

The History of Orthopaedic Surgery at the University of Pennsylvania

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The first free-standing Department of Orthopaedic Surgery in the United States was created by the Trustees of the University of Pennsylvania in 1889, and **Dr. DeForest Willard** was awarded the first professorship and chair of orthopaedic surgery.

In order to trace the history of orthopaedic surgery at the University of Pennsylvania, we must begin over 100 years before Dr. DeForest Willard's appointment. Many of the surgical professors of the University of Pennsylvania devoted much of their time and attention and wrote many papers about musculoskeletal conditions. The first Professor of Surgery, **Phillip Syng Physick**, who served as chair of the surgical department between 1804 to 1809, was known for his fracture treatment and described a non-union of the humerus in a sailor whom he treated.

John Syng Dorsey, surgeon at Pennsylvania Hospital, published a history of Physick's patient in his textbook of surgery. In 1802 Physick passed a curved needle containing twisted threads of silk between the ununited bone ends and left the "seton" in place. The arm was splinted, and the drainage from the wound dressed for fifteen weeks, during which time the wound closed and the fracture was said to be united. In 1830 Physick was asked to see a seaman, Isaac Patterson, in consultation for another illness, and Physick recognized him as his former patient with the non-union who told him his arm gave him no trouble. Patterson later died, and Physick, remembering his training with the great anatomist, John Hunter, examined the bone at post mortem. The humerus was united with a small hole at the site of the non-union where the silk had passed through it. His treatment caused inflammation and probably an infection, which irritated the fracture site and led to union [1].

John Rhea Barton was on the staff of the University of Pennsylvania and performed his surgery at Pennsylvania Hospital. Barton published the first account of a resection arthroplasty of the hip joint in 1827. The patient had an ankylosed, deformed hip joint which he osteotomized, and he resected part of the femoral neck similar to a Girdlestone procedure, thus correcting the deformity. "The wound of the soft parts was then healed while reunion of the bone was prevented by subjecting it from time to time to motion." The patient used this limb with no pain and walked almost without a limp, not using a cane for 6 years afterward, working daily as a trunk maker [2].

Barton also did a corrective osteotomy of the knee in a

patient who had an ankylosed knee joint secondary to an infection at the age of 9. When the patient was 23 years of age and walking with great difficulty because of his severe flexion contracture, Barton removed a wedge of bone from the anterior femur just above the patella, leaving the posterior cortex intact. The surgical time of the operative procedure performed without anesthesia was 5 minutes. The posterior cortex was broken manually over a period of weeks so as to avoid the sharp ends of the bone from impaling the popliteal artery and to prevent loss of position. The knee was gradually straightened in a splint, but a slight flexion angle was intentionally retained to prevent his catching the foot on the ground. (He presumably had an equinus deformity of the ankle as well.) In a letter to Barton in 1837, the patient stated that he was now practicing medicine and rode on horseback 30–50 miles a day making his rounds [3].

Barton's widow donated \$50,000 to the University of Pennsylvania to establish the first named chair of surgery which is still existent today and is awarded to the chair of general surgery.

George Washington Norris also practiced at Pennsylvania Hospital and was a busy fracture surgeon: after reviewing 2,195 fractures, he reported that in no instance did a non-union occur. X-ray control of fracture treatment does have certain disadvantages [4].

William Gibson occupied the surgical chair between 1819 and 1854, again concentrating on fracture treatment. He had the courage to report two cases of chronic dislocation of the shoulder which he manipulated with resulting rupture of the axillary artery.

Henry Hollingsworth Smith followed Gibson and occupied the professorial chair between 1855 and 1871. Smith was a student of surgery throughout his career and described stages of fracture healing and the development of a non-union, and even used microscopic drawings to emphasize his teachings. He made drawings of the osteonal system and commented on the role of the periosteum in fracture healing. His treatment for an ununited fracture was by instilling iodine into the ununited ends as an irritant. He also treated nonunions by dabbling with the use of galvanic electricity to heal them.

