Although research in medical schools is often thought of as a post WWII phenomenon, the pathologists in Houston and Galveston had incorporated research into their academic and clinical settings long before. Admittedly, the scope of research was limited by the heavy service and teaching demands, but it was a regular part of pathology practice and teaching all the same. At UTMB research was not the major preoccupation that it was at some other medical institutions, but faculty members did pursue their own research interests and encouraged students to do the same. In the first catalog, after Dr. Smith had described the commitment of the department to teaching, he added the comment that, “Throughout the course the laboratories and equipments are available to such students as may desire to prosecute special lines of study of investigation, without further expense, the teacher in charge of this department being anxious to foster any such tendencies on the part of the students of the school.” This atmosphere of supporting research interests among students, but not requiring it, persisted for several decades. Meanwhile, the faculty at UTMB found time to pursue research of their own, despite the fact that there was no outside funding to support the work.

The creation of extramural grant programs, first in the National Cancer Institute with its inception in 1937, and later in other National Institutes of Health (NIH), provided a major new source of funding for research in pathology. The ability of biomedical researchers, during both WWI and WWII, to quickly produce major advances with immediate practical applications in military medicine impressed the entire country with the advantages of federal funding for research, despite persistent resistance among biomedical scientists and medical practitioners to government involvement in their professions. The scope of possible advances was especially evident in serology and blood banking, services that had settled within pathology.

Research in pathology benefited substantially from the new availability of funds. The role of NIH after WWII was agreed to be the funding of only basic biomedical research, as a concession to the AMA, which strongly opposed any role for the federal government in medical education except in providing funds for building. However, with a severe shortage of all medical personnel, including pathologists, in the aftermath of WWII and during the Korean War, and the drain of biomedical personnel from academic institutions to the more financially lucrative fields of private practice and industry, NIH was highly concerned with the vitality of academic programs educating future generations of both basic scientists and practitioners.

The NIH staff members and Advisory councils emphasized that good medical research was absolutely inseparable from good medical education. Training grants were allowed only in cancer and mental health. To get around President Eisenhower's 1952 prohibition against NIH funding of medical education, the advisory councils adopted a tacit ranking scheme that encouraged the education of “good” research scientists over the production of knowledge itself. In awarding
The effect of federal funding on research in pathology is evident in the annual reports of the pathology department at Baylor College of Medicine. In the academic year 1952-1953, Dr. Wallace, the department chair, expressed dismay at the lack of an active research program, while acknowledging that his desires for a strong research component had been subordinated to the pressing needs among local hospitals for pathology services in the time since Baylor had moved to Houston. He felt that it would have been "...undiplomatic, and I think would have been wrong as far as the local need is concerned, to have turned down certain of the requests for assistance in the hospital laboratories..." But after nine years in Houston, the pathologists at Baylor felt they were finally reaching a balance, where research might take a more prominent role, and Dr. Wallace was clear that research was the single most significant need in the department. By 1961, the full-time faculty had increased to fifteen, nine were engaged in research projects, and four were supported by funds from the federal government. The research projects covered a wide array of topics including: experimental atherosclerosis in rats, fats and hypertension in pyridoxine deficiency, specific identification of pathogenic fungi with fluorescent antibody techniques, radiation effect on the central nervous system, pulmonary disease, the effect of hypertension on pulmonary arteries, drug-induced colonic polyps and carcinomas in rats, myocarditis in Coxsackie B viral infections, and blood lipids in experimental atherosclerosis. Plans for the following year included the addition of two more research pathologists to the faculty, one in neuropathology and one in cardiovascular diseases. The UTMB pathology department had a similarly broad research program, including projects on carcinogenesis, tumor metabolism, pineal gland relationships, immune mechanisms, endocrine tumors, and radiobiology.

One of the primary ways in which federal research funding assisted medical schools and hospitals, both in their research and their teaching capacities, was in providing funds for the equipment of laboratories. Although equipment purchases were specifically earmarked for research, the considerable overlap between research and teaching meant that the educational functions of pathology departments also benefited. Baylor arranged 900 square feet of laboratory space specifically for experimental pathology in 1961 when the department shifted their pathology museum into the student laboratories to make room for experimental laboratories for research in atherosclerosis, and electron microscopy. A generous contribution by Mr. Ben Taub equipped the Sam Taub Memorial Electron-microscopy Laboratory with an RCA-EMU 3F electron microscope, darkroom equipment, and two ultramicrotomes with stereo and phase microscopes. Furnishings and basic equipment were funded by a Cardiovascular Research Center Grant, one of the new multidisciplinary grants given by NIH designed to encourage large collaborative projects. The department acquired an additional 3300 square feet of experimental laboratory space the very next year, with most of the space devoted to microscope laboratories for individual faculty, and several others for radioisotopes, tissue culture, pulmonary histology, and hematopathology labs. From 1962 to 1968 Baylor enjoyed an enormous growth in research capabilities through federal funding.
The national preoccupation with cancer, and the concentration of public funds for research on cancer, greatly expanded new roles for pathologists both as collaborative researchers in teams of specialists and as highly valued diagnostic clinicians working in concert with surgeons to diagnose cancer in earlier stages when surgical treatment might effect a cure. Dr. Russell, at MDACC, commented that, "The clamor about cancer steadily increasing as it is disturbs (sic) the conservative physician, pleases the investigator and confuses the public." The reason pathologists were particularly pleased with the clamor about cancer was that it focused attention, and funding, on the pathologist's forte—the explication of the physiologic processes accounting for a change from normal to abnormal, and the application of that knowledge to everyday clinical practice.

It was pathologists, not biologists, who first addressed cancer as a biologic problem subject to organized investigation and improved therapy. It was also pathologists who helped establish that the function and growth of cancer cells could be moderated by extrinsic factors. Cancer was not simply normal cells run amok without reason, or a curious but inconsequential symptom of other diseases, as was originally believed, but a disease that could be traced to genetic predisposition, age, hormonal levels, and such extrinsic factors as exposure to carcinogenic substances, irradiation, and viruses. With this information, cancer became a disease that could be investigated, not merely as a curiosity, but as any other disease with an etiology and prognosis, and a variety of avenues for intervention in a specific disease process.

