Health & Medicine

Cournand & Richards and the Bellevue Hospital Cardiopulmonary Laboratory

Just about everything modern medicine knows about the heart and lungs was made possible by the work of Frédérick Cournand and Dickinson Richards, whose groundbreaking research revolutionized cardiology and pulmonology.

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We stand on the shoulders of giants to see even farther. For the contemporary cardiologist and pulmonologist these shoulders belong to Dickinson Woodruff Richards Jr. ’22GSAS ’23P&S ’66HON and André Frédéric Cournand ’65HON, Nobel Prize winners in Medicine and Physiology (together with Werner Forssmann of Germany) in 1956. But beyond this distinction, these physicians—each of whom partook of life in Columbia University for over fifty years—merit celebration for elevating the empiricism of cardiology and pulmonology of the pre–World War II era to the level of hard science.

The early years

André Frédéric Cournand (1895–1988) was born in Paris. His father, who held numerous patents in dental technology, was the source of the son’s interest in medicine. Cournand was educated at the Lycée Condorcet but withdrew from the final year for private tutoring in philosophy. He received the baccalauréat in 1912. The following year he enrolled in the Faculté des Sciences and entered the Faculté de Médecine in 1914. With the outbreak of World War I, he enlisted in the army and served in the trenches near the German army as an auxiliary battalion surgeon (a rank created for medical students because of the high mortality rate among battalion surgeons). His duties involved searching for the wounded in no-man's-land, rendering first aid on the spot, and then supervising their evacuation. He was assigned initially to an infantry battalion engaged in the bloody trench warfare on the Chemin des Dames front. Early in 1918 he was transferred to Soissons, where mobile warfare produced equally severe casualties. Ultimately Cournand was awarded the Croix de Guerre with three bronze stars. His experience with the wounded in shock convinced him that a technique to deliver therapy directly into the heart might substantially reduce mortality, and it continued to influence his thinking twenty years later. His battlefield experiences were also the likely source of Cournand's willinganess to undertake the risk of scientific challenges and to face crises with confidence and humor.

Cournand resumed his medical studies in 1919 and served as a house officer in the Hôpitaux de Paris, primarily at the Hôpital Laennec and the Hôpital Necker. During this period he also participated actively in the enthralling, vital cultural life of Paris of the 1920s. He was close to the Princess Marie Bonaparte and the French circle of Freudian psychoanalysts; the artists Yves Tanguy, Jacques Villon, Jacques Lipschitz, Max Ernst, Robert Delaunay and Max Jacob; and the composers Darius Milhaud, Igor Stravinsky, and Edgar Varèse. By 1930, Cournand was qualified to enter private practice but first sought further training in pulmonary medicine under James Alexander Miller '29HON, director of the renowned Columbia Chest Service at Bellevue Hospital. During this residency, Dr. Miller suggested that Cournand participate in some studies of pulmonary physiology Dr. Richards was conducting there. Cournand leaped at the proposal, believing that the opportunity in this country for a career combining full-time research, teaching, and patient care would be more satisfying than private practice in France. He settled his affairs in Paris and, in January 1933, presented himself at Richards' laboratory, where, in Cournand's words, Richards "introduced me to all the techniques he had mastered in his early investigations and to sound and precise physiologic method and thinking. To the demanding task master, to the scientific investigator, I owe more than I can tell."

Dickinson Woodruff Richards Jr. (1895–1973) was born in Orange, New Jersey. There were three generations of physicians in his mother's family, many with connections to the College of Physicians and Surgeons and/or Bellevue Hospital. He attended the

Hotchkiss School in Lakeville, Connecticut, and, in 1917, received his bachelor's degree from Yale, where he excelled in Greek, the humanities, mathematics, and natural sciences. He served overseas as an artillery lieutenant in the army after graduation and began his medical education after the war, following a discussion with his uncle, Adrian Lambert, Professor of Surgery and Attending, First (Columbia) Surgical Service at Bellevue Hospital. Richards received the M.A. in physiology in 1923 and the M.D. in 1923 from the College of Physicians and Surgeons. He served as a house officer at The Presbyterian Hospital (1923–27) and took a postdoctoral fellowship (1927–28) under Nobel Laureate Sir Henry Dale, whose laboratory at the National Institute for Medical Research, London, focused at the time on humoral agents responsible for circulatory control.

