnick and Alexey Bochkarev.



The faculty hired by Paul Weigel. Front row, Guangpu Li, Gillian Air, Karla Rodgers, Paul DeAngelis. Back row, Paul Weigel, Adam Zlotnick, Ann Louise Olson, Ron Bowditch, Alexey Bochkarev, Jialing Lin and Sanjay Bidichandani. Taken in 2001.





The Stanton L. Young Biomedical Research Center. Courtesy of the Office of Photographic Services, OUHSC. Taken about 1998.



Room 833 of the Biomedical Sciences Building being used for a Departmental meeting. Most of the individuals in the foreground are graduate students and technicians. Taken about 2000.



The Medical School campus in 1940. The view is looking Northwest towards the State Capitol. (1) The Medical School building, (2) University Hospital, (3) Future site of the OMRF, (4) Future site of the Veteran's Administration Hospital, (5) Crippled Children's Hospital, and (6) 13<sup>th</sup> Street.





The Health Sciences Center in 1998 looking Southwest towards downtown Oklahoma City. (1) Biomedical Sciences Building, (2) Basic Sciences Education Building, (3) Bird Memorial Library, (4) Dental Clinical Sciences Building, (5) University Hospital, (6) Children's Hospital, (7) Veteran's Administration Hospital, (8) College of Health, formerly the Medical School Building, (9) College of Pharmacy, (10) Student Center, (11) College of Nursing, (12) Location of Alfred P. Murrah Building bombed in 1995, (13) S.L. Young Biomedical Sciences Building, and 14) Oklahoma Health Center Research Park.

## **Chapter 10**

### **James L. Dennis, the Master Plan and the HERO bond issue**

#### **The New Dean of the Medical School**

James L. Dennis grew up in Oklahoma and graduated from the University of Oklahoma Medical School in 1940. He completed his internship and residency in general surgery in California, served in the navy during World War II and then took a pediatric residency at the University of Texas Medical Branch in Galveston. He entered private practice for awhile in California, but then joined the academic world by becoming Professor of Pediatrics and then Associate Dean at the University of Arkansas. He was selected to be Dean of the University of Oklahoma Medical School in 1964 and began work on September 1, 1964. Jim Dennis was the consummate genial pediatrician, but behind that exterior was a visionary and determined leader.

When he visited the campus he was struck by the “run down” condition of the campus due to years of underfunding (23). The facilities were also outdated: the University Hospital was constructed in 1919 and the Medical School Building in 1928. The University and Children’s Hospitals, the Medical School Building, the Research Building and the new nurse’s quarters were the entire University of Oklahoma Medical Center campus. Fortunately for Jim Dennis, the constellations were about to come into alignment for his vision to become a reality.

#### **The Long-Range Planning Committee**

Jim Dennis knew that the Medical Center was going to expand; the enrollment of the Medical School was going to have to increase to meet state and national priorities, a dental school and school of health were works in progress and much more library space would be needed to handle the technology explosion. In 1967, he was named Vice President for Medical Center Affairs by the Regents but retained the position of Dean of the Medical School. He formed the Long-Range Planning Committee with Bob Bird as the Chairman and charged them with developing a master plan. Bob Bird was Associate Dean for Planning of the Medical School and employing Bob Bird in this role was a stroke of genius because he was as much responsible for bringing the plan to fruition as any one individual besides Jim Dennis. The other members of the committee were L. Vernon Scott and Robert A. Patnode, both from Microbiology & Immunology; Stewart Wolf, Medicine; Ernst Lachman; Anatomy; and William Campbell, Campus Architect. Interestingly, one of the first considerations was where to locate the Center. Norman and Moore were considered, but Oklahoma City won out again because of the higher population base needed for a medical center (23).

The second important decision with respect to planning was to hire the firm of Lester Gorsline Associates from Tiburon, California as planning consultants. The Gorsline firm played a major role in developing the Master Plan and in planning most of the buildings.

#### **The Oklahoma Health Sciences Foundation**

The Health Sciences Center was scheduled to occupy the land between 8<sup>th</sup> and 13<sup>th</sup> Streets and Stonewall and Durland, now Lincoln Boulevard. This territory was in the Medical Center Urban Renewal Project and almost all of the homeowners in that area were black. Jim Dennis worried about this and indeed, later there was trouble with black activists

over this plan (23). The Oklahoma City Urban Renewal Authority, an arm of the Chamber of Commerce, administered the Medical Center Urban Renewal project. By now, there were many elements affected by the planning for the Center – the OMRP, Presbyterian, Mercy and the Veterans Administration Hospitals - in addition to many elements of the City, including the Chamber of Commerce. An umbrella organization to help in the planning was formed in 1966 called the Oklahoma Health Sciences Foundation, with Robert Hardy as the executive director of the Foundation. Bob Hardy and Jim Dennis were colleagues from Little Rock, where Hardy was administrator of the University of Arkansas Hospital (23).

### **The Basic Sciences Education Building**

One of the first buildings to come on line was the Basic Sciences Education Building, which was funded in January 1967, with \$2,175,383 from the Health Professions Education Act (HPEA). The remainder of the construction money came from the 1963 State of Oklahoma Bond Issue making a total project cost of about \$4 million (23). Making this building the first priority was a statement by Jim Dennis, who wanted to ensure that the first building was dedicated to medical student education. The planning Chairman for this building was Robert A Patnode, of the Department of Microbiology & Immunology. In order for construction to take place, they had to tear down the nurse's residence. Construction began on October 17, 1967 and the building was opened on January 27, 1970 with a dedication in its east lecture hall. There were two large lecture halls with state-of-the-art audiovisual equipment and multidisciplinary laboratories for 16 students each, with a desk, or home base, for each student. This was in decided contrast to the old situation where students came to the Medical School building for classes, but did everything else at home or in the small library in the Medical School building. Biochemistry, like most of the basic science departments, included a laboratory course for medical students. This consisted of about 20 experiments, done in small groups of sixteen students<sup>9</sup>. The HPEA grant allowed for an increase in enrollment from 105 to 125 medical students per class.

### **The HERO Bond Issue**

In contrast to his successors, Jim Dennis established a good working relationship with E.T. Dunlap, Chancellor of the State Regents for Higher Education. Both were convinced of the needs of the Health Sciences Center and with the Master Plan in tow, Dunlap was able to carry the message to Dewey Bartlett, newly elected Governor of Oklahoma. Bartlett was supportive, but because 1967 was his first year in office, he did not wish to bring a major bond issue before the people just yet. State Senator Bryce Baggett, who represented District 41, which included the Health Sciences Center, was a strong advocate of the Center. The issue was postponed for a year but came before the people on December 10, 1968 as a \$99.8 million general obligation bond issue supported by a one cent increase in the tax on cigarettes. Since the tax had already passed, there was no increase in taxes. At a meeting between Dunlap, Bryce Baggett and others, the decision was made to call the bond issue **HERO**, for **H**ealth **E**ducation for a **R**icher **O**klahoma. There was a tremendous amount of support for the issue from the business and professional communities, who contributed the dollars to promote the bond issue. There was very little

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<sup>9</sup>Application to the U.S. Public Health Service for the Biomedical Sciences Building

opposition, and the issue passed by a 3:1 margin. This was probably the high water mark for state support for the Health Sciences Center from the legislature, Governors office, State Regents and the business community. At this time, the Dental School came on Board with William E. Brown as the first Dean of Dentistry. Like Bob Bird, he was very savvy in the ways of the Washington power brokers and he got the first grant using matching funds from the HERO Bond issue;. In December of 1971 a grant of \$1,192,993 was obtained from the Health Professions Education Act for construction of a 3<sup>rd</sup> floor to the Basic Sciences Education Building for the education of freshmen and sophomore dental students. The total project cost was about \$1.8 million with the remainder coming from the HERO bond issue.

### **The Biomedical Sciences Building**

The Long-Range Plan for the Health Sciences Center forecast the addition of a College of Dentistry and major increases in the number of students in the College of Medicine. This meant that there would be significant increases in basic science faculty and therefore the need for more offices, research laboratories and support facilities such as a laboratory animal suite. Other programs would also come on line, including Pharmacy, Health, Allied Health and Dental Hygiene, some of which would also have need for basic science faculty. The original Medical School Building was built like a fortress, which was one of its problems, because it was difficult to remodel. Furthermore, it was not air conditioned, which even in the 1960s was passe'.

I was appointed the Chairman of the planning committee for the "Faculty Facilities" building in 1968 and worked closely with Bob Bird and the consultants from Gorsline Associates. The other members of the committee were Lazar Greenfield, Department of Surgery, William Felts, Chairman of the Department of Anatomical Sciences, Roy Deal from Biostatistics and Epidemiology and Robert Edelberg, from the Department of Psychiatry and Behavioral Sciences, The first Gorsline consultant was Roger Bennett, who was excellent, followed by Bob Hippe, who was also good, then the quality dropped off, but by this time we had our marching orders. The architectural firm assigned by the University Regents to work with us was Wright and Selby of Oklahoma City. Selby had passed away, but the principal of the firm, James Wright, kept Selby's name on the company banner out of loyalty to his partner. They not only worked without remuneration, but paid for preliminary work out of their own pocket. While this was a high-risk system for the architects, Jim Wright's explanation for "playing the game" was that he wanted to accomplish this last major project. Some years after the building had been completed, I encountered him walking around the 10<sup>th</sup> floor savoring his work.

We worked all through the planning process with the awkward name of 'Faculty Facilities" planning committee, but before the application was submitted, Jim Dennis suggested that we name it the Biomedical Sciences Building, which was much better. The concept was for a modular building and one that would be easy to remodel. The original idea was to group faculty by their research interests, rather than by Department, but this was torpedoed quickly by the then current Chairs of Physiology, Marion Cotton and Pharmacology, Eugene Jacobson. This would probably not sell even now, because each Department Chairman wants a home base. We were sold on the concept of a central utility chase after a visit to the Medical School at San Antonio, because of the ease with which laboratories could be remodeled with a minimum of disruption. We visited the architectural staff of the Facilities branch of the Health Professions section of the National Institutes of Health several times. They made several "suggestions," which it was clear should be in the final plans. One of the costliest changes was the requirement for an inordinately large



numbers of air changes per hour. Shortly after the building was opened, the price of energy skyrocketed. One of the remedies was to place ugly plastic sheets on the windows to reduce the light. Another suggestion concerned the third floor of the building, which was open to give a sense of airiness. However, the NIH staff rejected this idea and the third floor was filled in with offices for the Dean of the College of Medicine and lecture rooms for graduate courses.

At this time, I was the Associate Dean of the Graduate College on the Health Sciences Center, and my secretary was Ruth King. Bob Bird and I collaborated on writing the construction grant application, much of which was done in my den at home. When we needed a break from writing, we would visit the Zoo, go to the Wiley Post Airport control tower, (my wife and I were learning to fly at this time) or other arcane sites around town. When it came time to type the application, Ruth King did a masterful job. She was not only a superb typist but totally unflappable. She could type with agitated faculty buzzing around her and never make a mistake.