Through the perspectives on cancer given by pathologists, with Drs. Russell, H. Stephen Gallager, James Butler, J. Leslie Smith, and John M. Lukeman at MDACC playing a major role, cancer became a preventable disease, or at least one that could be moderated with therapeutic agents. At MDACC, much of the research focused on early detection of cancer, prior to overt symptoms. One of the first projects was on exfoliative cytology, adapting smear techniques to cancer of lungs, stomach, urinary tract, and other sites. With lung cancer a leading cause of death, the MDACC staff also instituted a joint pulmonary cytology program with the National Cancer Institute, and developed a membrane filter technique for diagnosis. Dr. Gallager revived and modernized an old technique of whole organ sectioning to study the extent and behavior of various cancers. One of the contributions most useful to surgical pathology was the development at MDACC of the open cryostat for making high quality frozen tissue slides that could be kept as permanent slides after enzyme, histochemical, and immunoenzymechemical studies had been performed.

The experiences of the pathology departments at UTMB, Baylor, MDACC, and UT-Houston illustrate several trends that affected all academic pathology departments. Although research conducted in the laboratory had been an integral part of pathology for decades before WWII, pathologists who pursued research projects had mostly done so on their own time, at their own expense. This changed after WWII, when federal funds were devoted to supporting research as an integral part of medical education in university-affiliated institutions. Pathologists were particularly eager to avail themselves of these new research opportunities in the 1950s and 1960s because the field of pathology was perceived to be in a crisis.

In 1954, Dr. S. Burt Wolbach, emeritus professor of pathological anatomy at the Peter Bent Brigham Hospital in Boston, described the state of pathology as doleful. In his view, surgical and clinical pathologists had become so indispensable to medicine that the scientific and research aspects of pathology had been
completely overshadowed. Seven years later, Dr. Howard Hopps, chair of the Department of Pathology at UTMB and editor of the Bulletin of the College of American Pathologists, reported that clinicians and medical scientists alike thought that pathology had failed to keep pace with other medical fields. Instead, students were advised to take courses in physiology, immunology, and biochemistry, where they would learn more about the pathogenesis of disease. With pathology viewed solely as a diagnostic tool, and not as a scientific discipline, the field of pathology was in grave danger of complete atrophy. Active research programs were the key to reinstating pathology to the position it had once enjoyed as the science upon which all other medical disciplines depended.

The full integration of research into education appeared at all levels: the revised curricula for medical students included experiments as part of pathology training and encouraged students to take additional time to pursue research projects; graduate degrees in pathology for non-physicians were established at UTMB, Baylor, and the University of Texas Postgraduate School of Medicine; residency programs at the same institutions were turned into hybrid programs with residents splitting their time evenly between research and classical pathology training; and virtually all faculty became involved in either basic or clinical research projects. Instead of an individual pursuit, research in pathology increasingly became collaborative research involving participation by people from many disciplines and research projects turned into major programs, with long-term commitments to research in particular areas.
Despite the relatively small numbers of pathologists at UTMB, women filled a significant role in the Department of Pathology from early in the century. Drs. Marie Charlotte Schaefer, Martha A. Wood and Violet Keiller were among the earliest students to graduate from the University of Texas Medical Department in Galveston and go on to practice or teach pathology as a full-time occupation. It is fortunate for the women who trained as pathologists at UTMB that Dr. Allen J. Smith did not bring with him from the University of Pennsylvania its ultra-conservative view of women in the medical world. The University of Pennsylvania adamantly refused to admit women as medical students until after WWI; by contrast, the University of Texas Medical Branch was coeducational from the outset. Female students no doubt benefited from Dr. Smith’s opinion that the influence of women in the classroom was good. In commenting in 1917 on the impact of women in the medical school, Dr. Smith reported that the women were excellent students.

The same year, Dr. W.S. Carter, dean of the University of Texas Medical Branch, expressed pride in the fact that UTMB had always been co-educational. Even though the school rarely had large numbers of female medical students, it averaged ten or twelve women in each class of 88 students. Dr. Carter admitted that he had been prejudiced against co-education when he first arrived at UTMB in 1897. However, after experience in the coeducational school, he was “...strongly in favor of this arrangement and believe it to be the very best that can be made....The tremendous cost of medical education at the present time makes it highly desirable that women should have the privilege of attending medical schools in good standing in different parts of the country and should not be restricted to a limited number of schools for women exclusively.” This staunch support for the medical education of women in a university-affiliated medical school was highly unusual.

Although women rarely held full faculty positions at UTMB during the early years, with the notable exception of Dr. Schaefer, women did fill a significant role in the education of medical students, especially in pathology. Many of the positions as instructors in pathology were filled by women who trained in medicine at the school. Between 1901 and 1903, when the Department of Pathology had four members, Dr. Schaefer was the demonstrator in histology, general biology, and embryology. These courses were later recognized as a separate department in 1912. For every year between 1907 and 1914, women served as fellows, student assistants, or assistants in pathology, making up the third person in a three-person department. Again in 1918 to 1921, a woman, Dr. Anna Mary Bowie, was the only instructor in pathology in addition to the professor of pathology, Dr. H.D. Hartman. In 1930-1932, Dr. Ellen D. Furey was the fourth member in a four-person department.
At a time when many medical specialties and academic disciplines were mostly closed to women, the Department of Pathology at UTMB provided an unusually open environment for women to train as practitioners, to serve as pathology educators, and to engage in scientific research.