David Hayes Agnew, during his tenure between 1871 and 1878, also was concerned with fractures and bone problems. We all recognize the famous painting by Thomas Eakins showing the Agnew–Grice amphitheater. This por-

trait shows Agnew teaching 300 medical students filling the amphitheater of his clinic. In one such clinic he discussed an Achilles tenotomy for an equinus foot, a fracture of the femoral shaft, and an intracapsular fracture of the femoral head which he diagnosed by the external rotation of the limb and the upward displacement of the trochanter [5].

John Ashurst, Jr. followed Agnew and was professor between 1889 and 1899; he published a monograph on injuries of the spine in 1867 [6].

DeForest Willard graduated in medicine in 1867 and was a lecturer in orthopaedic surgery since 1877. Like many other physicians his interest in orthopaedic surgery was engendered by a personal problem. He was lame due to an illness that occurred when he was 18 months of age which required a tenotomy of the Achilles tendon to allow an improved gait. This was probably a paralysis of the dorsiflexors of the foot due to poliomyelitis. In 1887 he organized the Department of Orthopaedic Surgery with the help of the ladies auxiliary and an endowment of \$4,000,000 donated by P.A.B. Widener, and he later became the first chair of an Orthopaedic Department in the United States in 1889. In 1872 when Presbyterian Hospital was opened he was appointed pathologist of this hospital.

Like Hugh Owen Thomas and Sir Robert Jones of Liverpool, Willard was primarily a pediatric orthopaedic surgeon. His 800-page textbook was on children's orthopaedics. Willard's practice was concerned primarily with children but also treated a few adults. The children were suffering from disabilities resulting from congenital abnormalities, infectious diseases, trauma suppurative arthritis, osteomyelitis, tuberculosis, cerebral palsy, club feet, dislocated hips, and malunited fractures. Acute fractures at that time were handled by general surgeons. Willard designed the first children's ward at the University of Pennsylvania, known as "Ward L," and this much later was taken over by Children's Hospital. The ward was designed to face south to gather as much sunlight as possible for his young patients with tuberculosis. During this era, bed rest in sanatoria high in the mountains with maximum sun exposure and a generous diet was the only treatment for tuberculosis. Such centers for tuberculosis were often in the mountains of Switzerland and were also established at Saranac Lake in the Adirondack Mountains in New York State [7].

Gwilym C. Davis was appointed the second Professor of Orthopaedic Surgery and served at the University of Pennsylvania between 1911 and 1918. Like so many academic physicians at the end of the 19th century and the early 20th century, Davis did post-graduate studies abroad, studying at the University of Göttingen and also in England. His legacy was a textbook of applied anatomy for surgeons that was reprinted in nine editions and was translated into Italian. I had the opportunity to read this text and was impressed with his knowledge of surgical approaches and what structures were to be avoided in different incisions. The text was not confined to the spine and extremities, as are most orthopaedic texts today, but it also described the anatomy of the skull, brain, oral pharynx, chest, and abdomen. Gwilym C. Davis described the first subtalar arthrodesis for foot defor-

mities resulting from poliomyelitis and cerebral palsy, which was later modified by Ryerson to become a triple arthrodesis. He treated club feet with multiple casts; congenital dislocations of the hip were manipulated and reduced and held in a spica cast. He treated idiopathic scoliosis by correcting the curve in a body spica by hinging it; at a later date (1930) these were treated by spinal fusion done through a window in the spica. This latter operation was described by Russell Hibbs working in the Hospital for the Ruptured and Crippled in New York City which later became the Hospital for Special Surgery.

Arthur Bruce Gill succeeded Davis in 1920 and retired in 1942. Gill was internationally known for his shelf procedure for congenital dysplastic hip joints. Strips of bone attached to the ilium just above the acetabulum were bent laterally to increase the capacity of the acetabulum, but these strips were not in contact with the femoral head because the hip capsule intervened, and it was thought that the hip capsule underwent metaplasia to become articular cartilage.

Gill instituted a system of making rounds in the communities outside of Philadelphia. Once or twice a month he would hold children's clinics in Scranton, Wilkes Barre, Hazelton, or Elizabethtown. Over 100 children with skeletal deformities would be collected in the local hospital, examined by him in each of these clinics during the course of a long day, and those young patients that could be helped were sent to Ward L for surgery. The first orthopaedic resident served during the latter part of Dr. Gill's tenure. David King, the first orthopaedic resident, was a graduate of the University of Pennsylvania Medical School and later practiced orthopaedic surgery in Wilmington, Delaware.