At this time, Bob Bird and Bill Brown made a gutsy decision, namely to submit applications for the Dental Clinical Sciences and the Biomedical Sciences Buildings to the same review cycle of the Health Professions Education Act Review Panel. The argument was that both buildings were essential because the Biomedical Sciences Building would be used to house both dental and medical basic sciences faculty, and it would be impossible to separate the needs. The HPEA staff kept on asking which building was our first choice and the answer always came back – “We need both.” (23). Both applications were funded in September of 1972 with a 3:1 match of Federal to State dollars. The Biomedical Sciences Building award was \$7.5 million, \$5,221,947 for the College of Medicine and \$2,278,695 for the College of Dentistry. The remainder of the construction money, about \$2,500,000, came from the HERO bond issue. The Dental Clinical Sciences award was about \$9 million for a total of \$16.5 million in Federal money. The sum total of Federal money available for that review cycle was \$90 million and Oklahoma came away with more than any other state.

Lippert Brothers was given the construction contract and finished the building on schedule in 1976. All of the basic science departments moved into the Biomedical Sciences Building from the Medical School building, the Research building and the OMRF. The old Medical School building became the home of the College of Public Health and College of Allied Health. The Biomedical Sciences building was dedicated on October 22, 1976. The speakers were: William G. Thurman, Provost; myself, as Acting Dean of the Graduate College; Thomas A. Lynn; Dean of the Medical School; Paul F. Sharp, President of the University; and Henry Bellmon, U.S. Senator from Oklahoma.

The final plan was for a ten-story building with 205,449 gross square feet and 107,748 net square feet. Each of the basic science departments was given an administrative suite plus research laboratories, smaller laboratories for the junior faculty and larger laboratories for the senior faculty. Biochemistry was assigned parts of the 8<sup>th</sup> floor and 9<sup>th</sup> floors. The first floor was given to shared facilities – isotope counting, fermentor, glass washing - and Biophysical Sciences and Dental Materials of the College of Dentistry. The second floor was occupied by the Central Animal Facility. The third floor contained administrative offices for the College of Medicine and lecture rooms for graduate education. The 4<sup>th</sup> floor was assigned to Anatomical Sciences and Pathology. The 5<sup>th</sup> floor was assigned solely to Anatomical Sciences and the 6<sup>th</sup> floor, solely to Physiology. The 7<sup>th</sup> floor was assigned to Pharmacology. Microbiology occupied parts of the 9<sup>th</sup> and 10<sup>th</sup> floors. Some space was also assigned to faculty of clinical departments who were doing basic research. These included Surgery,

Medicine, Laboratory Medicine and Otorhinolaryngology. Some of these programs no longer exist and much of this space was later given over to basic science departments.

### **What happened to the Master Plan?**

A surprisingly large part of the Master Plan was completed. The University Hospital, now named Everett Tower, the Basic Science Education Building, the Biomedical Sciences Building, the Dental Clinical Sciences Building, the Library, Presbyterian Hospital and the State Department of Health buildings were completed and situated close to where they were originally planned to be. The decision to move the College of Pharmacy to Oklahoma City from Norman was not in the original plan, but was a logical move. The Nursing building was built close to, but not on the original site. Some buildings never were completed; the School of Health Building actually was funded, but President Nixon impounded the funds for it and other projects and they were never completed (23). A student/faculty apartment tower was planned but was eventually discarded. Probably the biggest disappointment was the decision of Mercy Hospital to locate in the northwest quadrant of Oklahoma City rather than on the Health Center Campus. An administration building was planned, but had no chance of being funded because this was not a priority for the Health Professions Education Act. Administrative functions were located in the Biomedical Sciences Building and the Library. The Health Sciences Center also was given Moon Junior High, and this building became the center for the support functions. Later, control of Children's Hospital was transferred to the Department of Institutions, Social and Rehabilitative Services, commonly called DISRS, and Children's Hospital expanded in all directions with no regard to the Master Plan, resulting in its present unusual configuration. A second research tower, just south of the Biomedical Sciences Building was part of the Master Plan and that space is still available.

### **Dennis leaves for Arkansas**

After the venerable George Lynn Cross retired as President of the University of Oklahoma, J. Herbert Hollomon succeeded him in 1968, following a national search. Hollomon was a charismatic, but controversial, figure in the history of the University of Oklahoma (23). The students loved him, which was important because this was the time of student activism. However, his style rubbed many people the wrong way beginning with his elaborate investiture on July 1, 1968 which was described by many as more like a coronation. There were also undercurrents of inappropriate behavior by Hollomon. One of the people whom Hollomon infuriated was Governor Dewey Bartlett who openly called for his removal. Hollomon and Dennis also clashed quickly, probably because of conflicts in personality, although there were other reasons as outlined below. Hollomon initiated a comprehensive, and very expensive, study called *The Future of the University*. In this study, the Vice-President of the Health Sciences Center would report directly to the President of the University for administrative affairs and to the Provost on the Norman campus for academic affairs. Dennis saw this as a ploy by Hollomon to gain control of the financial resources of the Health Sciences Center, while Hollomon believed that something fishy was going on in Oklahoma City and that it was his responsibility to control it (23). Unfortunately for Jim Dennis, at this time a house was purchased for the Health Sciences Center in Nichols Hills so that he could entertain properly. However, this was strictly against University policy and there was some question about where the money for the house came from. Even Jim Dennis agreed this was a mistake. The conflict between Dennis and Hollomon came to a head in 1970, when the University Regents voted to retain Hollomon, even though Bartlett openly

wanted him gone. At this same meeting the Regents gave Dennis the title of Executive Vice President of the University for Medical Affairs and stipulated that he report to the regents so Dennis got what he wanted. What was galling to Bartlett, was that some of the Regents appointed by Bartlett, supported Hollomon. The vote of confidence in Hollomon by the Regents was the last straw for Jim Dennis, who was being actively recruited by other institutions because the success of the “Oklahoma Plan” had attracted national attention. He accepted an offer from Arkansas to become Vice President for Health Sciences in spite of requests by Governor Bartlett and Chancellor E.T. Dunlap to stay in Oklahoma and tough it out. Only three weeks later, Hollomon also resigned for reasons that are still vague. In any event, Dennis’ legacy is the fulfillment of the Master Plan, while almost nothing is left to remind us of the Hollomon years.

### **More financial problems**

If Hollomon had gained control of the Health Sciences Center, he may have lived to regret it because the Center almost immediately had serious financial problems. There was almost no financial planning for the expansion of the Medical School and the new schools that were added. Adding to the instability were a number of administrative changes. After several years as both Vice President and Dean, Dennis relinquished the position of Dean of the Medical School and Bob Bird was named Dean in May 1970. After Dennis left, John Colmore, an internist with interests in infectious diseases, was named acting Vice President. Sadly, this was a very short appointment, because he acquired an especially virulent case of hepatitis and died in November of 1970. According to C.G. Gunn, a close friend, Colmore acquired the disease from handling contaminated blood. Leonard Eliel succeeded John Colmore as Executive Vice President for Medical Center Affairs.

Almost immediately, Len Eliel was beset with severe problems of all kinds, mostly financial. Not only were there not enough state dollars to fund the new and expanded programs, but the Feds began withdrawing funds tied to increases in Medical School enrollments such as the Basic Improvement Grant, the Health Professions Education Improvement Grant and eventually the General Research Support Grant. Some faculty salaries came almost entirely from “soft” federal money. As if that weren’t enough, the black community surrounding the Medical Center came alive to protest the removal of residents from the Medical Center Urban Renewal project. One of the local activists was Donald “Cheetah” Gates who promoted the development of training programs so that blacks could have equal access to jobs at the Center. Minister Theodore G X, head of the Oklahoma City Black Muslim temple however, urged complete separation of the races (23).

The financial problems centered around Children’s and University Hospitals, which were bleeding cash. Rumors were circulating that either Children’s Hospital or the Emergency Room of University Hospital would be closed to save money. This worried the new Governor David Hall, who, in 1972, appointed his own investigator, Robert E. Lee Richardson, who was a Law School Faculty member of the University of Oklahoma. Richardson made two reports, one for public consumption and one for Hall and the University. In the latter he made several suggestions, some of which were eventually adopted. One of those practices which has since been discontinued, was the buying of buildings in the vicinity of the Medical Center and then renting them back to the University. This was done because there was no surge space for the new schools. Nobody profited from this personally, but the practice raised eyebrows. Another problem concerned the administration of grant funds, which were deposited in the Research and Development office of the OU Foundation. The R and D Office was not part of the University system

and was set up this way because state statutes were cumbersome, particularly regarding purchases. This arrangement was also discontinued and grant administration was handled by State, which resulted in long shipping delays and months for reimbursement of travel claims. Fortunately, this has been changed; shipping is almost instantaneous, and administration of grant-supported travel much less cumbersome. The irony of this situation was that David Hall was convicted in Federal Court for violations of anti-racketeering statutes shortly after leaving office and spent 18 months in a Federal prison (8).

Another major controversy concerned the Physicians Practice Plan, which generated money for physician's salaries, resident stipends and much of the budgets of clinical departments by a tax on physician earnings. Amid all the other problems, O.U. Regents conducted an investigation of the physician's earnings, which caused considerable resentment among the clinical faculty. No wrongdoing was ever proven, but several key clinical faculty left for other institutions. This was very stressful on Bob Bird, who had suffered from angina for several years and who was being recruited by several other institutions. He resigned in 1974 to become director of the Lister Hill Institute for Bio-Medical Communications in Bethesda, Md. There he introduced the use of computers to access medical and scientific literature, leading to the present day excellent National Center for Biotechnology Information.

### **House cleaning**

The new President of the University was Paul F. Sharp, who took over in 1971 and promptly inherited the financial problems of the Health Sciences Center. One of the solutions being floated was to close either the College of Public Health or College of Allied Health. Matters escalated when, in 1973, the College of Health faculty and students camped out on the grounds of the State Capitol hoping to pressure legislators to provide funding to save their college. This infuriated a number of legislators who "dumped" on Paul Sharp. At a meeting of the Health Sciences Center Deans in Norman on April 27, 1983, Paul Sharp asked Philip Smith, Dean of the College of Allied Health, to prepare a budget for the Colleges of Allied Health and Public Health. This action effectively fired William F. Schottstaedt as Dean of the College of Public Health. I was at that famous meeting and it was clear that Leonard Eliel, Bob Bird and Bill Brown were taken by surprise. Philip Smith said that he had no inkling of what was in the President's mind before the meeting (23). Shortly thereafter, Len Eliel resigned because he felt he was a liability to Paul Sharp. William E. Brown, Dean of the College of Dentistry replaced him as Interim Provost. Bill Brown had an excellent administrative style, was highly respected, and was the perfect choice to soothe trouble waters. Later, William G. Thurman was named to the Provost's position and Thomas A. Lynn replaced Bob Bird as Dean of the College of Medicine and things slowly began to simmer down.