This early precedent for women in pathology carried over into the following decades. Drs. Keiller and Wood were both very influential as chief pathologists in Hermann Hospital and Methodist Hospital in Houston. Dr. Wood helped found the Houston Pathology Society in 1914, the State Pathological Society of Texas (SPST) in 1921, and the reorganized SPST in 1934. Dr. Keiller served as president of the same organization in 1930. Even during the decades when the percentage of women in medicine as a whole declined, the numbers of women working in pathology in clinical practice, in education, and in research in this area continued to grow. In the post-WWII period, the great demand for pathologists and their relative scarcity meant that women found pathology to be a field more open to women than some of the other specialties. Today, approximately half of all residencies in pathology in this area are filled by women.

As the numbers of women in pathology increased, so did their influence on students and colleagues. For instance, Dr. Joyce Davis, director of student education at Baylor for many years, had a significant impact on Baylor students through her reorganization of the pathology curriculum to focus more on small group teaching and clinical experience. Women in pathology also played an active role in the HSCP since its inception in 1948. During its history, the HSCP has had seven women elected as president of the organization: Drs. Margaret Carter, Ethel Erickson, Joyce Davis, Ena Mocega, Jan Bruner, Rhonda Shannon, and Linda Green.

Histology lab taught by Dr. M. Charlotte Schaefer, 1903. Courtesy of Blocker Collection, Moody Medical Library, UTMB.
The changes in pathology education during the first half of this century were paralleled by similar changes in the practice of pathology. Just as pathology was taught within a great variety of medical disciplines in the early 1900s, pathology was practiced, or ignored, by a wide variety of physicians and surgeons as part of their general practice. The emergence of pathology specialists in the 1910s marked a shift in both the location of pathology practice, and the people responsible for performing laboratory services. But the acceptance of pathologists as specialists depended on the acceptance of the idea that pathology was too complicated for general practitioners to master, and that pathologists possessed unique technical skills. The simplification and automation of laboratory techniques gradually changed the practice of pathology from a solo occupation into one entailing the delegation of much routine work to medical technologists, and later to machines. As a consequence, pathologists found themselves having to argue strenuously, once again, that pathologists provided valuable services, this time in interpretation, rather than in technique. World War II dramatically changed the demand for pathology services, expanded the medical fields in which pathologists made major contributions, and blurred the line between practice and research.
Pathology as a Practice with Immediate Clinical Applications

Pathology, as it was first taught in Galveston under Dr. Smith, was a science of correlation, teaching the physician to visualize what would be revealed in a patient at autopsy. This type of pathology practice was intended to raise the scientific sensibilities of physicians, not necessarily to aid in diagnosis. The microscope initially took this type of pathology to new levels, but did not substantially change the intent of pathological examinations. Because autopsies were viewed as so distasteful by many, and pathology examinations were time consuming, few physicians were attracted to use pathology in their practices. Dr. Smith, in his 1901 address to the TMA Section on Pathology, even commented on the fact that the members of TMA had recognized the importance of pathology in the medical curriculum although pathology was only beginning to show any practical applications in hygiene and treatment of disease. He made no mention of the idea that pathology might be a practical aid in diagnosis.

It was at the point that specimens could be taken from the living patient and quickly analyzed that pathology became something more than a science with long-term contributions to the understanding of disease—it became a practical tool in diagnosis. Although the clinical application of pathology is often thought of as resulting from the development of increasingly sophisticated instruments, dramatic changes in the application of pathology to clinical practice came from the standardization of available techniques in clinical pathology to increase their reliability, the more standardized use of descriptive terms in anatomic pathology to allow comparisons of multiple cases between pathologists, and the more routine application of existing tests to identify the parameters of normal results.

In 1913-1914, the surgical pathologists' reports provided by the UTMB anatomical pathologists for John Sealy Hospital, St. Mary's Infirmary, and for doctors who mailed in specimens or slides for assistance in diagnosis, were often simply a confirmation of the physician's diagnosis after surgery. Even though freezing microtomes were available by 1900 for making frozen sections for quick diagnoses during surgery, the prevalent view of frozen sections prior to 1940 was that the resulting cell shrinkage and distortion of cell structure made frozen sections an unreliable diagnostic method. The more time-consuming method of fixation and embedding in paraffin or celloidin provided a good permanent slide, but was too slow to be done while the patient was still on the operating table.

The standard surgical pathology requisition form had spaces for a short history, physical examination, anesthetic, surgical treatment, and the signature of the intern, although this was rarely signed. Usually, a pathologist's report consisted solely of a diagnosis written in a single line squeezed onto the bottom of the form, underneath the instructions for how specimens should be wrapped and delivered to the pathology lab. Occasionally, a physician outside Galveston would send a specimen to the UTMB pathology department for diagnosis. One commented, "I am not equipped to make section of this [soft bony tissue taken from a tumor of the antrum of Hymore] and have no diagnosis to offer. Will you please make section of it and let me know what the condition is?" Another physician who was accustomed to making his own pathology slides for examination nevertheless sent in some specimens for confirmation, with the note that, "I have been doing very nicely with my pathology the last fortnight, but I have two conditions here which I wish you to diagnose for me....I am also enclosing a piece of tissue from this breast in the event that you cannot make a diagnosis from the slide that I am presenting." Physicians had become more adept both at preparing samples for the pathologist to examine and at examining pathologic materials.
themselves. By 1922, the pathologist was no longer noting on the charts that specimens were inadequate, or impossible to prepare slides from, as had been the case in the reports for 1913-1917.

A significant change occurred by the end of the 1920s. In 1928 the standardized request form for pathology tests had become a long check list of possible tests, with chemistry, blood, bacteriologic, and tissue studies all appearing on the same request form; surgeons and internists no longer used separate request forms. Likewise, the pathologist's reports increased in detail as well. The pathologist, usually Dr. Paul Brindley, described in great detail the gross and microscopic characteristics of each surgical specimen with a description of the tissue's color, form, texture, resistance to cutting, visual appearance of cut surfaces and microscopic findings, all rendered in a routine order, using a limited number of descriptors. The specificity of the pathologist's diagnoses had increased, and Dr. Brindley usually gave numerical grades for cancers.