In 1942 **Paul C. Colonna** was invited to become Professor of Orthopaedic Surgery at the University of Pennsylvania. Colonna had been chair of the Department of Orthopaedic Surgery at the University of Oklahoma and was known nationally for two operative procedures he had described. The first procedure of these two procedures was for a congenital dislocation of the hip and involved enlarging the acetabulum by removing the central cartilage of the acetabulum with a curette to increase its depth and then covering the head of the femur with the redundant capsule, and placing it in deepened acetabulum where it was held by a spica cast. Like Dr. Gill before him, he and others were convinced that the capsule would undergo metaplasia and become articular cartilage [8].

The second operative procedure he described was for non-union of a femoral neck fracture. In this procedure he removed the ununited head and covered the greater trochanter with hip capsule as a membrane and placed it in the acetabulum, holding it with a spica cast. Again the premise was that the capsule over the head would undergo a metaplasia and become articular cartilage [9].

Before World War II the treatment of acute fractures was in the domain of general surgery both in the United States and Europe. In some centers hip fractures, children's fractures and pathological fractures were referred to orthopaedic surgeons. During the war thousands of doctors without gen-

eral surgical training were called into service and given the task of treating military acute injuries, receiving their training as trauma surgeons in the field. These young surgeons were instructed and supervised by consultants with orthopaedic training who traveled to all the combat theaters and put their stamp of approval on the treatment of musculoskeletal injuries.

Major General Norman Kirk, director of medical services in the army, an orthopaedic surgeon and a fellow of the American Academy of Orthopaedic Surgeons and a fellow of the American Orthopaedic Association, was the person most responsible for bringing the treatment of acute fractures to the orthopaedic operating rooms of this country. Kirk believed all fractures to be in the province of orthopaedic surgery and appointed theater consultants trained in orthopaedic surgery who issued treatment specifics based on orthopaedic principals. There were, of course, other factors; it required a cataclysmic upheaval to displace the 200-year traditional grip of general surgeons on fracture treatment. Also the many American and Canadian doctors in Great Britain during the war witnessed the treatment of fractures, which had been taken over by British orthopaedists since the first World War in 1918. On returning to America these doctors mounted a full orthopaedic tide that wrested acute fractures from the general surgeons.

When Colonna accepted the orthopaedic surgery chair at the University of Pennsylvania, he stipulated that all acute fractures that were being treated by general surgery must be treated by the Department of Orthopaedic Surgery. He had a formidable opponent, Isadore Ravdin, who refused. Finally a compromise was reached and the acute fractures were rotated: one week in orthopaedics and one week in general surgery. By this time, fractures in the Midwest and far west of the United States were being treated by orthopaedic surgeons, but in the conservative east, surgeons clung to the privilege of treating fractures. William Fitts was the general surgeon most interested in fractures at the University Hospital. Other staff members of the surgical department and the surgical residents had little interest in fractures, and most fractures gradually were referred to orthopaedics.

Colonna had four residents, one appointed each year after the applicant had served a one-year internship. The period of orthopaedic post-graduate education for a resident was five years, as it is today. During Colonna's tenure, the number of residents increased.

It might be of value to take a step backward and survey the School of Medicine at the University of Pennsylvania and the Hospital in 1945 at the end of World War II.

The medical school consisted of a single structure, the John Morgan building, but the Richards building would soon be completed. All teaching and research activities and the medical library were in this building. The University Hospital consisted of three buildings, all attached. The central building was the Administration building, which was flanked on the west side by the Maloney building and on the east side by the White building. The surgical suite was on the fourth floor of the White building, and two rooms were

designated for orthopaedic surgery. Orthopaedic nurses and an orderly were assigned to the orthopaedic operating rooms. Orthopaedic charts were filed in the department, and the department did its own billing. Two wards accepted indigent orthopaedic patients who paid no fixed fee to the hospital and who were treated free of charge by the staff. Ward O had 12 beds each, for male and female patients. Ward L, for children, had 40 beds and cribs. Any patient below the age of 12 was admitted to Ward L. It had a new sun porch where beds were wheeled on sunny days. A separate room was supposed to be used for isolation, but it was not often used for that purpose and was increasingly used for incarcerating unruly children who referred to the room as "the prison". Ward L was ruled by an iron-fisted nurse who dominated the children for over 20 years, Mrs. Varian.