### **University Hospital/Everett Tower**

Funds for construction of the new University Hospital tower, later named Everett Tower, after Mark R. Everett, were obtained in 1969 from Hill Burton and the Health Professions Education Act and were matched by HERO bond money. The low bid was \$11,959,000 and construction was scheduled to be completed in 1972. However, the Hospital was not opened until 1973, again because of financial problems. After it opened, there were more financial problems. Hospital moneys were being used to support expensive educational programs.

In April of 1973, Children's Hospital was transferred to the Department of Institutions, Social and Rehabilitative Services, and immediately began to expand. DISRS was under the control of Lloyd Rader, who was a superb gatherer of funds for his department and had ample money to remodel and expand Children's Hospital. Rader was widely regarded as the most powerful man in Oklahoma because of the wealth of his Department and his political connections in Oklahoma and in Washington. However, there was a lot of disappointment with the finished Children's Hospital; it was criticized as a not up-to-date hospital and it certainly did not fit in well with the architecture of the rest of the campus (23).

## Chapter 11

### The Third Chairman

#### Interim leadership

After Connor Johnson retired from the Chair in 1978, the Department went through seven years of interim leadership. Part of this was due to the change in Medical School Deans from Thomas A. Lynn to Charles A. McCall in 1982, part was due to the slow recovery from the financial stress caused by expanded educational programs and finally, some of it was probably due to lack of concern by administrators. Dean Lynn appointed Peter Gray as Interim Head, a position that he held in 1978-79. Lynn changed the titles of all Department Chairmen to Heads in order to avoid the usage of the politically correct, but cumbersome, title of Chairperson. Because Peter Gray was an Associate Professor in a Department that had several Professors, this appointment was probably in recognition of his excellent research program.

In 1980, Dean Lynn appointed H. Lowell Stone, already Head of the Department of Physiology and Biophysics, as Interim Head of Biochemistry & Molecular Biology. This was a curious move because Stone was also head of the Search Committee for a new Head of Biochemistry & Molecular Biology. This must have been perceived as a lack of confidence in the existing faculty. Stone accepted the Interim position for one year with the stipulation that a new Head for Biochemistry & Molecular Biology would be named after that time. Stone was adamant that the new Head come from the outside. However, the search was unsuccessful and true to his word, Stone resigned as Interim Head of Biochemistry & Molecular Biology. Lowell Stone was a very aggressive Type A personality which made him an excellent scientist and Head of Physiology and Biophysics. Unfortunately, this also took his life since he died shortly thereafter of a massive heart attack while on a hunting trip.

In 1980, Dean McCall again named Peter Gray as Interim Head of Biochemistry & Molecular Biology. Usually Interim Heads do not hire faculty; however, Peter Gray was given the resources to recruit one individual, Sara (Sally) Tobin in 1982. She earned her Ph.D. from the University of Washington Department of Zoology in 1977 and gained recognition for her postdoctoral work with Peter Fristrom and Bryan McCarthy. However, her stay at Oklahoma was troubled, initially because of lost work due to illness and finally because of several confrontational episodes with some of the top major administrators on the Health Sciences Center over the honorarium for a CD-ROM she had contracted to produce. She left in 1996 to become a Fellow of the Center for Biomedical Ethics at Stanford University.

There was some sentiment in the Department that Peter Gray be named permanent Head, but according to Connor Johnson, Dean McCall told Gray that he would not become permanent Head<sup>10</sup>. For whatever reason, in 1983 Peter Gray took a job as Director of Life Sciences Research for IMC, Terre Haute Indiana. He headed an interesting applied research project on the biochemical “shearing” of sheep co-sponsored by the Australian government. The process worked but was never used commercially and IMC closed out the unit. He was the first member of the Department to pursue a career in industry, a career move that has since become popular.

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<sup>10</sup>Brief History of the Department of Biochemistry & Molecular Biology by B. Connor Johnson

After Peter Gray left, Albert Chandler was named Interim Head by Dean McCall, a position that Chandler held from 1982-84. However, after all the years of Interim leadership, the morale in the Department was low.

### **The third Chairman of Biochemistry & Molecular Biology – John R. Sokatch**

Early in 1984, I was summoned for a visit with Dean McCall, the subject of which turned out to be a talk about becoming Chairman of the Department of Biochemistry & Molecular Biology. At that time, I was George Lynn Cross Research Professor of Microbiology and Immunology and an adjunct Professor of Biochemistry & Molecular Biology. The appointment as Chairman would be for five years, which fit in with my plans because my research was going well, was well funded and I had no desire to retire in the position of Chairman. My plan was to take a sabbatical leave after five years to give the fourth Chairman uninhibited time to break in. The agreement with McCall was that I would be given four new positions plus my own to add to the Department of Biochemistry & Molecular Biology.

I was born in Joliet Illinois, in December 1928, and earned a Bachelor of Science from the University of Michigan in 1950. My graduate work was at the University of Illinois, Department of Bacteriology, where I earned a Master's degree in 1952 and a Ph.D. in 1956. My major professor was I.C. Gunsalus, who later became a member of the National Academy of Sciences and President of the Federation of American Society for Experimental Biology, FASEB for short. One of my thesis committee members was Salvador Luria, who later won the Nobel Prize with Max Delbrück for the "jackpot effect" experiment (27). The gist of the famous experiment was that a series of tubes containing a very dilute suspension of bacteriophage-sensitive *Escherichia coli* was mixed with bacteriophage and incubated. If phage resistance were due to spontaneous mutations, then the distribution of tubes containing-phage resistant bacteria would show a "jackpot" effect. Most of the tubes would show no growth, but those where a mutation had occurred would contain cultures of phage-resistant bacteria. If phage resistance were due to "adaptation" or a directed mutation, then every tube would have had growth. Luria was a superb teacher, had an excellent sense of humor and had little use for religion of any kind. My postdoctoral training was at Washington State University where I met my wife Carol, who was the only other person in the Chemistry Department from Illinois. In 1958, I was hired as an Assistant Professor of Microbiology at the University of Oklahoma Medical School.

My research for the next 41 years was a study of branched-chain amino acid metabolism of *Pseudomonas putida*. These studies were, in order, biochemistry, enzymology, genetics and finally structural studies of the branched-chain keto acid dehydrogenase complex. Branched-chain keto acid dehydrogenase is the target enzyme in the human genetic disease, maple syrup urine disease, and the enzyme complex from *Pseudomonas putida* has architecture similar to the mammalian complex. As of this writing, there are not many other bacterial models of this complex to study. My final research publication in 1999 was a collaborative study with Wim Hol at the University of Washington that resulted in a crystallographic structure of the E1 $\alpha_2\beta_2$  component of the complex (2).

### **What was biochemistry like in 1984?**

By 1984, Biochemistry was in an exponential phase of growth and molecular biology was the hot topic. Herbert Tabor was the Editor of *The Journal of Biological Chemistry*, which published 15,689 pages in 24 issues, four times as many pages as in 1965. To handle the

increasing number of manuscripts, there were nine associate editors (Quentin Gibson, C.H.W. Hirs, Wolfgang Joklik, Edward D. Korn, Stuart Kornfeld, Edwin G. Krebs, Alton Meister, Robert T. Schimke and Robert H. Wells) and 178 reviewing editors! The topics of the Journal were *Carbohydrates, Lipids and other Natural Products; Cell Biology and Metabolism; Enzymology; Membranes and Bioenergetics; Nucleic Acids, Protein Synthesis and Molecular Genetics; and Protein Chemistry and Structure.*

### **Recruits to Biochemistry & Molecular Biology**

Committees to search for new faculty were organized with the charge that they should recruit at the Assistant Professor level but should not try to focus on any one area. The first person added to the faculty was Bryan Fuller in 1985. He earned his Ph.D. in 1978 from the University of Arizona. From there he went to the Texas Tech Department of Biology in Lubbock, where he was an Assistant Professor and he came to Oklahoma at the same rank. His research interests are in molecular regulation of pigmentation in mammals, especially man. He formed MelanX, the first company in the Department of Biochemistry & Molecular Biology, which is described more fully later in this chapter

Jay Hanas earned his Ph.D. at the State University of New York at Stony Brook in 1981. He did his postdoctoral fellowship in the Department of Biochemistry at Stony Brook and then came here in 1985. His research interests are in expression and regulation of ribosomal genes.

Hiroyuki Matsumoto was the third member of the Department hired in 1985. He earned his Ph.D. in 1977 in Kyoto, and his postdoctoral training was at Purdue University. He studies the molecular mechanism of visual excitation using *Drosophila* as a model system.

Robert A. Steinberg, was hired in 1986, the only one of the first four hired at the rank of Associate Professor. He earned his Ph.D. from the University of California at San Francisco and spent several years at the University of Connecticut, as a Research Assistant Professor, which is why he was hired at the rank of Associate Professor. He studies transmembrane signaling in cultured mammalian cells using molecular genetic methods.

### **The Mid-America Molecular Biology Colloquium**

Bryan Fuller proposed the idea of developing a Department colloquium, along the lines of the Miami University program in honor of Feodor Lynen. The Dean's Office annually provided discretionary funds to each Basic Science Department of the Medical School and these were used to support the Colloquium. Other support was from the Presbyterian Health Foundation, the Noble Foundation, indirectly through Bud Patterson, and from enrollment fees. Bud Patterson was the Head of the Medical Division at the Noble Foundation in Ardmore, a Division which no longer exists. The first colloquium was held at Shangri-La near Afton, Oklahoma, which is a scenic resort with two professional golf courses, and something of a reputation for oilmen to party discreetly. Speakers and attendees were intrigued by the thought of going to Shangri-La, but the program suffered from the handicap of having to arrange transportation from the Tulsa Airport to Shangri-La. Several nationally prominent speakers made presentations including Stanley Cohen, of epidermal growth factor fame, Darryl Granner, Joel Habener, Martin Rosenberg, Masayori Inouye, and Beatrice Minx. The Colloquium was an artistic success, but a money loser and required a lot of faculty time. After about five years, it was discontinued.



## **The Ed Miller Chair in Molecular Biology**

The Ed Miller Chair in Molecular Biology was the first endowed chair in any of the basic science departments of the Health Sciences Center. We submitted an application to OCAST (Oklahoma Center for the Advancement of Science and Technology, the State organization described in the next chapter) in 1988, which was approved, but the reviewers unanimously pointed out that the award provided only for salary. Other inducements would be needed to attract a worthy candidate, including new equipment, start-up funds, some discretionary money and secretarial help. The problem with trying to recruit an established scientist was that they were probably already well fixed at their present institution. On the other hand, an endowed chair is more than a lateral career move. The OCAST award provided for a 2:1 match of state money for the interest earned on the principal. The supporters of the effort to fund the chair included such Oklahoma movers and shakers as James G. Harlow, President and CEO of Oklahoma Gas and Electric Company, Lee Allen Smith, Chairman of the Oklahoma City Chamber of Commerce and Lynn Carrossa, General Manager of Center City Inc. The person responsible for recruiting these luminaries was Hershel Lamirand, at that time Executive Secretary of Development at the Health Sciences Center. Shortly, over a half million dollars was pledged, including \$200,000 from the Presbyterian Health Foundation, \$200,000 from the Noble Foundation and \$100,000 from the Kerr Foundation. Several other pledges of lesser amounts were quickly received so that the endowment quickly reached \$750,000. The first personal cash pledge came from Rainey and Martha Williams. Recently, the University Regents added enough money to the endowment to raise the principal to over \$2 million.