Another notable new feature of the pathology reports was the distinction made between the treating physician's diagnosis and the pathologist's diagnosis. Dr. Brindley began to add a section for pathology diagnosis, even when it was not part of the printed form. At times the diagnoses matched. In many cases they did not, with the pathology exam revealing undetected cancers, infections, and chronic conditions not identified by the referring physician. It was about this time that the pathologist's microscopic examination of tissue, or other specimens, was increasingly viewed as the definitive diagnosis of disease, superseding the clinician's diagnosis if the two differed. The unfortunate consequence of this was that, for a time, pathologists were often asked by hospital administrators to police the medical staff, reporting on physicians who routinely misdiagnosed their patients.

In laboratory testing, the tools used in the 1920s were essentially the same as those used at the turn of the century. These instruments fell into two general categories: those that aided in the microscopic examination of specimens; and those that involved measurements of specimen properties. The hemocytometer, a grid for counting the cellular elements of the blood, remained virtually unchanged from its inception in the late 1800s until the Coulter counter was introduced in 1953. Since counting blood cells was tedious and difficult, various substitutes were developed. The hemoglobinometer, which estimated the red cell count by comparing the color of blood with a known standard, appeared in many variations by the turn of the century, as did hematocrits, which measured the percentage of blood cells in the blood by volume. The instruments for measuring the color, specific gravity, sugar, and urea content in urine also changed, but to a lesser degree. What did change was the idea that
these tests could provide not only an indication of a patient's general health, but accurate indications of specific disorders, even without the evidence of specific pathogens. Between 1905 and 1920, laboratory tests gradually became a means for monitoring the progress of disease and the effectiveness of treatment through repetitious testing, rather than a single diagnostic test performed only once.

In 1906, John Moore, a physician in Galveston and chair of the section on pathology and bacteriology of the TMA, bemoaned the fact that so few of his colleagues made use of the various instruments of precision diagnosis available to them. He argued that, "The physician or surgeon does not discharge his obligations unless he acquaints himself with every available method of diagnosis, or puts his patient in the way of getting these." He noted that many of the older physicians were not trained in any of these methods, and resisted incorporating them into their practices because they had little appreciation of their value, and viewed laboratory testing as expensive, time consuming, and inconvenient. It is true that a patient's private physician still often examined the patient at home, and it was an inconvenience to carry around a microscope, a urinalysis kit, and instruments for blood testing.

Between 1900 and 1906, many of the laboratory instruments and supplies originally developed as research tools were standardized and made commercially available to general practitioners. This made it possible for them to incorporate an array of blood tests, urine tests, examination of stomach contents, feces, and sputum, and bacteriologic tests into their clinical practices. The minimal equipment required was still small, with a good microscope the most valuable tool of all. With the addition of a centrifuge, burettes for accurately measuring liquid volumes, test tubes, and a selection of reagents, a physician was equipped to perform a basic battery of laboratory tests. For those who wished to be more sophisticated in their clinical testing, a large array of specialized equipment was available. One of the changes most significant for the general practitioner was the development of portable lab tests that the physician could conveniently carry to the home of the patient or to the hospital, which rarely had its own lab equipment in this period.
Memorial Hospital System
Memorial Hospital, first named the Baptist Sanitarium, began in 1907 as the wooden frame building that had formerly housed the Rudall Sanitarium at the corner of Smith and Lamar Streets. It originally had only a rudimentary lab, but by 1921 the situation had changed, and advances in laboratory medicine had introduced a new array of equipment necessary for good laboratory services.

Dr. Elizabeth Powell arrived during WWII to run the pathology service from 1942-1945. A less complimentary account of the lab was given by Dr. R.H. Chappell, who came to Houston in 1946 to take the position as pathologist at Memorial Baptist, with his wife assuming him as medical technologist. By his account, the cramped laboratory was inadequately furnished and the working conditions were terrible, with no air conditioning to alleviate the stench of chemicals. The pathology labs improved quickly after the war, and when Dr. Franz Leidler arrived as chief pathologist in 1958 the situation had changed. With funding from the Ford Foundation the hospital had purchased new laboratory equipment in 1956, the same year that Memorial Hospital opened its outpatient clinics for the diagnosis of minor illnesses not requiring hospitalization. The professional staff donated their time to the clinic, and patients received physical exams, and any necessary laboratory testing on a sliding fee scale.

Memorial Hospital System joined with the newly established University of Texas Medical School at Houston to create a residency program in family practice in 1971, as an antidote to the ultra-specialization in medicine over the previous decades. Under that agreement, Dr. Leidler accepted an academic appointment with UT-Houston.

The centrifuge has held an important place in the pathology lab from the time hand crank models were generally available early in the 1900s. Although water-powered and electrically-powered models were available by 1910, this hand cranked model was still popular in 1925. From Maw, Son & Sons catalog of medical instruments. Courtesy of Blocker Collections, UTMB.

The lack of interest in laboratory testing among general physicians changed little in the next decade. Dr. B.F. Smith, a Galveston physician who later did much of the pathology work at St. Joseph Hospital in Houston, published detailed instructions for building a practical clinical laboratory, all of which could be contained in a table measuring four and a half feet long, and 22 inches deep. He even specified that it was best to stand for laboratory work and, thus, the height of the table should be measured by holding the microscope in a comfortable viewing position and measuring to the floor. Dr. Smith included a sink plumbed with fresh water, a Chapman suction pump for cleaning blood pipettes, and an electric socket for a light to be used at night or on dark days and for running an electric centrifuge. In his own lab he also included a hemoglobinometer, a urinometer, a hemocytometer, a ureometer, and a large variety of stains and fixatives for tissue work. He made no specific recommendations on microscope and microtome, since he assumed that every physician had his own preferences for those.