Back in New York, Richards was appointed to the Columbia faculty and initiated studies of blood oxygenation and carbon dioxide elimination as well as some aspects of circulatory physiology. A technique central to these studies involved measuring the volume of blood flowing through the lung each minute by what was known as the indirect Fick method, the only technique available at the time for use in human subjects. It was to an investigation of this method that Cournand was recruited.

By the time they met, both men had a clear understanding of their intellectual and scientific roots. Richards, the classicist, looked to the intellectual freedom and empiricism of fifth-century B.C. Greece as manifest in the writings of Hippocrates, which emphasized a wholly objective description of experience. He regarded Johannes Müller and Carl Ludwig, founders of the German school of experimental physiology, as his scientific progenitors (as did Dale, who traced his own roots, via Starling and Bayliss, to Ludwig). Cournand, French to the core, regarded the rational and humanistic morality of René Descartes and Blaise Pascal as his guiding light, while Claude Bernard was his patron saint of experimental circulatory physiology. How many of Cournand's fellows still own copies of Bernard's *Introduction to the Study of Experimental Medicine!*

When Richards and Cournand began their collaboration, cardiology and pulmonology were dominated by the stethoscope, the electrocardiogram, and the necropsy suite, which defined normal and abnormal structure but gave precious little information about quantifiable disturbances in function. From the outset, therefore, these two were ideally positioned in a field lacking verifiable hypotheses (and methodologies) capable of explaining the functional disturbances encountered in lung diseases, and in an environment (the First Medical Service and Chest Service at Bellevue Hospital, both under the aegis of Columbia University) rich in clinical material and diagnostic expertise.

A pattern of progress in their investigations persisted throughout the careers of these two researchers: functional descriptions in normal subjects and patients, elaboration of hypotheses concerning mechanisms, and experimental verification of hypotheses. Richards and Cournand began with studies of lung function, which they then extended to the heart and to the interaction of heart and lung. Their work resulted not only in methodologic and therapeutic advances but also in the production of new generations of investigators who continued and disseminated the work internationally. In the course of these efforts Cournand and Richards established the Cardiopulmonary Laboratory, the first clinical investigative unit of its kind.

Lung studies

Richards had been heavily influenced in his thinking by the celebrated Harvard physiologist Lawrence J. Henderson, and he took as the point of departure for his own studies Henderson's precept that the lungs, heart, and circulation constituted a single system whose function was to extract oxygen from the atmosphere and transport it to the various tissues to support their activities. It was clear to him that the key to a precise definition of this functional unit was an accurate measurement of blood flow through the lungs. The classic technique available for this assessment in humans at the time was the indirect Fick technique. The direct technique from which it evolved was developed during the nineteenth century for studies in animals. This benchmark method involved measuring oxygen consumption and mixed venous (i.e., right heart) and arterial blood oxygen contents so that flow could be calculated as the formula presented below.

Because mixed venous blood was thought to be too dangerous to obtain in humans, researchers up to this point had used a modification that substituted carbon dioxide for oxygen in the above equation. This indirect method assumed equilibrium between carbon dioxide in the alveolar air and that in the mixed venous blood. Researchers measured carbon dioxide in a rebreathing bag system and arterial carbon dioxide content in samples obtained by direct arterial puncture. This method was used commonly and uncritically by others.