Originally, the Chair was called the Endowed Chair in Molecular Biology, but in 1989, the chair was named after Ed Miller, the first President of the Presbyterian Health Foundation (see next Chapter). Shortly after the application was approved, Ed Miller was honored at the Evening of Excellence Dinner, described in the next chapter, on January 20, 1989<sup>11</sup>. At the dinner, it was announced that the Chair would be named the Ed Miller Chair in Molecular Biology in recognition of his leadership role in directing the Presbyterian Health Foundation towards support of biomedical research. Unfortunately, he died just two months later of metastatic prostate cancer.

The position of the Ed Miller Chair was advertised nationally and a number of excellent candidates applied, and several interviews were held. The most outstanding candidate was Richard Cummings, a young and already highly successful glycobiologist from the University of Georgia. While the salary was acceptable, the thousands of dollars needed to help him set up his laboratory in Oklahoma City were harder to come by. Here the Center for Molecular Medicine (described in the next chapter) came to the rescue with a competitive financial package that tipped the balance in favor of Cummings moving to Oklahoma City. Cummings earned his Ph.D. from Johns Hopkins University and then did his postdoctoral fellowship at Washington University with Stuart Kornfeld. In 1983 he joined the Department of Biochemistry at the University of Georgia as an Assistant Professor and rose to the rank of Professor in 1992. In 1992, he joined the Department of Biochemistry & Molecular Biology as the Ed Miller Professor of Molecular Biology. He is a glycobiologist with an interest in a wide variety of glycosylated (sugared) proteins, especially in human diseases and parasites.

There was one final, amusing, but potentially serious problem to this story. The

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<sup>11</sup>Daily Oklahoman, January 20, 1989

letter of offer to Richard Cummings specified a salary that was off by a factor of 1000, i.e., the salary was quoted in the millions of dollars rather than the thousands. The letter of offer was reviewed by the Provost's Office, the Dean's office in the Medical School and by me, but no one picked up the error until after the letter was signed. Fortunately for us, Cummings was a gentleman with a sense of humor and did not make an issue of the misprint.

After Richard Cummings was signed up, I resigned as Chairman of the Department of Biochemistry & Molecular Biology. I had been Chairman seven and a half years, two and a half years longer than I planned and wanted to pay full attention to my research. Al Chandler was again named Interim Chairman and he was in charge until 1994, when Paul Weigel came on board.

### **MelanX and Cutanix**

The first business stemming from research done in the Department of Biochemistry & Molecular Biology was MelanX, a company started by Bryan Fuller. A Houston-based venture capital fund, "Ventures Medical" screened invention disclosures at the University of Oklahoma, Oklahoma State University and the Health Sciences Center. They were interested in Fuller's disclosure of a procedure for tanning skin biochemically. This process had the potential of not only protecting fair-skinned individuals from serious sunburns but possibly, also of reducing their risk to melanoma. Ventures Medical liked the concept, entered into a licensing agreement with the University and formed MelanX in 1994. However, after a few years, Ventures Medical ran out of money, shut down operations in 1998 and sold the equipment bought on company funds. Several of Fuller's patents were released to him by the University, which he used in a second business venture with Cutanix which licensed the technology in 2001. Cutanix is a spin-off of Centaur Pharmaceuticals with interests in the role of nitrones in blocking inflammation, skin-lightening creams for the Asian market and stimulating tanning in the absence of sun. Research and development for Cutanix is headed by Fuller and is located in the Phase III building of the Oklahoma Health Center Research Park developed by the Presbyterian Health Foundation and described in the next chapter.

## Chapter 12

### Serious Support for Biomedical Research in Oklahoma

#### Change in attitude towards research

Influential Oklahomans were convinced that research was an essential component of student and faculty activities if Oklahoma was to have a nationally competitive health sciences center. To meet this need, programs, agencies and foundations were created that would provide research grants for biomedical research. This was especially important for junior faculty who needed assistance to get their programs started. Oklahoma, which at one time had a poor environment for research, by the 1980's, had programs that were admired and copied.

#### The Evening of Excellence

John Bozalis, a graduate of the University of Oklahoma Medical School, attended a fund raising dinner where the funds went out of state, and the idea occurred to him that the same could be done for his alma mater. He conceived the idea of having a black tie dinner to raise funds for research in the Medical School, which he named "The Evening of Excellence." The first dinner was held in 1985 and has been repeated every year since. The program was placed under the umbrella of the University of Oklahoma Medical School Alumni Association, now part of the Office of Development and Alumni Affairs of the College of Medicine. The first dinners were held at the Skirvin hotel, then at the Marriott hotel and now at the National Cowboy and Western Heritage Museum. There is an honoree at each banquet; some of the honorees were James L. Dennis, the architect of the campus Master Plan, Ed Miller, President of the Presbyterian Health Foundation and Stewart Wolf, the first full-time clinical Professor.

The dinner has been highly successful and was one the first local programs for the support of biomedical research at the Medical School. The gross revenue from the dinners through 2001 has been \$2.1 million. A portion of the annual proceeds was added to the principal, generating income interest, which was also used for grant awards. The principal stood at \$332,359 in 2001. The grant awards to OUHSC faculty through 2001 were \$1.35 million which included many of the junior faculty in the Department of Biochemistry & Molecular Biology.

#### The Presbyterian Health Foundation

Presbyterian Hospital was an important component of the Dennis Master Plan but it was by no means a sure thing that it would be located on the Health Sciences Center campus (23), particularly after the defection of Mercy Hospital to the Northwest. However, the decision was made to locate on the campus and construction for the hospital began in 1974, supported by a bond issue. There was strong local support for Presbyterian Hospital by businessmen, in particular by Stanton L. Young and Dean A McGee. However, the Oklahoma Legislature threw a roadblock in the way of making the hospital self-sustaining by mandating that University faculty could not put patients in the hospital (23). A year later, the hospital was in default.<sup>12</sup> The hospital struggled for years; there was even a donation of

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<sup>12</sup>Presbyterian Health Foundation; A Celebration of 10 years, 1985-1995

\$100,000 by the Episcopal Diocese of Oklahoma engineered by Bishop Chilton A. Powell. But by 1983, the debt was \$40 million.

There is a trite expression “Making lemonade from lemons” which truly applied to the formation of the Presbyterian Health Foundation. The hospital could have gone out of business and the Presbyterian Health Foundation would never have happened. However, an offer to purchase the hospital was tendered by the Hospital Corporation of America with the novel stipulation that a foundation be endowed to support research and teaching programs in the health sciences. The offer was accepted and the Presbyterian Health Foundation was created in 1985. The Foundation recruited Ed Miller, a successful Oklahoma banker as its first President. He was the first President of Founders Bank and Trust of Oklahoma City and was involved in many civic activities, even while he was President of the Presbyterian Health Foundation. A board of Trustees was created in 1986, and the organizers presented the following mission statement for the Foundation:

“The purpose of the Foundation is to provide resources and to encourage the development of medical education and research programs, conducted primarily in Oklahoma. The Foundation is also committed to support clinical pastoral care services and the healing processes of people with special needs.”<sup>13</sup>

One of the founding Committees was the Funds Development Committee, which increased the fair market value of the Foundation from the original \$67 million to \$160 million by the end of 1999, even after making millions of dollars in awards. The Grants Committee and the Technology Transfer Committees were to distribute the income from the Trust in accordance with their charges. The Grants Committee accepted investigator-initiated applications for research projects, which were reviewed by faculty of the Health Sciences Center, i.e. local peer-review. The Grants Committee distributed an average of \$4 million a year in the first ten years of the Foundation. Most of these awards went to the Health Sciences Center junior faculty, especially those in Biochemistry & Molecular Biology. Another category of grants was for support of projects that received favorable reviews from national granting agencies, but not quite good enough to be funded. This was the “Approved-but-not-funded” category and was for the purpose of enhancing faculty competitiveness for national funding. Other grants were for resident physician medical education and medical student research scholarships. Grants were also given for the support of endowed chairs, such as the Ed Miller Chair, for the clinical pastoral program, the M.D./Ph.D. program and the Physician Scientist Fellowship program.

The Technology Transfer program was another forward-looking program conceived by the Foundation. Making the commitment to support technology transfer in central Oklahoma was a bold step because in 1986 there was not yet a critical mass of technology to transfer. The Presbyterian Health Foundation developed the Oklahoma Health Center Research Park on a 23.5-acre site at the Southwest corner of 8<sup>th</sup> Street and Lincoln Boulevard. The purpose of the Research Park was to provide incubator laboratories for start-up biotechnology companies. The first building was completed in 1995 and was immediately filled up. A second building, completed in 1998, was also immediately filled up and a third building was completed in 2001. The main occupant of the first building was Urocor Inc., a company formed as a result of a project started by George Hemstreet, in the Department of Urology and one of the first businesses spun off from University research.

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<sup>13</sup>Presbyterian Health Foundation; A Celebration of 10 years, 1985-1995

There are two businesses derived from research in the Department of Biochemistry & Molecular Biology, which are located in the Phase III building of the Oklahoma Health Center Research Park. These are Cutanix, described in the preceding chapter and Hyalose, described in the next chapter.

### **OCAST, the Oklahoma Center for the Advancement of Science and Technology**

Just a year after the establishment of the Presbyterian Health Foundation, the State of Oklahoma created OCAST, an innovative and outstanding program designed to strengthen academic research and stimulate technology transfer. The mission statement says that OCAST is “to foster innovation in existing and developing businesses by supporting basic and applied research, by facilitating technology transfer between research laboratories and firms and by providing seed-capital for new innovative firms and their products”.

OCAST was established in 1987 by statute, which provided for a 14-member board of directors, including ex-officio members from the Oklahoma Department of Commerce, the Chancellor of the Oklahoma State Regents for Higher Education and the Dean of the Division of Agriculture at Oklahoma State University.

The *Oklahoma Health Research* program is modeled after that of the Division of Research Grants of the National Institutes of Health, which is the gold standard for health research grants. Individuals from Oklahoma public or private universities, non-profit organizations and Oklahoma businesses are eligible to submit proposals, which are reviewed and evaluated by a panel of experts, drawn from all over the United States. This is a substantial program that awarded \$60.2 million for applied and health research grants through fiscal 2000<sup>14</sup>. Many of these were seed grants to junior faculty which could be leveraged into much larger grants from the National Institutes of Health, National Science Foundation and other extramural granting agencies. Most of the junior faculty in the Department of Biochemistry & Molecular Biology got their start with OCAST, Presbyterian Health Foundation or College of Medicine Alumni Association grants.