Children's Hospital was in downtown Philadelphia on Bainbridge Street, the chief orthopaedic surgeon being Jesse Nicholson. He and Colonna were on non-speaking terms, and no University of Pennsylvania orthopaedic resident ever went down to Children's Hospital. Children's training for orthopaedic residents was on Ward L supplemented by three months at the Dupont Institute in Wilmington, Delaware, under the competent service of Alfred R. Shands, a nationally known orthopaedic pediatrician, and the author of a widely read textbook "Handbook of Orthopaedic Surgery for Children".

Each Friday, formal grand rounds was a momentous occasion for the residents. In anticipation, floor were waxed, beds lined up in military fashion, all dressings changed, broken casts repaired and cleaned, and tractions carefully adjusted. Twenty or more persons traveled from bed to bed from Ward L to Ward O, skipping no patient. This retinue consisted of the professor, all staff members, residents, interns, medical students, social and occupational services personnel, nurses, nursing students, and visiting professors. Grief to the responsible resident who couldn't recite from memory the blood counts, sedimentation rates, and chemistries and present up-to-date X rays of all patients.

Surgical procedures on children were for club feet, congenital dysplastic hips, scoliosis, slipped capital epiphyses, cerebral palsy, tuberculosis, poliomyelitis, osteomyelitis, and suppurative arthritis. Most children's and adult fractures were treated by casting or traction. Open reduction and internal fixation in adults was reserved for hip fractures, non-unions, malunions, or fractures of the ankle or patella. Torn menisci and loose fragments of the knee joint were totally removed, and ligaments were repaired. In the spine discs were removed and spinal fusions done when indicated. A Smith-Peterson vitallium cup was used for hip arthroplasty.

The epidemic of poliomyelitis in the 1950s provided much surgery for the Orthopaedic Department. After the acute attack, a period of about 18 months was allowed for recovery of function. The residual paralysis was treated by tendon transfers or limb lengthening or shortening, osteotomy, epiphysiodeses, or fusions.

The Orthopaedic Surgical Schedule at the Hospital of the University of Pennsylvania for October 6, 1957, was as follows:

Operation	Diagnoses
Ankle Fusion	Post Triple Arthrodesis
Subtalar Arthrodesis	Traumatic Arthritis
Spinal Fusion	Degenerative Disc
Manipulation—cast change	Congenital Dislocation Hip
Exposure Trochanter for Traction Congenital Dislocation Hip	Wire Insertion
Tenolysis Right Hand	De Quervain's Disease
Shelf Procedure	Congenital Dislocation Hip
Bilateral Ober Procedure	Hip Contracture

The Surgical Schedule for October 25, 1962, was as follows:

Subtalar Arthrodesis	Post Polio Paralysis
Insertion Walldius Prosthesis	Arthritis
Bilateral Tendo Achilles Lengthening	Club foot
Excision Lumbar Disc	HNP
Synovectomy Hand	Rheumatoid Arthritis
Tendon Transfer Hand	Congenital Deformity
Excision Lumbar Disc	HNP

With Colonna's retirement, **David Grice** was appointed. Grice had been assistant professor at Children's Hospital in Boston under William Green. He had little experience with adult orthopaedics and acted out his insecurity by being abrasive to the residents; his ability to ridicule and embarrass a resident made him much disliked. Several years after his appointment, Grice was killed in an airplane accident; he had been in the habit of returning to Boston to follow his patients, and on one of these occasions the plane took off from Logan Airport and lost power when birds were sucked into the jet engines. The Grice procedure was widely used for a valgus foot, and modifications of it are still done today. Bone struts were placed between the talus and calcaneus to correct the deformity. This could be done at a young age while the subtalar arthrodesis for this condition had to wait until the age of 12.