At the outset, Cournand and Richards made an effort to validate and improve the rebreathing method for estimating mixed venous carbon dioxide content and to apply it to individuals with lung disease. Their efforts, however, were only partially successful, for while they were ultimately able to define the “steady state” conditions (later adopted internationally) necessary for accurate measurements of flow, they ultimately demonstrated the inadequacy of the indirect Fick technique—a development that led inevitably to the development of cardiac catheterization, as discussed below. These studies, however, did indicate the value of a gentleman’s three-piece suit: blood specimens obtained at Bellevue were immediately tucked into a vest pocket (to maintain them close to body temperature) and moved to the Medical Center for analysis.

Early in their collaboration Cournand and Richards successfully developed techniques that permitted the estimation of the volume of air in the lungs at the end of a complete inspiration (“the vital capacity”) and at the end of a complete expiration (“residual volume”), using the elimination of nitrogen from the lungs during oxygen breathing (the “open circuit method”) to calculate this “residual volume.” The sum of the vital capacity and the residual volume defined the total lung capacity. Such assessments were obtained first in normal subjects, then repeated in patients with emphysema. In the first group nitrogen was eliminated within two minutes. The far slower rate of elimination of nitrogen in emphysema constituted the first demonstration of the maldistribution of respiratory gas in the lungs caused by airway obstruction. This observation had important implications for the study of ventilation-perfusion relationships, pulmonary arterial hypertension, and pulmonary heart disease, all future topics of concern for Cournand and Richards.

Within five years Cournand and Richards had sufficiently defined methods for describing lung function to permit them to evaluate mechanical respirators developed by the army air force to deliver oxygen to pilots flying at high altitude. They conducted these assessments in normal individuals, and the instrumentation was subsequently adapted for use in patients with respiratory failure due to heart failure, central nervous system depression, and neuromuscular disease (this being the era of rampant poliomyelitis). By the end of the 1940s they had described a fairly modern classification of pulmonary insufficiency, established standard methods of assessment, and published normal values of pulmonary function tests. They next turned their attention to abnormalities encountered in diffuse diseases of the lung parenchyma, and they described a novel disturbance of blood oxygenation (alveolar-capillary block with diffusion abnormality) stemming from such diseases.

Subsequent investigations conducted by Cournand and Richards and other members of the Laboratory applied increasingly complex mathematical formulations to examine in greater detail the impact of pulmonary disease on respiratory gas exchange within the capillary blood phase in diseases involving the alveolar spaces. They also examined hemoglobin abnormalities and anemias as a source of changes of oxygen concentration in the blood. Finally, at the time of Cournand’s retirement, a new technique that permitted quantitative descriptions of lung anatomy was developed.

Heart studies

By 1936 it was clear to Cournand and Richards that the indirect Fick technique was inadequate for measuring pulmonary blood flow, especially in patients with chronic lung disease. Uniform equilibration between mixed venous blood carbon dioxide and alveolar concentration of the gas did not exist; furthermore, even in normal subjects, small shifts in the level of ventilation destroyed the “steady state” conditions required for accuracy. To measure pulmonary blood flow accurately, it would be necessary to sample mixed venous blood by the direct Fick technique. Cournand and Richards were aware of Werner Forssmann’s report of catheterizing his own heart in 1929 and of subsequent pioneering work by European radiologists who injected contrast material into the right atrium for diagnostic purposes. Despite the opposition of many renowned cardiologists of the time, over the next four years Cournand worked to demonstrate the feasibility and safety of catheterizing the right heart, first in dogs, then in a chimpanzee, and, finally, in humans.

In this present age of interventional cardiology, it is difficult to realize the magnitude of the opposition to catheterizing the human heart—this in spite of the fact that catheters had been employed successfully in a variety of animals to measure blood flow since the previous century and that the necessary preliminary work had been accomplished in animals and human cadavers. Richard Riley, a senior member of the Laboratory in the 1940s, describes important pragmatic considerations that helped Cournand and Richards to overcome this antagonism. With war looming on the horizon, the Office of Scientific Research and Development had a paramount interest in studies of the management of traumatic shock, for which measurement of blood flow was a necessity. He adds that, despite the disparaging things Richards had to say about tradition-bound medical priesthoods, his own status within that priesthood apparently gave him the privilege that others, including Cournand himself, lacked. Riley concludes that “these practical considerations in no way detract from Richards’ inspired recognition. . . . He had the right intuition and he seized the moment.” It is also important to remember that the inception of the work far antedated the concerns of ethics committees, patients’ rights, and informed consent.