The *Small Business Research Assistance* programs provide support to small businesses in Oklahoma in order to make them more competitive for Federal grants. The *Oklahoma Applied Research Support* program is aimed at technology transfer and provides grants to public or private universities, non-profit organizations and businesses in Oklahoma to accelerate development of technology with potential for producing commercially successful products. These grants require a 1:1 match and awards can be for up to three years and a total of \$300,000. The *Research and Development Faculty and Student Intern Partnerships* provide support for students and faculty of Oklahoma universities to intern in businesses in Oklahoma. A 1:1 match is required.

Two innovative early programs were the “Centers of Excellence” and “MOST Eminent Scholars”, neither of which now exist. The concept of the Centers of Excellence was to provide substantial seed funding for centers of excellence, which would then carry on under their own steam. The Center for Molecular Medicine at the Health Sciences Center was one of the first three. I was the Principal Investigator of the proposal with a very powerful committee of Joe Ferretti (then Chairman of Microbiology and Immunology, now Senior Vice President and Provost), Pat McKee (as Chairman of the Department of Medicine), Mark Allen Everett (as Chairman of the Department of Dermatology) and Phillip Silverman (OMRF). The grant was funded for \$8.7 million for five years. Shortly after the

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<sup>14</sup>Paulette Shafer at OCAST

grant was funded, I resigned as Principal Investigator, to devote more time to my research and Pat McKee became the Principal Investigator. The Centers program was not renewed, partially because the Centers were so expensive and partially because they fell short of their expectations. However, the Center for Molecular Medicine played an important role in recruiting Richard Cummings for the Ed Miller Chair in Molecular Biology.

The MOST Eminent Scholars program provided a 2:1 match for the interest on the principal of an Endowed Chair for five years and this is the program that funded the Ed Miller Chair in Molecular Biology. The MOST Eminent Scholars program was later transferred to the State Regents for Higher Education as their Endowed Chairs program.

### **The Stanton L. Young Biomedical Research Center**

The need for additional research laboratories continued to increase. Some teaching laboratories in the Basic Sciences Education Building had been converted to research laboratories, but this was not enough to meet the need. Part of the need was filled by the construction of the Stanton L. Young Biomedical Research Center. Planning began in 1991, with Frank Waxman as the planning chairman. Construction was financed from revenue generated by State Questions 649 and 650, also known as Hero Bond II. The building was located just southeast of the Biomedical Sciences Building and connected to it by a walkway. There was a total of 105,300 gross square feet contained in four floors at a construction cost of \$17.7 million. In the Master Plan of James Dennis, a second phase of the Biomedical Sciences Building was planned, but directly south of the present building – space which still exists. The building was dedicated in 1998 and was named after Stanton L. Young, who had long been a vigorous supporter of the Health Sciences Center in many ways. Several of the new faculty of the Department of Biochemistry & Molecular Biology were assigned to laboratories in the building. Richard Cummings, Ed Miller Professor of Molecular Biology, moved from remodeled classroom space in the Basic Sciences Education Building to the Stanton L. Young Biomedical Research Center. Others included Ron Bowditch, Adam Zlotnik, Sanjay Bidichandani, and Alexey Bochkarev.

### **The State of Oklahoma encourages entrepreneurial activity by universities**

By the end of the 90's, the attitude towards entrepreneurial activities in Oklahoma universities had become much more positive. This was undoubtedly due to the success of high tech industries and of the many research parks associated with universities around the country. Two pieces of legislation were passed which authorized placing the technology transfer issue on the state ballot; these were House Joint Resolution 1073 and House Bill 2863, "The Oklahoma Technology Transfer Act of 1998." In order for these issues to take effect, it was necessary to amend the Constitution. The issues were State Question 680, which amended the Constitution to permit institutions of higher education to allow businesses to use their property for research, and State Question 681, which amended the Constitution to allow institutions of higher education and their employees to own an interest in businesses that developed technology. There was a lot of support for the issues, and both questions passed handily.

## Chapter 13

### The Search for a new Chairman

#### The Fourth Chairman – Paul H. Weigel

Ed Brandt was the Dean of the Medical School when I resigned. Brandt had had a distinguished career in national public service where he served as an Assistant Secretary of Health Education and Welfare. When we discussed the strategy for attracting a new Chairman, he commented that resources were slim, but that he would “suck it up” and find some way to come up with the money – which did not seem very promising. Dean Brandt appointed a search committee with Robert Foreman, Chairman of Physiology and Biophysics as the Chair of the Search Committee. A short list of candidates was developed, but the search seemed to stall. Then an event that had a major impact on the search occurred. Jay Stein was named Provost of the Health Sciences Center and he took a personal interest in the search for a new Chairman of Biochemistry & Molecular Biology. Stein and Brandt clashed early and Brandt shortly resigned his position. A new search committee was appointed with Fred Silva, Chairman of Pathology, as head of the committee and told that significant assets would be available for the new Chairman, but that the Candidate must come from outside the Health Sciences Center.

A short list of candidates was presented to Stein who selected Paul Weigel as the fourth Chairman of Biochemistry & Molecular Biology. Weigel came from the Department of Human Biological Chemistry & Genetics at the University of Texas Medical Branch at Galveston. After Weigel's selection was announced, Stein met with the faculty of the Department of Biochemistry & Molecular Biology to discuss the reasons for his selection. The short list included some excellent candidates, but Stein's reason for selecting Weigel was that he was the candidate with the best thought-out plan for the Department.

#### The Weigel Plan

So what was the plan that convinced Jay Stein that Paul Weigel was the right man and how did it play out? The Weigel plan envisioned a Department within the third quartile of US Medical Schools Biochemistry Departments with respect to extramural grant awards and with 75% of the faculty being funded. He proposed a full-time faculty of 21, and that he would hire 11 faculty, excluding the Chair, in three phases. These would consist of 3 Professors, 1-2 Associate Professors and 5-6 Assistant Professors. The first stage would include senior faculty to provide leadership to the junior faculty. He suggested that the start-up package for junior faculty would be about \$225,000 per person which would include three years salary for a technician, supplies and equipment. The total recruitment cost would be about \$2.25 million. He projected a need for 41,000 square feet of laboratory space for this size faculty. Other parts of the plan included a need for faculty development – mentoring and a grants facilitator for development of grantsmanship and increase in support staff and new equipment.

Paul Weigel was born in New York City on August 11, 1946, and graduated from Cornell University in 1968 with a BA in Chemistry. He continued his studies at the Johns Hopkins University School of Medicine for his doctoral work with P.T. Englund working on the structure of 3' terminal nucleotide sequences and the inhibition of DNA replication by cyanide, carbon monoxide and dibromophenol. He stayed at Johns Hopkins for his postdoctoral work with Saul Roseman and Y.C. Lee. Here he began his studies on

carbohydrate structure with work on adhesion of hepatocytes to  $\beta$ -galactosides. In 1978, Weigel accepted a position as Assistant Professor of Biochemistry in the Department of Human Biological Chemistry & Genetics at the University of Texas Medical Branch at Galveston. In 1987 he became Professor, then Vice Chairman (1990) and Acting Chairman (1992). At Galveston, he developed his interest in structural carbohydrates into his current research interests in structure and function of endocytic recycling receptors and hyaluronan binding receptors. In 1994 he was named Chairman of the Department of Biochemistry & Molecular Biology at the University of Oklahoma Health Sciences Center.

### **Biochemistry in 1994**

Biochemistry was now a vigorous science and the boundaries between biochemistry, cell biology, microbiology and medical subjects such as medical genetics, were blurry. In 1994, there were 52 issues of *The Journal of Biological Chemistry*, with a total of 33,186 pages, twice the number of 1984, but not the exponential growth of ten years ago. The leveling off was due to a decision by the American Society of Biochemistry & Molecular Biology to control the size of the Journal and due to the increase in postage rates for bulk mail. The chief editor was still Herbert Tabor, but now there were 16 Associate Editors, seven more than in 1984, with four holdovers, Gibson, Hirs, Meister and Schimke. There were 271 reviewing editors, one of which was Paul H. Weigel. Minireviews were now an important part of the journal with 31 minireviews in 1994 on an eclectic variety of subjects from protein function, transcription, homologous recombination in mice, signal transduction, biosynthesis of nitric oxide to peptides containing D-amino acids from frogs and mollusks. The topics were the same as in 1984, *Carbohydrates, Lipids, and Other Natural Products, Cell Biology and Metabolism, Enzymology, Membranes and Bioenergetics, Nucleic Acids, Protein Synthesis and Molecular Genetics*, and *Protein Chemistry and Structure*. Molecular biology was all throughout the Journal, but now in the methods sections, rather than as a novelty in itself.

### **Remodeling the Department**

Although it was not in the original Weigel Plan, on his second visit, he asked for and received \$2 million dollars for remodeling. Eventually he remodeled all of the laboratories and offices in the Department of Biochemistry & Molecular Biology in the Biomedical Sciences Building. He moved the Departmental office from the ninth floor of the Biomedical Sciences building to the eighth floor. A combination lecture/meeting room was included in the plans – room 833, which turned out to be very useful. Many graduate classes seminars and departmental meetings would be held in room 833. Almost all of the small lecture/meeting rooms in the Biomedical Sciences Building had been appropriated for other purposes - offices for the Dean's suite and research laboratories for clinical scientists - so that rooms assigned to Departments were all that were left for graduate teaching. Weigel also added a small lunchroom with a kitchen to be used by employees, students and faculty for lunch and coffee breaks. The closest other lunchrooms were in the hospitals.

Remodeling was done in stages, but all current and new scientists were given remodeled laboratories. My laboratory on the 9<sup>th</sup> floor of the Biomedical Sciences Building was one of the first labs remodeled.

### **The first search committee**

Shortly after he accepted the position, Weigel appointed a committee to search for an Assistant Professor. One of the candidates encouraged to apply was Paul DeAngelis, who had been a highly productive postdoctoral fellow in Weigel's lab. DeAngelis earned his B.S.



from Harvard and his Ph.D. from the University of California at Irvine in 1990 and then went to Weigel's lab where he stayed until 1994, when he joined the faculty in Oklahoma City. It was natural that there would be concern that DeAngelis would become a super post-doc rather than an independent investigator. However, this turned out to be a non-issue, since DeAngelis rapidly acquired his own research grants and research program. His research focus is on the biosynthesis of complex carbohydrates, especially hyaluronic acid, which is an important constituent of warm-blooded animals. Organisms being used for this study are *Pasteurella multocida*, the cause of fowl cholera and shipping fever and *Chlorella* virus PBCV-1. His laboratory is on the 8<sup>th</sup> floor of the Biomedical Sciences Building.