Despite the firm consensus around the turn of the century that laboratory work in pathology was an essential approach to teaching and to research, the idea that laboratory-based pathology held any role in general medical practice was slow to catch on. The reliance on laboratory test results for diagnosis was viewed by many physicians as antithetical to the true skill of the physician. In fact, Prof. Henry Bigelow, a leading authority in internal medicine, had claimed in 1870 that family doctors did not need laboratory training at all, because the more important attributes required for good medical practice were character and judgment. Some physicians even proposed that laboratory tools were just technical crutches for use by physicians who lacked clinical diagnostic skills.

Physicians who actively used laboratory diagnostic techniques around the turn of the century, and increasingly identified themselves by their skill and precision in using their equipment, embodied the challenge of the new scientific medicine to the traditional practice of medicine. This traditional approach was based on finely honed clinical diagnostic skills and intimate knowledge of the patient, and the patient's circumstances, habits, and history. Physicians who relied on quantitative laboratory tests for diagnosis represented to many physicians a dangerous trend toward the deskilling of medical practice. After all, if blood and urine tests could provide objective data and conclusive diagnoses while the patient was still alive, what role would be left for physicians, whether pathologists or general practitioners? Most disturbing was the idea that quantitative laboratory techniques could be so routinized that a physician was not needed at all, merely a well-trained technician who could take specimens, run the lab instruments, and identify disease on the basis of the resulting numbers.
In 1886 a group of three French men responded to a plea from Bishop Claude M. Dubus, the second Bishop of Galveston, and came to Galveston to begin the first private hospital in Texas, St. Mary's Infirmary in Galveston. At the time the University of Texas opened the Medical Branch in Galveston, the pathology department of the medical school took on responsibility for pathology examinations for the infirmary.

Six of the sisters in Galveston came to Houston in 1887 to establish St. Joseph's Infirmary, which had no laboratory until 1912. After the donation of basic lab equipment by a former intern at the hospital, a resident staff member or visiting pathologist supervised all lab work. The hospital's first full-time pathologist, Dr. Albert B. Braden, Sr., was appointed in 1921. Under his guidance, the lab was modernized considerably, and he began to train sisters in laboratory techniques. Sister M. Angelique Crabbe served as lab assistant for most of the 1920s, and then her successor, Sister M. Romana Ryan, remained as assistant until after WWII. Sister Ryan is credited with introducing clinical pathology services at the hospital in the 1930s. The chemistry procedures provided were somewhat limited: the laboratory technicians tested for non-protein nitrogen and calcium with visual colorimeters, and did white blood cell counts and differentials. However, they did not have equipment for microbiology or immunohematology.

The situation changed dramatically after WWII. The laboratory began to perform prothrombin time determinations in the late 1940s, at the insistence of Dr. L.B. Zies, an internist. The hospital acquired a photometric colorimeter in 1945 and a flame photometer in 1950. James Serrano, one of the chemistry technologists, developed a set-up for electrophoretic procedures. The new colorimeter provided the capacity for both a greater range of chemical tests, and faster and more accurate results. With the flame photometer, the lab was able to provide regular electrolyte determinations for gravely ill patients. The laboratory was further automated in the early 1960s when a single-channel glucose analyzer was added to the equipment.

Some of the services originally performed in the clinical laboratory later moved to separate departments, such as hematology. By the 1960s, hematology had emerged as a separate department, and one of the first fully automated Coulter S counter was likewise installed in the hematology lab in the early 1970s.

Blood banking began in the clinical laboratory under Dr. Braden, and the hospital kept its own blood bank from 1943 until 1950, when the Southwest Blood Bank was established as a commercial blood bank. The extent of blood work performed by the laboratories at St. Joseph's expanded greatly with the introduction of Rh typing in the 1940s. Indirect Coombs in 1950, and Direct Coombs a few years later. By 1957, the amount of time spent on blood testing was sufficient to justify hiring a full-time blood bank technologist. Within a decade, antibody testing of panels of red blood cells was a routine part of the laboratory work.

Dr. Peter Marcuse joined St. Joseph's in 1949 as its first board-certified pathologist, in the position of director for the clinical, pathologic, and research laboratories. Under Dr. Marcuse, Sister M. Anciera Kelleher acted as technical director, supervising several laboratory technicians. Sister Ryan had trained Sister M. Anciera Kelleher in laboratory techniques, and when Sister Ryan retired after WWII, Sister Kelleher returned to St. Joseph's as technical and administrative director, serving in that capacity until her death in 1976.

Those who objected to reliance on instrumental aids in diagnosis emphasized that accuracy was often of no utility in clinical diagnosis. For instance, the color of a drop of blood on a handkerchief could often give an estimate of hemoglobin level that was just as useful to the physician as the more accurate measurement of hemoglobin with a hemoglobinometer. For the physicians who still saw the vast majority of patients in their own homes through the early 1900s, the additional time, expense, and inconvenience of using laboratory diagnostic procedures was not compensated by a significant rise in diagnostic accuracy.

In Texas, few physicians in 1916 were equipped with even the most rudimentary laboratory equipment, and knew how to use it because relatively few of them had completed medical school after such instruments were widely available. At UTMB a course in blood chemistry was first offered as an elective in 1920, so those students who gained experience in blood testing prior to that time, did so through practical experience at John Sealy Hospital. The diagnostic methods available in that period included Widal tests, red cell or leucocyte counts, hemoglobin or color index estimation, microscopic urinalysis, pus or sputum examination, Wassermann tests, and spinal fluid cell counts. But general practitioners in Texas were not alone in omitting these diagnostic aids from their standard practices—in 1902, fewer than 10% of the general practitioners in Michigan did blood examinations or had them done by independent laboratories. Even when laboratory tests were performed they were most often not central to clinical diagnosis in the hospital prior to WWII.