Early examinations in human subjects employed ureteral catheters used by urologic surgeons. Cournand and Richards reported more systematic comparisons of normal subjects and those with cardiac disease shortly thereafter. This later work provided an initial description of the hemodynamic abnormalities encountered in heart disease. Moreover, it demonstrated the safety, painlessness, feasibility, and diagnostic value of cardiac catheterization. Mixed venous blood was now available for measurement of pulmonary blood flow.

At this stage of development, intravascular pressure levels were measured with low-frequency water manometers that afforded only mean measurements of intracardiac pressures. Within a few years, however, technology evolved that permitted continuous recording of intravascular pressures. A special indwelling needle for sampling arterial blood and recording blood pressure was designed (the Cournand needle). The high-frequency Hamilton manometer that permitted accurate display of phasic intravascular blood pressure contours replaced the water manometer.

A description of a procedure in the catheterization room at Bellevue Hospital during this period may be of interest. The early fluoroscopes used to guide passage of the catheter did not couple the X-ray tube (below the table) to the above-table luminescent screen. Imagine one postdoctoral fellow manipulating the screen to follow the catheter tip while his wife (also a fellow) lay on the floor under the table moving the X-ray tube to follow the screen. Once the catheter was in place, all lights in the room were turned off, and the Hamilton manometer (which focused a light on sensitive paper to record the pressure contour) was attached to the catheter and manipulated in absolute darkness so that its light output could be captured with a handheld mirror and adjusted to strike the paper. Researchers then could record intravascular pressures and obtain samples for measuring blood flow. Not an easy procedure.

In all the early procedures, the catheter tip was positioned in the right atrium. It was feared that attempts to catheterize the pulmonary artery might be excessively dangerous. Indeed, catheterization of that vessel was fortuitous. The momentum of flowing blood, however, tends to carry a catheter along its direction of flow, and on several occasions in 1944 Cournand noted that the right atrial catheter suddenly appeared in the pulmonary artery at a time when no manipulations were being made. The catheters were permitted to remain in that position for prolonged periods without side effects or complications. As a consequence catheterization of this vessel became a routine feature of hemodynamic evaluations.

World War II interfered, for a time, with further development and wider application of the catheterization technique. Under the auspices of the Office of Scientific Research and Development, the Laboratory undertook studies of the physiologic disturbances encountered in traumatic and hemorrhagic shock. This work established the therapeutic value of blood volume expansion with Dextran in patients with shock.

At the end of the war, in 1945, Richards became director of the First (Columbia) Medical Service at Bellevue. His educational, clinical, and administrative responsibilities precluded hands-on efforts in the Laboratory, but he continued to participate actively in planning projects and protocols and evaluating results. Cournand was responsible for administrative and educational direction of the Laboratory as well as direction of the diagnostic and research protocols.

An explosion of scientific and technical activity accompanied the conclusion of the war: in short order electronic advances achieved during the war were applied to pressure transducers and carrier amplifiers that permitted continuous pressure contour recording. Cardiac catheters fabricated from extruded nylon were designed to Cournand’s specifications. The new technology of modern cardiac catheterization generated important new biomedical industrial activity. Within five years of the end of the war, Cournand, Richard, and other members of the Laboratory had published systematic descriptions of the hemodynamic abnormalities encountered in congenital heart disease and in pulmonary heart disease, and of the hemodynamic response, in patients with heart failure, to the administration of digoxin. In short order the same investigators followed these reports with detailed examinations of rheumatic valvular disease and of pericardial restrictive disease. Major consequences of these latter reports included innovations in patient management and criteria for selection of candidates for cardiac surgery. They provided currently employed normal and abnormal hemodynamic values and were the impetus for further studies of important side effects of heart failure. The work done in Cournand and Richard’s Laboratory had established modern diagnostic cardiology and paved the way for the development of interventive cardiology and radiology.