### **The hiring class of 1996**

The first senior faculty member hired was Gillian Air, a National of Institutes Merit Awardee, who was recruited from the Department of Microbiology at the University of Alabama in Birmingham. She earned her Ph.D. from the University of New South Wales, Australia. She is studying ways to control the spread of the influenza virus, which mutates rapidly. Her approach is to change the surface proteins of the influenza virus by directed mutations in order to prevent the escape of the virus from its antibodies and by influencing the binding of neuraminidase, an important viral protein, with its antibody. Her laboratory is on the 8<sup>th</sup> floor of the Biomedical Sciences Building.

Ron Bowditch earned his Ph.D. from the University of California at Davis in 1989, and was doing postdoctoral research at the Scripps Institute when he was recruited here in 1996 as an Assistant Professor. His research focus is on the structure and function of proteins involved in cell adhesion and migration, especially the extravasation of lymphocytes during inflammation. His laboratory first was located in the Basic Sciences Education Building, but is now on the 4<sup>th</sup> floor of the Biomedical Research Center.

The third addition to the faculty in 1996 was Ann Louise Olson, who was recruited from the University of Iowa where she was an Associate member of the Department of Physiology and Biophysics. She earned her Ph.D., also from the University of Iowa, in 1986. She is studying the transport of glucose in normal and diabetic situations, by the glucose transport protein, GLUT4. In insulin resistant glucose transport, as in type II diabetics, there is a reduction in the amount of GLUT4 and not as much of it gets to the membrane where it is needed for glucose transport. She is studying this process by the creation of genetically altered, i.e. transgenic, mice. Her laboratory was on the 9<sup>th</sup> floor of the Biomedical Sciences Building, and she moved into my laboratory after I retired, also on the 9<sup>th</sup> floor.

The fourth addition in 1996 was Guangpu Li who earned his Ph.D. from Washington University in St. Louis, and remained there as a postdoctoral fellow and Research Assistant Professor. His research is on the transport of proteins and other large molecules into the cell and into the correct location. This complex process, named vesicular trafficking, is being studied using Sindbis virus as a model system. Li is on the 9<sup>th</sup> floor of the Biomedical Sciences Building.

### **The class of 1998**

The faculty member with the most interesting background added in 1998 was Alexey Bochkarev, who was trained in the Soviet Union. He earned his B.Sc. from the Moscow Institute of Electronics and Mathematics in 1981 and then worked on the Soviet space program for four years, including work on the MIR. He earned his Ph.D. in 1992 from the Engelhardt Institute of Molecular Biology in Moscow. His postdoctoral training was at Hamilton University and the University of Toronto. He is a structural biologist who studies

the structure of proteins that bind DNA using X-ray analysis of protein crystals. Bochkarev is situated on the 4<sup>th</sup> floor of the Biomedical Research Center.

Jialing Lin earned his Ph.D. in 1994 from the University of Tennessee. He is studying apoptosis, the process of cell death that occurs in both normal and diseased states. Bcl-2, a protein originally identified as playing a role in lymphomas, belongs to a family of proteins that inhibit apoptosis. Bcl-2 is anchored to cell membranes and seems to form a pore, which may be one of the factors regulating apoptosis. Lin is on the 9<sup>th</sup> floor of the Biomedical Sciences Building.

Karla Rodgers earned her Ph.D. from the University of Illinois in 1991. She is studying the structure and function of proteins that catalyze DNA recombination and the role of zinc in DNA binding. She is also a structural biologist and is one of the three coordinators of the Laboratory for Macromolecular Crystallography. Rodgers is on the 8<sup>th</sup> floor of the Biomedical Sciences Building.

The fourth person hired in 1998 was Adam Zlotnik, also a structural biologist and also involved in the Laboratory for Macromolecular Crystallography. He is studying the assembly of proteins, with a focus on the protein coat of viruses, named capsids. Zlotnik is on the 4<sup>th</sup> floor of the Biomedical Research Building.

### **The class of 2000**

Sanjay Bidichandani was the only person hired in 2000. He earned a medical degree (M.B.B.S) and Ph.D. from the University of Poona, in India and a second Ph.D. from the University of Glasgow in the United Kingdom. He is a molecular biologist specializing in human genetic diseases. He studies the role of triplet DNA repeats in Friedreich's ataxia. Because of his research, he has a joint appointment in the Department of Pediatrics. Bidichandani is on the 4<sup>th</sup> floor of the Biomedical Research Center.

### **Core laboratories, centers and companies**

**The Laser Mass Spectroscopy core facility.** There are two core facilities in the Department, which provide services to researchers without the latter having to invest in expensive equipment and learn a complex technique for just a few specialized experiments. The Laser Mass Spectroscopy Facility is under the direction of Hiro Matsumoto and Jay Hanas. The exact title is the National Science Foundation Oklahoma EPSCoR Laser Mass Spectroscopy Facility. In 1994, Matsumoto published a paper on the identification of a protein, which had been digested with a protease, the fragments separated on a two-dimensional gel, and the mass of the fragments determined by use of the mass spectrometer. From these data, it is possible to determine the amino acid composition of the peptide. This methodology forms the basis for research in the science of proteomics, the identification of proteins formed from the expression of genes. The Laser Mass Spectroscopy laboratory was opened in 1995 on the 8<sup>th</sup> floor of the Biomedical Sciences Building. This instrument is so accurate that the amino acid composition of the fragments could be determined from their masses. This facility was established with help from a National Science Foundation Oklahoma Biotechnology Network EPSCoR grant. The instrument is a Matrix-assisted laser desorption/ionizing time of flight mass spectrometer, usually abbreviated MALDI-TOF mass spectrometer. Funding for the facility came from the National Science Foundation EPSCoR grant with assistance from Paul Weigel.

**Laboratory for Macromolecular Crystallography core facility.** Alexey Bochkarev, Director, heads the Laboratory for Macromolecular Crystallography with Karla

Rodgers and Adam Zlotinik as Coordinators. This laboratory was created in 1998 and is located in the Biomedical Research Center building. The X-ray equipment includes a Rigaku model RUH3R Rotating Anode X-Ray generating system, R-Axis IV imaging plate system, MSC confocal optics and an X-stream low temperature system. Service is provided to academic laboratories at no charge.

**The Oklahoma Center for Medical Glycobiology (OCMG).** Richard Cummings was the architect of the OCMG, which is located in the Stanton L. Young Biomedical Research Center Building. The Center was officially recognized in 2000 and is both a research center and a core facility. The purpose of the Center is to make available to researchers "... the multidisciplinary expertise and expensive instrumentation..." needed to study complex carbohydrates of medical importance. Glycosylated proteins, glycolipids and glycosaminoglycans are involved in important cellular processes such as cellular communication, gene expression, inflammation and growth and development. There is a core of excellent investigators at the University of Oklahoma Health Sciences Center engaged in these studies that are members of the Center. In addition to Cummings, they are Gillian Air (Biochemistry & Molecular Biology), Paul DeAngelis (Biochemistry & Molecular Biology), Rodger McEver (Medicine), Kevin Moore (OMRF), A. Kwame Nyame (Biochemistry & Molecular Biology), Goverdan P. Sachdev (Pharmacy) and Paul H. Weigel (Biochemistry & Molecular Biology). The OCMG received funding from the Presbyterian Health Foundation, the Office of the Senior Vice President and Provost and the Department of Biochemistry & Molecular Biology. Cummings has been involved with the National Institutes of Health in developing continued funding for the Center. The NIH agreed to fund Cummings and a group of collaborators at Scripps Institute and the University of California-San Diego and other labs in the U.S., Europe and Japan to develop a \$25 million program entitled the "Consortium for Functional Glycomics." Cummings and the OCMG will receive major funding from this Consortium to develop the OCMG into a Core Facility nationally and internationally for all those working on carbohydrate-binding proteins and the complex carbohydrates they recognize and the biological functions of these interactions.

**Hyalose.** Hyalose is a company formed within the Department by Paul Weigel and Paul DeAngelis to make designer hyaluronans for commercial use. Hyaluronic acid is a ubiquitous polysaccharide found in almost all eukaryotic cells and is especially abundant in fibroblasts, chondrocytes, many tumor cells and the trabecular meshwork cells of the eye. The enabling technology is the production of hyaluronic acid by hyaluronic acid synthases from certain *Streptococcus* and *Pasteurella* species. They can make commercial amounts of the polysaccharide from 200,000 to greater than 1 million Daltons by fermentation of recombinant organisms. In another technology, in vitro bioreactors are used to make small hyaluronic acid oligosaccharides (1,000-2000 Daltons) with potential for anti-cancer, neovascularization, and immune system treatments. They are looking for commercial partners in the areas of wound healing, drug delivery, osteoarthritic diseases, ophthalmology, cosmetics, urology, tissue engineering and anti-adhesion devices. Hyalose has attracted venture capital funding from Emergent Technologies, a company that has licensed some of their patents. They also now have a corporate partner in Novozymes, which produces ~40% of the commercially used enzymes worldwide. Novozymes is owned by Novo Nordisk, a large Danish healthcare firm with an emphasis on diabetes care and genetic diseases. Hyalose is located in the third building of the Oklahoma Health Center Research Park.

### **The graduate program in Biochemistry & Molecular Biology**

There were major changes in the admission of graduate students to the program and to the curriculum of the graduate program soon after Weigel became Chairman. Currently, when students apply for admission to the Graduate School they request admission to the Graduate Program in Biomedical Sciences, which goes by the mnemonic of GPiBS. This is a program supported by a consortium of six Departments; Biochemistry & Molecular Biology, Cell Biology, Microbiology and Immunology, Pathology, Pharmacology and Toxicology and Physiology plus the interdisciplinary program in Neurosciences. There is a common curriculum for the first year of study which includes courses in Molecular and Cellular Biology, Integrative Biology, Current Issues in Biomedical Research, First Year Journal Club, Seminar and Laboratory rotations taught by faculty in the GPiBS program. Laboratory rotations are short-term research projects done under the direction of a faculty member the student is considering as a mentor for graduate study. Students going on to the doctoral program in Biochemistry & Molecular Biology take a course in macromolecular structure (x-ray crystallography) and participate in one of three journal clubs. Most of these courses are held in room 33 of the Biomedical Sciences Building. There are elective courses in glycobiology, biotechnology, molecular genetics and signal transduction and human molecular genetics. The remainder of the degree program consists of taking the general examination for admission to the doctoral program and dissertation research.

The Department hopes to offer an M.S. in Biotechnology, directed at students who wish to go into biotechnology and to supply workers for the budding biotechnology industry in Oklahoma.

### **How did the Weigel Plan play out?**

Pretty well actually. Even though Jay Stein left shortly after Weigel arrived, most of the commitments were honored by his successor, Joe Ferretti. There are currently 19 tenure track faculty in the Department versus the 21 projected. Ten full-time positions were filled, excluding Weigel's. Of these, nine were Assistant Professors and one, Gillian Air was hired as a Professor. The Assistant Professors were Bidichandani, Bochkarev, Bowditch, DeAngelis, Li, Lin, Olson, Rodgers, and Zlotnick. The total dollars of extramural grants has gone from \$1.2 million in 1992 to over \$5 million in the middle of 2001. All of the new faculty have extramural funding – mostly National Institutes of Health, but also National Science Foundation, American Heart Association, American Cancer Association, OCAST and Presbyterian Health Foundation.