Laboratory testing was more readily adopted in hospitals than it was in private practice for a variety of reasons. For hospital administrators trying to transform the hospital from a place of pestilence for the indigent into the center of scientific care for all classes, pathology provided a powerful image of scientific rationality and efficiency, even with a modest collection of equipment. But even charity hospitals without paying patients saw pathology testing as a necessary part of hospital practice in the 20th century. In 1907 Baptist Memorial Hospital originally had room for only seventeen beds, but it did have a laboratory measuring eight by eight feet, equipped with a microscope, an alcohol burner, and ten test tubes. Although meager, this still provided the rudiments for basic laboratory work. At St. Joseph Hospital there was no pathologist, laboratory staff, or hospital laboratory equipment until 1912; instead, physicians all brought their own
Peter M. Marcuse, M.D.

Dr. Peter Marcuse came to St. Joseph's Hospital in 1949 as its first board-certified pathologist, after completing a residency in pathology at Jefferson Davis Hospital under Dr. Donald Henderson, and then serving as director of that laboratory himself. As St. Joseph's, Dr. Marcuse served as director of the clinical, surgical, and research pathology laboratories until his retirement in 1988. He was one of the founding members of the Houston Society of Clinical Pathologists, and served as vice-president the first year of its formal existence. He played a major role in the gynecologic-endocrinology research program instituted at St. Joseph's during the late 1960s. Dr. Marcuse and the clinical staff in the Pathology Department collaborated extensively with the obstetrical and gynecological clinical staff in the Colposcopy Clinic by providing elaborate hormonal tests for research and patient care. Out of that research came Dr. Marcuse's book, Diagnostic Pathology in Gynecology and Obstetrics (1968).

Equipment with them, and conducted the blood and urine tests themselves. A former intern at the hospital, Dr. B.F. Smith, donated laboratory equipment to the hospital after WWI. The modest supply of equipment consisted of a microscope, a Bunsen burner, and some test tubes—exactly what Baptist Memorial Hospital had in 1907. Once the hospital had this basic set of equipment, a resident staff member or a visiting pathologist supervised the laboratory and physicians no longer did their own lab work. During the period from 1912-1921, Dr. E.F. Cooke was the primary visiting pathologist. The first full-time pathologist employed at St. Joseph's in 1921 was Dr. Albert H. Braden, Sr., who made considerable changes in modernizing the laboratory; among other things, he performed regular autopsies and introduced the use of frozen sections for surgical pathology. Dr. Peter Marcuse assumed leadership of the labs in 1949.

For surgeons who were trying to reform their own specialty as a scientific field of practice, lab tests, especially blood tests indicating major infections such as in appendicitis, provided valuable support for surgical decisions about when to operate. For the hospital administrator trying to attract paying patients, pathology services were seen as a way of providing the best of scientific medicine to the patients and promoting the image of the hospital. In this context, it is not surprising that Hermann Hospital, built as the epitome of the modern scientific hospital in 1925, placed the pathology laboratory prominently adjacent to the outpatient clinic where all who came to the hospital would be able to see it.

While many physicians were still reluctant to adopt laboratory testing in their own practices in the early decades of the 20th century, increasing numbers of physicians chose to specialize in pathology practice despite the fact that the role of pathologist was commonly considered a suitable position for a doctor-in-training, not as a suitable career for full-fledged physicians.

In the early 1900s, a few of the students graduating from UTMB, such as Dr. E.E. Cooke and Dr. Martha Wood in Houston, chose to specialize in laboratory practice after graduating from medical school. Within just a few years, they were joined by at least sixteen other pathologists in Houston. The precedent for specialization had already been set by physicians specializing in internal medicine and surgery; a major difference, however, was that physicians who specialized in diagnostic pathology removed themselves from direct contact with patients and became dependent upon other physicians for referral. The argument in favor of pathology specialization was that the methods used in the clinical lab required special technical expertise. Dr. Ira Chase, in an editorial supporting the idea of pathology specialists as a new professional group within medicine, proclaimed that,

"without such help[sic] diagnosis is so imperfect that the physician is more of a comfort than a help to his patients, treatment is often misdirected, needed medication or operation overlooked and prognosis veritable guess-work. Every physician without such aids feels helpless,
oppressed and disgusted at times with medical practice. These methods are the crowning gifts of human wisdom for the welfare of man. If the public understood their value it would demand their intelligent application. How to secure the advantages of scientific methods of precision in daily medical practice is the greatest problem confronting the medical profession today.13

Chase viewed the pathology specialist as the best solution to this gap between the clinical benefit promised by new science and technique, and the vast underutilization of pathology exams to aid in diagnosis. However, the clinical pathologist of 1916 was a far cry from the pathologist of today—the pathologists who set up as community pathologists in that period might serve as all-purpose support physicians to those in general practice. With the proviso that a community pathologist must not compete in general practice, the pathologist was often expected to engage in X-ray work, and serve as anesthesiologist, in addition to providing chemical, microscopic, bacteriologic, and serologic examinations.

The increasing reliance of physicians on clinical pathology is reflected in the number of laboratory tests and tissue examinations performed each year in the Houston and Galveston area. Between 1928 and 1948, the volume of tests performed increased sixfold at Hermann Hospital, with the laboratory staff providing 19,000 examinations in 1928, and 120,000 two decades later. By 1961 the volume of testing at Hermann Hospital had increased to 629,000 examinations in one year; this number almost doubled again within the next four years. The numbers from UTMB reflect the same kind of exponential increase in the volume of testing done: in 1955 the annual load of lab tests was about 220,000, compared to more than two million tests in 1995. This did not include the approximately 20,000 surgical pathology accessions done in 1995. At Baylor, the increase in numbers of tests performed in each of its affiliated hospitals was comparable. These numbers are impressive as a measure of the quantity of work demanded of pathology services and the concentration of personnel required to perform the procedures. But these numbers also reflect the increasing variety of tests available, the dramatic rise in population in the Gulf Coast area, the increasing use of periodic lab tests for monitoring a patient’s status, and the use of lab tests for screening asymptomatic populations.