By the 1960s members of the Laboratory had developed additional techniques to examine detailed aspects of cardiac function. They employed radioisotopes for the noninvasive evaluation of right ventricular ejection rates, pulmonary blood flow, and pulmonary blood volume. Fiberoptic techniques were applied to cardiac catheters and permitted detection of blood flow through abnormal communications between the left-sided and right-sided chambers of the heart.

The pulmonary circulation

At the end of World War II it was generally held that the pulmonary vessels, by virtue of their scant smooth muscle endowment, were incapable of vasomotion (that is, functional change in caliber and hence in flow-resistive properties). Pulmonary hypertension in patients with chronic airway obstruction was thought to be the irreversible consequence of accompanying inflammatory changes. In 1946, however, Swedish physiologists reported that a decrease in inspired oxygen concentration evoked pulmonary arterial vasoconstriction in the cat. Recognizing that disease imposed a similar hypoxic stimulus on the pulmonary vessels in humans, and that this deficiency of oxygen might serve as the link between lung disease and the development of pulmonary arterial hypertension, Cournand identified such vasoconstrictive properties in normal human subjects within a matter of months. He then initiated a systematic descriptive study of chronic airway obstruction and hypoxemia, which demonstrated a close relationship between the severity of hypoxemia and the level of pulmonary hypertension, as well as the amelioration of hypertension with relief of hypoxemia during treatment.

Because an acute hypoxic stimulus was considered too hazardous to use in such patients, members of the Laboratory employed an alternative experimental approach to confirm the role of hypoxia as the source of vasoconstriction. Acetylcholine, a selective pulmonary vasodilator in normal subjects under hypoxic conditions (selective because the agent is rapidly destroyed by circulating cholinesterase before it arrives in the left heart), was infused directly into the pulmonary artery of patients with chronic airway obstruction. A significant fall in pulmonary artery pressure resulted, confirming the functional nature of pulmonary hypertension in these patients. Equally important, the results indicated that hypoxic vasoconstriction diverts blood flow away from the least ventilated regions of the lung toward better-ventilated areas, thus defending blood oxygenation in the presence of disease.

After Richards and Cournand retired, other members of the Laboratory extended these observations to consider the impact of respiratory acidosis on pulmonary artery pressure. They confirmed that increasing acidosis and hypoxemia were interacting factors that determined the level of pulmonary hypertension in chronic airway obstruction, in the obesity hypoventilation syndrome, in neuromuscular disease, and in the presence of respiratory muscle fatigue. They reported advances in understanding of the pulmonary circulation from an important educational podium over a period of thirty years, demonstrating sustained leadership of the Laboratory in this field.

The Cardiopulmonary Laboratory

From the late 1940s on, the Laboratory’s publications and distinguished reputation brought a host of fellowship applicants. As these physicians left Bellevue Hospital they assumed leadership positions in cardiologic and pulmonary centers across this country and Europe, disseminating the concepts Cournand and Richards had developed and contributing to the primacy of the Laboratory. A stellar cadre of senior investigators also coalesced in the Laboratory. William Briscoe provided detailed descriptions of the matching of abnormal lung ventilation and pulmonary blood flow as well as its consequences with respect to respiratory gas exchange. Harry Fritts Jr. studied the apportionment of blood flow between normal areas of the lung and sites of inflammatory or neoplastic abnormalities; he also examined the separate oxygen consumptions of these regions. Domingo Gomez, a renowned biomathematician, author of the first modern treatise on hemodynamics in the 1930s, and president-in-exile of Cuba in the aftermath of the Castro revolution, elaborated physico-mathematical models of pulmonary function in health and disease. Réjane Harvey ’43P&S and M. Irené Ferrer ’41P&S examined the factors responsible for vasomotor control of the pulmonary circulation and the genesis of right heart disease caused by chronic lung disease, developing along the way many of the modern methods for managing chronic bronchitis and emphysema. Richard

Riley investigated oxygen diffusion within the lungs and in the pulmonary microcirculation.