## Epilogue

The changes that have taken place at the University of Oklahoma Health Sciences Center since Long and Everett's time would absolutely astound these pillars of the Medical School and its Department of Biochemistry & Molecular Biology. The final two pictures in this book are aerial photos of the Oklahoma City Campus taken in 1940 and in 1998. The 1940 picture shows the Medical School building, University Hospital, and Crippled Children's Hospital but not the nurses quarters. There are empty fields where the Oklahoma Medical Research Foundation and the Veteran's Administration Hospital will be located. The 1998 picture shows the modern campus, but even so, the third building in the Oklahoma Health Center Research Park and the OU Physicians Building, at 825 N.E. 10<sup>th</sup> Street, do not appear in the picture. All of the basic sciences faculty were fitted into the Medical School building in 1928, which was half the size of the current College of Public Health Building! Now, they are spread out between the 10 floors of the Biomedical Sciences Building, the Stanton L. Young Biomedical Research Center and the Oklahoma Health Center Research Park.

The present Health Sciences Center is a vibrant campus with world-recognized basic and clinical science faculty. The faculty of Biochemistry & Molecular Biology is one of the top Departments in terms of research grants; they serve on national panels and are invited to travel all over the world to talk about their research. All of the buildings in the Research Park are filled and more are planned. One of the companies in the Research Park (Novazyme) has signed a multimillion-dollar licensing agreement with Genzyme and Hyalose has signed a licensing agreement with Novozymes.

What will happen in the next 50 years?

**TABLE 1. Faculty of the Chemistry, Biochemistry & Pharmacology and  
Biochemistry & Molecular Biology departments and date of hire<sup>15</sup>**

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<b>1900</b>
DeBarr, Edwin C., Ph.D. Professor of Chemistry
<b>1924</b>
Everett, Mark Reuben, Ph.D. Professor of Physiological Chemistry and Pharmacology <sup>16</sup>
<b>1925</b>
Shoemaker, Harold A, Ph.C. Assistant Professor of Biochemistry and Pharmacology
<b>1926</b>
Sheppard, Fay, M.S. Assistant in Biochemistry and Pharmacology
<b>1927</b>
Meyers, William Arthur, M.D. Assistant Professor of Biochemistry and Pharmacology
<b>1928</b>
Hood, F. Redding, Ph.C. Instructor in Biochemistry and Pharmacology
<b>1930</b>
Whelan, Mary, M.S. Instructor in Biochemistry and Pharmacology
<b>1937</b>
Danielson, Irvin S., Ph.D. Assistant Professor of Biochemistry
<b>1939</b>
Crews, Lowell Thomas, M.S. Research Fellow in Biochemistry

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<sup>15</sup> The Chemistry Department was the precursor to the Department of Biochemistry and Pharmacology (1924), the Department of Biochemistry (1935) and the Department of Biochemistry & Molecular Biology (1969).

<sup>16</sup> This was Mark R. Everett's original faculty title which was changed when he became Professor and Head of the Department of Biochemistry and Pharmacology.

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**1941**

Diamond, Lewis Edward, M.S. Research Associate in Biochemistry

**1942**

Kurtz, Alton Clair, Ph.D. Assistant Professor of Biochemistry

**1943**

Hladky, Frank, Jr., B.S. Research Fellow in Biochemistry

**1946**

Shetlar, Marvin Ray, Ph.D. Research Associate in Biochemistry

**1951**

Kochakian, Charles D., Ph.D. Professor of Research Biochemistry

**1953**

Caputto, Ranwel, M.D., Assistant Professor of Research Biochemistry

**1955**

Bever, Arley Tunis Jr., Ph.D. Assistant Professor of Biochemistry

Larsen, Earl G., Ph.D. Assistant Professor of Biochemistry

**1957**

McClure, Lawrence E., Ph.D. Assistant Professor of Research Biochemistry

**1958**

Condit, Paul Taylor, M.D. Assistant Professor of Research Medicine and Research  
Biochemistry

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**1960**

Alaupovic, Petar A., Ph.D. Assistant Professor of Research Biochemistry<sup>17</sup>

Wigler, Paul W., Ph.D. Assistant Professor of Research Biochemistry

**1961**

Dubowski, Kurt M., Ph.D. Associate Professor of Clinical Chemistry and Toxicology and in Biochemistry and Pathology

**1962**

Crider, Quincy Edward, Ph.D. Research Associate in Research Biochemistry

Tang, Jordan J.N., Ph.D. Research Associate in Biochemistry

**1963**

Anglin, J. Hill, Ph.D. Assistant Professor of Research Dermatology and Instructor in Research Biochemistry

Carubelli, Raul, Ph.D. Assistant Professor of Research Biochemistry

**1964**

Coleman, Ronald Leon, Ph.D. Assistant Professor of Research Biochemistry and Preventative Medicine and Public Health

Li, Yu-Teh, Ph.D. Assistant Professor of Research Biochemistry

**1965**

Johnson, B. Connor, Ph.D. Professor and Chairman, Department of Biochemistry

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<sup>17</sup>Alaupovic, Caputto, Carubelli, Kochakian, Tang, Li and Wigler were considered joint members of the OMRF and the Department of Biochemistry. Later on they became full time members of the OMRF and adjunct members of the Department of Biochemistry & Molecular Biology.



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**1966**

Chandler, Albert, Ph.D. Assistant Professor of Biochemistry

Delaney, Robert, Ph.D. Assistant Professor of Biochemistry

Unger, Leon, Ph.D. Assistant Professor of Biochemistry

**1967**

Abell, Creed, Ph.D. Assistant Professor of Biochemistry

Briggs, Thomas, Ph.D. Assistant Professor of Biochemistry

Hodgins, Daniel S., Ph.D. Assistant Professor of Biochemistry

Mays, Jary S., Ph.D. Assistant Professor of Biochemistry

Rabinovitch, Bernard, Ph.D. Assistant Professor of Biochemistry

**1969**

Cox, A. Chadwick, Ph.D. Assistant Professor of Biochemistry

**1973**

Gray, Peter, Ph.D. Assistant Professor of Biochemistry & Molecular Biology

**1976**

Levine, Martin, Ph.D., D.D.S. Assistant Professor of Biochemistry & Molecular Biology

**1977**

Broyles, Robert A., Ph.D. Associate Professor of Biochemistry & Molecular Biology

**1982**

Tobin, Sara, Ph.D. Assistant Professor of Biochemistry & Molecular Biology

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**1984**

Sokatch, John R., Ph.D. George Lynn Cross Research Professor and Chairman of  
Biochemistry & Molecular Biology

**1985**

Fuller, Bryan B., Ph.D. Assistant Professor of Biochemistry & Molecular Biology

Hanas, Jay S., Ph.D. Assistant Professor of Biochemistry & Molecular Biology

Matsumoto, Hiroyuki, Ph.D. Assistant Professor of Biochemistry & Molecular Biology

**1986**

Steinberg, Robert S., Ph.D. Associate Professor of Biochemistry & Molecular Biology

**1988**

Cummings, Richard, Ph.D. Ed Miller Chair in Molecular Biology and Professor of  
Biochemistry & Molecular Biology

**1994**

DeAngelis, Paul, D., Ph.D. Assistant Professor of Biochemistry & Molecular Biology

Weigel, Paul H., Ph.D. Professor and Chairman, Biochemistry & Molecular Biology

**1996**

Air, Gillian, Ph.D. Professor of Biochemistry & Molecular Biology

Bowditch, Ron, Ph.D. Assistant Professor of Biochemistry & Molecular Biology

Li, Guangpu, Ph.D., Assistant Professor of Biochemistry & Molecular Biology

Olson, Ann L., Ph.D. Assistant Professor of Biochemistry & Molecular Biology

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**1998**

Bochkarev, Alexey, Ph.D. Assistant Professor of Biochemistry & Molecular Biology

Lin, Jialing, Ph.D. Assistant Professor of Biochemistry & Molecular Biology

Rodgers, Karla, Ph.D. Assistant Professor of Biochemistry & Molecular Biology

Zlotnick, Adam, Ph.D. Assistant Professor of Biochemistry & Molecular Biology

**2000**

Bidichandani, Sanjay, Ph.D. Assistant Professor of Biochemistry & Molecular Biology

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TABLE 2. Graduates of the doctoral programs in Medical Sciences, Biochemistry and  
Biochemistry & Molecular Biology

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1927

Sheppard, Fay<sup>18</sup>, - Mark Reuben Everett, Chairman of thesis committee

1956

Padron, Jorge - Marvin Shetlar, Chairman of thesis committee.

1957

Raut, Vijayanand - Alton Kurtz, Chairman of thesis committee

1958

Schoenfeld, Robert - Arley Bever, Chairman of thesis committee

1959

Costa, Giovanni – Earl Larsen, Chairman of thesis committee

Endahl, Gerald - Arley Bever, Chairman of thesis committee

1961

Cahill, Charles – Marvin Shetlar, Chairman of thesis committee

Stidworthy, George – Marvin Shetlar, Chairman of thesis committee

Tang, Jordan, J.N. – Raul Trucco, Chairman of thesis committee\*<sup>19</sup>

1962

Yang, Hsiu-Ying – Marvin Shetlar, Chairman of thesis committee

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<sup>18</sup>Fay Sheppard actually earned a Master's degree. However, she is included because she was the first graduate of the program and a protégé of Mark R. Everett.

<sup>19</sup> \*Indicates adjunct faculty with graduate college privileges.