Edgar Ralston was made interim chair after Grice's death and later given the position in 1963. Under Ralston the residency program expanded and research activities increased. The Veteran's Hospital and Presbyterian Hospital, as well as Pennsylvania Hospital and later, Germantown Hospital were included in the training program. The new Children's Hospital was now adjacent to the University Hospital in West Philadelphia and residents were rotated there for children's training. The Seashore House in Atlantic City treated children with chronic conditions and each week a resident or staff member would make the trip to Atlantic City and select patients that required surgery to be sent back to Ward L, which closed soon after the move of Children's Hospital to West Philadelphia.

In his quiet self-effacing manner, Ralston commanded respect and loyalty from all members of the department, and the department basked in the light of increasing national prestige.

An interesting sidelight might be brought into focus at this point. Graduating medical students of the University of

Pennsylvania in times past regarded orthopaedic doctors with a sneering attitude as "strap and buckle" doctors, referring to their frequent use of splints and braces. Rarely did a medical student ever apply for an orthopaedic residency. It was in this period that the tide changed, and students increasingly selected orthopaedics. Some of this changed attitude was national in scope, but locally, increased emphasis on research and teaching, and the increasing number of surgical operations influenced those who might have gone into general surgery to select orthopaedics.

Carl T. Brighton was appointed to the chair in 1977 and guided it through the tumultuous changes of the age of the information explosion. Soon after his appointment he had all full-time staff members join with CPUP (Clinical Practices of the University of Pennsylvania) to bind closer to the other departments of the hospital. Later the organization of the orthopaedic staff was verticalized so that each subdivision, such as sports medicine, shoulder, trauma, spine, hand, foot, joint reconstruction, etc., had its own chief, meetings, and teaching assignments. Brighton correctly foresaw the importance of strong research in the department, and increasingly, federal research funds found their way to support this effort. Between 1988 and 1993 the Orthopaedic Department at Pennsylvania was ranked number one in funding by the NIH. The concept of inter-departmental cross-pollination involved the orthopaedic department in research in conjunction with medicine, anatomy, engineering, biomechanics, biophysics, and others. Under Brighton, eight residents were selected each year. Each resident spent the second year of training in the research laboratory, but this was later changed to the third year of training. As a result, scientific papers burgeoned and in one eventful year more than 50 papers from the department were presented at the combined meeting of the Orthopaedic Research Society and the Academy. In 1979 the McKay Research Laboratory was dedicated providing 14,000 square feet for Orthopaedic Research. At this time the Department moved into its new clinical quarters in the Silverstein Pavilion.

Brighton was co-founder of the Bioelectric Repair and Growth Society (BRAGS), which is now known as the Society for Biophysical Regulation. He was also the recipient of the Kappa Delta Award, the Shands Lecture Award, and received the Merit Award of the National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS). Since the scholastic economy was changing and the bottom line was becoming more important to a chairman than the search for the truth, Brighton thought it was time to step down, which he did in 1993. Joseph Ianotti and then Marvin Steinberg stepped into the breach until a new chairman was selected.

Robert Fitzgerald from Wayne State University was selected in 1995 and undertook the difficult job of guiding the department through the cross-currents of reduced federal outlays, increased expenses, and reduced income. Fitzgerald retired in 1999.

In 2000 **Richard Lackman**, a former resident and a na-

tionally known tumor surgeon, was selected to deal with the increased financial complexities of running a large department. Teaching and research as well as service to the community continue in spite of the economical situation facing this and all other departments. Maintaining academic prestige and solving the financial pitfalls is a difficult balancing act in which Lackman is succeeding.

Two hundred seventy-three residents have completed their education in the Orthopaedic Department at the University of Pennsylvania by June of 2001, and they have practiced their skills throughout the country and the world. Among these, forty-seven have attained academic rank and, in turn, have become teachers. Seven have been elevated to the Chair of an Orthopaedic Department in a prestigious university.

Without prejudice it can be said that the orthopaedic residents at the University of Pennsylvania now, as in the past,

are receiving the most advanced teaching from a most dedicated staff in a wholesome environment.

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