In the late 1950s Richards was an august personage in the Laboratory. His rather taciturn and, in the eyes of young postdocs, austere demeanor was probably due to modesty, almost to the point of shyness. His warmth, kindness and moral strength were most evident at the bedside with house officers and patients. He was not, however, without an understated, wry sense of humor. He had given the house staff permission to use his office as a library; when he announced one day, regretfully, that it was necessary to place a lock on his dial telephone because he had noted abuse of its availability, particularly with respect to calls to Paris, it was apparent to all that he was referring to Cournand rather than to the house officers. After winning the Nobel Prize, Richards immediately turned his efforts toward persuading the city administration to modernize the antiquated physical plant at Bellevue Hospital. Subsequently, he was generous with his time in support of the construction of the new hospital.

Cournand was equally endowed with gravitas. He was shorter, stocky, physically vigorous, and enthusiastically volatile under appropriate stimulation. He and Gomez (who, although Cuban, had been educated in Paris) would argue vociferously in the hall outside their offices, ranging from politics to the arts to science, and swinging from French to English and back. All members of the Laboratory met in conference around a long table on Saturday mornings when clinical cases, work-in-progress, or physiologic topics were discussed. After Cournand had remarked on a paper he had read recently, one junior fellow remarked that his comments seemed paranoid. Cournand rose in a flash, ran down the table and confronted the young man nose-to-nose. “Correct! And by the end of your fellowship, Doctor, you will also have a yellow streak of paranoia down your back eighteen inches wide!” His kindness and scientific curiosity were unbounded. When the same fellow noted a phenomenon related to the reflection of light by flowing blood that could not be explained, Cournand arranged for him to confer with the eminent physicist Richard Garwin. The solution was not forthcoming, but became apparent at a cocktail party attended by all members of the Laboratory the following Christmas, when Briscoe suggested that the phenomenon resembled the Rayleigh effect, which causes the sky to appear blue. He was correct. Apparently we could not refrain from discussing scientific problems, even under social circumstances.

Cournand and Richards provided an intellectually rich and nourishing environment for the members of the Laboratory. One rubbed neurons with the best and the brightest on a daily basis. Eminent physiologists from all over the world visited each time they came to this country for a meeting or vacation. The urge to work, to understand, to "measure up" was generated from within and involved all. When time for retirement came, Charles Ragan '36P&S '76HON, an eminent rheumatologist, succeeded Richards as director of the First Medical Service, while Harry Fritts Jr. a leading member of the cadre of senior investigators in the Laboratory, succeeded Cournand as director. Research, education, and patient care continued undiminished under this new regime. However, in 1968 the city administration decided that three universities (Columbia, Cornell, and New York University) providing patient care at Bellevue Hospital was redundant and requested that Columbia and Cornell provide care at other components of the city hospital system. Accordingly, the First Medical Service moved to The Harlem Hospital Center. The Cardiopulmonary Laboratory closed its doors; its members dispersed.

Postretirement

After retirement, both Cournand and Richards continued their intellectual pursuits as well as their activities within the University. Richards devoted himself to a variety of scholarly interests. As historian he edited (with Alfred Fishman) *A History of the Circulation* and published insightful essays on William Harvey and Hippocrates. He celebrated his devotion to Greek classicism, to social criticism, and to cardiopulmonary physiology in a volume entitled *Medical Priesthoods and Other Essays*. He also helped organize interdisciplinary projects as a member (with Cournand and David Truman '25C of the Administrative Committee of Columbia University) of the Institute for the Study of Science in Human Affairs and directed a program in the history of biomedical sciences at the College of Physicians and Surgeons. In a tribute to Richards, Cournand concluded that his colleague's post-retirement concerns reflected qualities that characterized his entire professional life, "the sensitive yet very effective clinician, the dispassionate analytical philosopher, and the humanist of warmth and great moral strength."