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1963

Anglin, J Hill – Arley Bever, Chairman of thesis committee

Coleman, Ronald – Arley Bever, Chairman of thesis committee

Li, Yu-Teh – Marvin Shetlar, Chairman of thesis committee

Sanbar, Shafeek – Petar Alaupovic, Chairman of thesis committee

1964

Capps, Jerry – Marvin Shetlar, Chairman of thesis committee

Jibril, Abbas – Paul McCay, Chairman of thesis committee\*

1965

Eliceiri, George L.- Paul McCay, Chairman of thesis committee\*

Mills, John Norman – Jordan J.N. Tang, Chairman of thesis committee

1966

Hurst, Max Wayne – Reagan Bradford, Chairman of thesis committee\*

Li, Su-Chen – Reagan Bradford, Chairman of thesis committee\*

May, Hubert Eugene – Paul McCay, Chairman of thesis committee

1967

Choi, Haing Ug – Raul Carubelli, Chairman of thesis committee

Forsyth, George – B. Connor Johnson, Chairman of thesis committee

Frow, Frank – Marvin Shetlar, Chairman of thesis committee

Lee, Dianne – Petar Alaupovic, Chairman of thesis committee

Olson, Anita C. – Petar Alaupovic, Chairman of thesis committee

Wie, Yong Huang – Jordan J.N. Tang, Chairman of thesis committee

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1968

Mendenhall, Charles – Reagan Bradford, Chairman of thesis committee\*

Oei, Gek Lien – Marvin Shetlar, Chairman of thesis committee

Tsang, Joseph – Petar Alaupovic, Chairman of thesis committee

1969

Black, Owen – J Hill Anglin, Chairman of thesis committee

Gilliam, James – Paul McCay, Chairman of thesis committee\*

Lacefield, Delbert – Earl Larsen, Chairman of thesis committee

Poyer, Lee – Paul McCay, Chairman of thesis committee

Wober, Wolfgang – Petar Alaupovic, Chairman of thesis committee

1970

Chiba, Naoki – B. Connor Johnson, Chairman of thesis committee

Huang, Henry – B. Connor Johnson, Chairman of thesis committee

Keller, Nadya – Martin Griffin, Chairman of thesis committee\*

Solyom, Antal E. – Reagan Bradford, Chairman of thesis committee\*

Stroman, David W. – Leon Unger, Chairman of thesis committee

Tam, Billy – Paul McCay, Chairman of thesis committee\*

1971

Ali, Muhammad – Albert Chandler, Chairman of thesis committee

Campbell, Dale – Robert Delaney, Chairman of thesis committee

Johnson, Leslie – Creed Abell, Chairman of thesis committee

Lu, Wuan-Tsun, Leon Unger, Chairman of thesis committee

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McConathy, Walter – Petar Alaupovic, Chairman of thesis committee\*

Wang, Chi Sun – Petar Alaupovic, Chairman of thesis committee\*

1972

Chen, Ching-Shyong – Jordan J.N. Tang, Chairman of thesis committee\*

Enochs, Mary Rebecca – Jordan J.N. Tang, Chairman of thesis committee\*

Girsch, Steve – Bernard Rabinovitch, Chairman of thesis committee

Kuo, Wu-Nan – Creed Abell, Chairman of thesis committee

Luh, Sylvia Shing – Martin Griffin, Chairman of thesis committee\*

Marchand, Nancy – Creed Abell, Chairman of thesis committee

Parkhurst, Rodney – Daniel Hodgins, Chairman of thesis committee

Plante, E.O. – Bernard Rabinovitch, Chairman of thesis committee

Price, Gary – Martin Griffin, Chairman of thesis committee\*

Stith, William – Creed Abell, Chairman of thesis committee

Tai, Yu-Lin – Robert Delaney, Chairman of thesis committee

White, Betty – Raul Carubelli, Chairman of thesis committee\*

1973

Bussjaeger, Carolee – Thomas Briggs, Chairman of thesis committee

Cheung, David Chung-Hong – Leon Unger, Chairman of thesis committee

Fong, Kuo-Lan – Paul McCay, Chairman of thesis committee\*

Howard, Charles – Mary Carpenter, Chairman of thesis committee\*

Kelley, Darshan – B. Connor Johnson, Chairman of thesis committee

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Kelley, Jimmy Lee – Petar Alaupovic, Chairman of thesis committee\*

Lane, Daniel, M.D. – Petar Alaupovic, Chairman of thesis committee\*

Ledford, Joanna H. – Petar Alaupovic, Chairman of thesis committee\*

Lucid, Shannon Wells – A. Chadwick Cox, Chairman of thesis committee

Parkhurst, George – Jary Mayes, Chairman of thesis committee

Tan, Eugene – Thomas Briggs, Chairman of thesis committee

Yeh, Alex – Raul Carubelli, Chairman of thesis committee\*

1974

Freny, Berkenbile – Robert Delaney, Chairman of thesis committee

1975

Bazzell, Kirstan – Martin Griffin, Chairman of thesis committee\*

Lovig, Charles Arthur – Richard H. Bottomley, Chairman of thesis committee\*

Sanny, Charles – Jean Hartsuck, Chairman of thesis committee\*

Schneider, Ed – Leon Unger, Chairman of thesis committee

Weddle, Charles – Paul McCay, Chairman of thesis committee\*

1976

Curry, Michael Dean – Petar Alaupovic, Chairman of thesis committee\*

Dashtizadeh, Nassrin – Joseph A. Ontko, Chairman of thesis committee\*

Garner, William Darwin – Richard Bottomley, Chairman of thesis committee\*

Niday, Evelyn Gay – Petar Alaupovic, Chairman of thesis committee\*

Suenram, Clifford Alan – Petar Alaupovic, Chairman of thesis committee\*

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1977

Comp, Phillip Cinnamon, M.D. – Fletcher B. Taylor, Chairman of thesis committee\*

Drzymala, Robert Edmund – Bernard Rabinovitch – Chairman of thesis committee

Girardot, Jean-Marie - B. Connor Johnson, Chairman of thesis committee

Huang, Shuan Shian – Diana Lee, Chairman of thesis committee\*

Martin, Ronald Ray – Leon Unger, Chairman of thesis committee

Otto, David A. – Joseph A. Ontko, Chairman of thesis committee\*

Roberts, Charles Martin - John R. Sokatch, Chairman of thesis committee

Shires, Ann Kirkpatrick - Mary P. Carpenter, Chairman of thesis committee\*

1978

Carey, John Christopher - Petar Alaupovic, Chairman of thesis committee\*

Dao, My Lien - B. Connor Johnson, Chairman of thesis committee

Inyangator, Patrick - A. Chadwick Cox, Chairman of thesis committee

Liu, Diane Hui-Chun – Jordan J.N. Tang, Chairman of thesis committee

Thorlton, Cydney L. – Leon Unger, Chairman of thesis committee

1979

Cullum, Malford Eugene – B. Connor Johnson, Chairman of thesis committee

Jackson, Kenneth W. – Jordan J.N. Tang, Chairman of thesis committee

Jih, Jyh-Hwang – Jean Hartsuck, Chairman of thesis committee\*

Suen, Erick Tsi-Tee – B. Connor Johnson, Chairman of thesis committee

Price, Joy Ann - B. Connor Johnson, Chairman of thesis committee

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1981

Jones, Janis Barbara - Daniel S. Hodgins, Chairman of thesis committee

1982

Dorn, Allan Richard – Robert H. Broyles, Chairman of thesis committee

Gilmore, Michael S. – Albert Chandler and Joseph J. Ferretti, Co-Chairmen of thesis committee

Hanson-Painton, Olivia - Jordan J.N. Tang, Chairman of thesis committee\*

May, Patrick C. – Peter Gray, Chairman of thesis committee

1983

Cooper, Denise R - Mary P. Carpenter, Chairman of thesis committee\*

Demczuk, Stephen - Albert Chandler, Chairman of thesis committee

Guinto, Enriqueta, R. - Charles T. Esmon, Chairman of thesis committee\*

Oaks, Melanie L - Daniel Trachewsky, Chairman of thesis committee\*

Skogen, William Frank - A. Chadwick Cox, Chairman of thesis committee

1984

Azain, Michael Joseph – Joseph A. Ontko, Chairman of thesis committee\*

Kozelak, Stanley N. Jr – Jean Ann Hartsuck, Chairman of thesis committee\*

Maples, Phillip Brooks - Robert Broyles, Chairman of thesis committee

Niedbalski, Joseph Stewart – Peter Gray, Chairman of thesis committee

Sifers, Richard Norman - Jary Mays, Chairman of thesis committee

Wong, Ricky Ngok-Shun – Jordan J.N. Tang, Chairman of thesis committee\*

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1985

Chao, Fei-Fei – Joseph A. Ontko, Chairman of thesis committee\*

Smith, Floyd Lee – Mary P. Carpenter, Chairman of thesis committee\*

1987

Dell, Virginia Anne - Martin Levine, Chairmen of thesis committee

Harris, Kevin W. - Charles T. Esmon, Chairman of thesis committee\*

Nixon, Randal R. - Charles T. Esmon, Chairman of thesis committee\*

Vigoreaux, Jim O. - Sara Tobin, Chairman of thesis committee

1988

Wright-Sandor, Laurie Anne - Sara Tobin, Chairman of thesis committee

1989

Roberts, Margaret M.- John R. Sokatch, Chairmen of thesis committee

1990

Burn, Timothy Campbell - Sara Tobin, Chairman of thesis committee

Gaskins, Christopher John - Jay Hanas, Chairman of thesis committee

O'Brien, Charles A. – Michael Gilmore, Chairman of thesis committee\*

Palmer, Judith Ann – John R. Sokatch, Chairman of thesis committee

Shupert, William Lesley - Wai-Yee Chan, Chairman of thesis committee\*

Smith, David Joseph - Robert Broyles, Chairman of thesis committee

1991

Han, He-Ping – Jordan J.N. Tang, Chairman of thesis committee

Liu, Le-Wen - Charles T. Esmon, Chairman of thesis committee\*

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Komori, Naoka – Hiroyuki Matsumoto, Chairman of thesis committee

Saugstad, Julie Ann – Sara Tobin, Chairman of thesis committee

1994

Do, Ki-Young – Richard D. Cummings, Chairman of thesis committee

Gregoli, Paul Armand - Robert Delaney, Chairman of thesis committee

Rungta, Deepa – Bryan Fuller, Chairman of thesis committee

Shilatiford, Ali - Richard D. Cummings, Chairman of thesis committee

1995

Cho, Moonjae - Richard D. Cummings, Chairman of thesis committee

Corn, Todd - Bryan Fuller, Chairman of thesis committee

Ogilvie, Martha Kay - Jay Hanas, Chairman of thesis committee

1996

Kahn, Esther Susan – Hiroyuki Matsumoto, Chairman of thesis committee

Koelsch, Gerald Eugene – Jordan J.N. Tang, Chairman of thesis committee\*

Lee, Sheau-Ling – Robert Steinberg, Chairman of thesis committee

Wilkins, Patricia – Richard D. Cummings, Chairman of thesis committee

Yeh, Jiunn-Chern – Richard D. Cummings, Chairman of thesis committee

1997

Cho, Somi – Richard D. Cummings, Chairman of thesis committee

Miller, Frederick Kris – Martin Levine, Chairman of thesis committee

Pan, Junliang – Rodger McEver, Chairman of thesis committee\*

Takagi, Yuichiro – Joan W. Conaway –Chairman of thesis committee\*

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1998

DuBose-Boyd, Russell A. – Richard D. Cummings, Chairman of thesis committee

Moreland, Rodney James – Jay S. Hanas, Chairman of thesis committee

Robinson, Kent - Robert Floyd, Chairman of thesis committee\*

1999

Helderman, Coy – Paul H. Weigel, Chairman of thesis committee

Hester, Kathryn Lynn – John R. Sokatch, Chairman of thesis committee

Xu, Jun – Charles T. Esmon, Chairman of thesis committee\*

2000

Beverly Jean Elmendorf – Joan Conaway, Chairman of thesis committee\*

Epperson, Terry Kay - Richard D. Cummings, Chairman of thesis committee

Loy, Jeffrey – Jordan J.N. Tang, Chairman of thesis committee\*

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