Clinical laboratory at UTMB in the 1940s. The practice of pipetting samples by mouth was standard practice in that period, but it would be unheard of today. Courtesy of Blocker Collection, Moody Medical Library, UTMB.
The relationship of pathologists with hospitals

During the 1920s, many pathologists set up private labs, but the more common pattern was to join the staff of a hospital. Hospitals for the care of paying patients was a new phenomenon in the 1920s, and in the effort to appeal to paying patients, hospital administrators were eager to enlist the pathologist as a symbol of the newly scientific approach to hospital care. Pathologists benefited from the automatic referrals from physicians treating patients in the hospital, and the increasing expense required to outfit a lab made hospital employment appealing. St. Joseph Hospital, Baptist Sanitarium, and Hermann Hospital all hired salaried full-time pathologists in the early 1920s. The pathologist’s role as a hospital employee, grouped with other ancillary hospital services, was reinforced by the appearance of hospital insurance plans that guaranteed coverage of all hospital expenses including laboratory tests. This pattern of practice predominated for the next two decades, and provided a solid foundation for the incorporation of pathology services into routine clinical care.

Hospital employment, which started as a great boon to pathologists trying to carve out a niche for themselves, soon became a problem. Hospital administrators had discovered that the pathology lab was a lucrative division of the hospital, and they increasingly used the revenues from pathology to subsidize other services. However, if pathologists worked as employees or agents of the hospital, the hospital was then engaged in the practice of medicine, against legal requirements of the Texas Medical Practice Act and the ethical guidelines of the AMA. In addition, when hospitals used billing for laboratory services as a means to support other departments in the hospital, as was prevalent in radiology, that amounted to commercial exploitation of the physician employed by the hospital.

The relationship between the pathologist and the hospital had preoccupied Dr. Russell for some time, starting in the late 1930s, long before he came to MDACC. In 1939, the AMA specifically recognized clinical pathology as a specialty in medicine, and stated that the rapid changes in laboratory medicine required clinical medical knowledge for the safe conduct of many pathology tests. For this reason, they resolved that those physicians practicing pathology should have three years of specialized experience in pathology. Two years later, the AMA made the additional recommendation that staff pathologists should be members of the medical staff, with equal voice in medical decision-making in the hospital. This assessment of the situation was not shared by many hospital administrations, well into the 1950s. On the contrary, with the standardization of many tests and increasing reliance on laboratory assistants to handle routine work, pathologists found themselves facing a growing perception within the medical community that lab work no longer required the experience of a physician.

In the post-WWII era, the relationship of pathologists with hospitals, and the forms of compensation they arranged, changed significantly. Whereas pathologists had worked prior to the war primarily as employees of the hospital, after the war pathologists negotiated new relationships with the hospitals where they practiced. Between the 1930s and the 1950s, Dr. Russell repeatedly discussed with fellow pathologists the fact that pathologists needed to rethink their relationship with the hospital and with patients; hospital administrators needed to do the same. “It is needless to say that we [the pathologists] are going to comprehend these points more readily since we have a chance to improve our practice and to assist medicine more, and they are going to be slow to comprehend the advantages. Therein lies the problem.”
The hospitals in this area made many different arrangements, many of them complicated by the close integration of medical schools with various hospitals. In private hospitals after WWII, a contract for percentage of the profit from the lab had frequently replaced salary as the standard compensation, but many pathologists were not happy with that arrangement. The members of the HSCP had a lengthy discussion about payment arrangements in 1953, and proposed that a provision be added to the by-laws so that HSCP members in private practice could set a minimum fee structure for services. For example, they proposed $10 for diagnostic surgical reports, $5 for diagnostic cytologic studies, $25 for bone marrow punctures, and $100 for adult autopsies and reports. These fees were based on the average of fees charged by the four hospitals in the city with more than 250 beds: Memorial, Hermann, Methodist, and St. Joseph's hospitals. All services were to be billed directly to the patient on a fee-for-service basis, with the exception of those services performed for hardship cases, professional courtesy, and as part of medical education.

When Dr. Hill joined St. Luke's Episcopal, the pathologists billed patients directly, but that system was subsequently changed to billing by the hospital. The pathologists at Baylor made different arrangements with each of the school's affiliated hospitals, with some pathologists receiving a salary from Baylor, some receiving a salary from the hospital, and some receiving compensation from both institutions. Some of the pathology work was done gratis, as it was for the Houston Tuberculosis Hospital. Hermann Hospital paid an honorarium to Dr. Wallace for his services, and the Southern Pacific Hospital Laboratory paid the pathologists with annual passes for free travel on the railroad. It was at the point that Blue Cross and Blue Shield split into separate entities that direct billing by the pathologist became more common. By the mid 1970s, most hospital pathologists in this area had started to bill patients directly for their professional services, although a few hospitals continued to bill and reimburse pathologists with a percentage of the income generated by the pathology labs. The saga continues today, with ever more complicated regulations and cost-containment measures intruding on the function of the pathologist in the medical community.
Prior to WWII, blood transfusions in Houston hospitals were commonly made directly from donor to patient, with the two lying side-by-side in the operating room. After the use of refrigerated blood was introduced in the early 1940s, laboratories were able to collect blood from donors, mix it with anticoagulant, temporarily store the chilled blood, and then transfuse it to the patient by syringe. Transfusion requests at Hermann Hospital were handled in the emergency room, where laboratory staff came to draw blood, establish compatibility, and refrigerate the blood during normal business hours for later transfusion. Patients were responsible for paying $5.00 and furnishing two donors for each unit used. Similar systems for providing blood for patients were set up at Jefferson Davis Hospital, St. Joseph Hospital, and John Sealy in the same period. For several years during the war, the American Red Cross maintained two large freezers for blood storage at Hermann Hospital. However, these were soon removed and there was no blood bank at Hermann until 1949, when space was set aside for donor tables, cross-matching, and refrigeration for donations.