For a number of years after retirement Cournand worked to acquaint American readers with the doctrines of Gaston Berger '57HON, which advanced a method of planning for the future (*Prospective Approach to the Future*) by placing preferred futures as the driving force for planning. He translated a number of Berger's works into English and published them as *Shaping the Future*. He also introduced into the medical school curriculum a course on the relationship between medicine and society, which he regarded as an opportunity to disseminate prospective ideas and methods. Another concern during retirement was to develop the principles of an ethical code for the scientist. At meetings of the Frensham Pond group (scholars, sociologists, philosophers, and educators brought together by the Bernard van Leer Foundation) he developed a close association with the social scientists Robert Merton '85HON and Harriet Zuckerman and was stimulated to articulate his own experiences as a scientist. Subsequently he and Zuckerman published "The Code of the Scientist and Its Relationship to Ethics in Science" in the journal *Science*. Finally, Cournand considered his own life as a scientist and its aftermath in a biography entitled *From Roots…To Late Budding*. He became preoccupied with the question "What is a scientific investigator?" The papers he wrote during these final years reflect his abiding concern with scientific responsibility.

L'envoi

The Nobel Prizes, and the recognition and encomiums stemming from them, memorialize an innovation. But these honors may tacitly scant the sum of achievement over the course of a professional life that in the most profound sense reflects the true value of that life. Cournand and Richards produced a technological innovation that resulted in a paradigmatic shift in diagnosis of diseases of the heart and lungs. The substance of their contribution, however, was the creation of modern cardiopulmonary medicine both technologically and conceptually. Henderson was correct: the heart, lungs, and circulation really are a single functional unit; here are its normal values, this is how it works, and these are the manifestations of malfunction. The framework they evolved for understanding normal and abnormal cardiopulmonary function was disseminated on a lasting and international basis and had a profound impact on patient management, on medical education, and on the biomedical industry. We truly do stand on the shoulders of giants.

Columbia at Belleview

Columbia’s presence at Bellevue Hospital is inextricably linked to the medical and social history of New York City during the late– eighteenth and early–nineteenth centuries. Aside from the customary apprenticeship training prevalent at the time, the sole institution of medical education in New York was the Medical Faculty of Columbia College, which merged with the College of Physicians and Surgeons (chartered in 1807) in 1814. The city had established an almshouse and hospital on the south side of Chambers Street behind City Hall and near Broadway in 1795. Shortly thereafter Samuel Bard, Dean of the Medical Faculty of Columbia College, began to petition the city fathers to permit the faculty of the College to provide care at the hospital and to teach students at the bedside. He was successful in 1805. Two sources of pressure, however, necessitated removal of the almshouse: a succession of epidemics of yellow fever, bubonic plague, and typhus required enlargement of the hospital; and the rich and famous, whose mansions on lower Broadway were disturbingly close to the almshouse and hospital, began to complain.

In 1811 the city bought the meadows and orchards of the Kipps farm, five acres named Belle Vue located between 23rd and 28th streets and running from the East River to Second Avenue. Work on a prison, almshouse, and hospital at that site, renamed Bellevue, was slowed by the War of 1812. The installations were opened in 1816 and, from those earliest days, Columbia faculty and students continued to provide patient care under Drs. Bard and David Hosack, professor of the theory and practice of physic and clinical medicine. By mid-century the size of Bellevue Hospital had increased markedly, making patient care a most demanding task. Because three other medical schools (Cornell, New York University, and the Post-Graduate Hospital) were now available to share the burden, Bellevue was reorganized between 1876 and 1879. By the latter date, four separate divisions had been established, each run as almost a separate institution, and administered by one of the four schools. Columbia continued to be responsible for the First Service.

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Guide to school abbreviations