Procedures developed by the military during WWII for collecting, typing, separating, storing, and freezing blood profoundly changed the nature of blood transfusions in civilian practice after the war. Pathologists took on the responsibility of managing blood supplies, in large part because no other medical specialty expressed any strong interest in adapting the military blood banking techniques for the civilian setting.

With the advent of separation of blood into components, transfusions increasingly involved frozen plasma rather than whole blood. Longer-term storage and long-distance transportation of blood were made possible by the new techniques and it consequently became possible to develop a system of anonymous blood donation, banking of substantial quantities of blood, and widespread distribution of blood components. The new techniques also allowed more patients to benefit from each unit of blood donated, as the utility of specific blood components were recognized for particular needs. Nevertheless, the available blood supply in this area proved quite inadequate for handling large scale disasters. The American Association of Blood Banks was formed shortly after the treatment of casualties from a major explosion in Texas City in 1947 overwhelmed the capacity of local blood banks to provide blood.

Shortly thereafter, in 1950, the Southwest Blood Bank was established as a commercial blood bank, mostly eliminating the need for each hospital to run its own blood donation center. However, the drawbacks of a commercial blood bank were soon evident, when it became apparent that blood from paid donors carried viral hepatitis more often than blood from volunteer donors. Hermann Hospital and the Veterans Administration were both sued in 1963 for the transmission of hepatitis through the blood bank. The lawyers involved asked pathologists in the
HSCP to provide notarized statements about the technology of blood banking and the possibilities of blood contamination; the HSCP agreed to discuss the general topic of hepatitis transmission, but not the specific cases.

As a commercial organization, the Southwest Blood Bank distributed blood to all parts of the United States, occasionally leaving a shortage of blood for local uses. The demand for blood increased dramatically in this area during the 1950s and 1960s as more institutions joined the TMC, the population quickly expanded, and medical care used greater quantities of blood in treatment. The increase in cardiac surgery is just one example. For each patient undergoing operation, the surgeon required 12 units of blood just to prime the bypass pump, in addition to any blood required for transfusion. St. Luke's became a treatment center for hemophiliacs, and other hospitals developed expertise in various other types of blood therapy.

It was the uncertainty of the blood supply and the problems associated with commercial blood banking that prompted a special committee of the HSCP to begin working in concert with the Harris County Medical Society in 1950 to standardize and improve local blood banking. The efforts of Drs. Hill, Russell, Lind, Leidler, and Milam contributed greatly to the eventual creation of the Gulf Coast Regional Blood Center in 1974, later known as The Blood Center. As a non-profit organization, The Blood Center was designed to supply local needs for blood with all-volunteer donors, supported entirely by fees paid by hospitals using the service. The Blood Center presented many advantages over previous arrangements for blood supplies in this area.

By relying entirely on volunteer blood donors, The Blood Center greatly reduced the contamination of blood supplies with transmissible diseases. It also substituted for the six organizations previously operating in this area a coordinated system of inventory control, replacement policies, fee structures, and management of collecting agencies. This resulted in much better usage of available blood and far better assurance of adequate supplies for local needs.

During the first year of operation, The Blood Center collected more than 46,000 units of blood, producing 64,000 transfusable components. Even with such a large volume of blood, the outdated percentage was a very low 4% during 1976. The role pathologists played in educating the medical community about component therapy, and the collaboration they provided to The Blood Center, contributed greatly to its immediate success. The Blood Center quickly became a national model for the organization and maintenance of regional blood banks.
Throughout the last century, the pathologists in Houston and Galveston have periodically drawn together to fight for the recognition of pathology as a legitimate, even vital part of medical practice, and themselves as medical equals among medical practitioners. They have fought together against the encroachment on their field by non-pathologists, despite occasional tensions among private laboratory, hospital, and academic pathologists about the proper arenas for their respective practices. While dealing with recurrent attempts from outsiders to define pathology as a technical rather than a medical practice, to undercompensate pathologists' time, to legislate and regulate pathology practice, the pathologists in this area have consistently called upon affiliation as a professional group, self-regulation, and quality improvement through voluntary action as the most effective way to cope.

Professionalization

Houston Pathological Society, 1914

There were no pathology labs in Texas in 1889, but there was sufficient interest in pathology among general physicians by 1893 for the State Medical Association of Texas to establish a Section on Microscopy and Pathology under the direction of Dr. Allen J. Smith. The number of physicians practicing pathology and identifying themselves as specialists in pathology increased rapidly after 1900, to the point that there were at least 18 pathologists practicing in Houston by 1914.

Whether or not these physicians devoted themselves full-time to pathology, they had a sufficient professional stake in pathology as a special field of clinical practice that they formed the Houston Pathological Society in that year. Drs. E.M. Arnold, C.M. Aves, C.C. Cody, Jr., E.F. Cooke, E.L. Goar, C.C. Green, A.E. Greer, R.F. Herndon, C.W. Hoeflich, E.H. Lancaster, M.W. McMurray, H.L. McNeil, J. C. Michael, R.H. Moers, I.E. Pritchett, M.B. Stokes, A.E. White, and Martha Wood formed the organization. Dr. Edward F. Cooke, first president of the society, had been in private practice in pathology since 1906, and he played an important role in championing the practice of pathology as a respected medical field. Dr. Cooke served as the primary visiting pathologist at St. Joseph Hospital from 1912 to 1921. Since St. Joseph Hospital was the largest hospital in Houston at the time, Dr. Cooke was in a good position to impress upon a large number of Houston's physicians the benefits of pathology testing in diagnosis.

The Houston Pathological Society was one of the earliest specialty organizations to be established in Houston. The express purpose of the society was to foster interest among physicians for the study of pathology and its relationship to the practice of medicine, promoting fellowship and better mutual understanding among pathologists, and to collaborate with the Harris County Medical Society in maintaining the standards of the medical profession. The tacit purpose of the