MEDICAL HISTORY

Student Discoveries in the Pulmonary and Cardiovascular Systems*

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Contributions to science by medical undergraduates are legion. In the pulmonary and cardiovascular fields there were more than a dozen outstanding contributors, and this paper will discuss them briefly.

Naturally, one thinks first of Laennec in the pulmonary field. His first published paper was on mitral valvular disease. Contrary to popular belief he was a pathologist at heart, and in fact before graduating he was made editor of the Journal of Medicine, Surgery and Pharmacy. Among the preoccupations of this penniless but brilliant student were the membranes which lined the heart, the brain, the joints, and the abdominal cavity. His student paper on peritonitis has been described as a fine piece of original work. The membranous coverings of viscera were also investigated by the youthful student at La Charité where he studied under Corvisart, who was translating the classic work of Auenbrugger on percussion. Clearly Laennec was the right man in the right place when, in 1817, he invented the stethoscope to verify, through the chest wall in the living, what he had studied for years in the dead. Two years later he produced his book De l'auscultation Médiate which he regarded as describing a “means of enabling us to ascertain the character, not only of the action of the heart, but of every species of sound produced by motion of all the thoracic viscera.” His second edition seven years later added the clinicopathologic correlation of his findings in tuberculosis, pneumothorax, emphysema, bronchiectasis, cancer of the lung, and pleurisy. Sir William Osler never tired of urging his students to read the Forbes translation, for instance, as it related to Laennec’s account of pneumonia: “Besides the sound of crepitation, a sensation of humidity... is clearly conveyed... it is the pathognomonic sign of the first stage of peripneumony, disappearing on the supervention of hepatisation and reappearing with the resolution of the inflammation.”

Laennec’s classic work on the stethoscope was translated into English six years after its appearance in Paris, by an Edinburgh medical student, William Stokes (1804-1878) son of the Regius Professor of Medicine in Dublin. Neither the stethoscope nor Stokes’ translation proved popular in Edinburgh, so the gifted son returned, after graduation, to Dublin where he led a most distinguished career. The 226-page “translation” allowed Stokes to indulge his own interests in clinicopathologic pursuits. He named the volume “An introduction to the use of the stethoscope with its application to the diagnosis in disease of the thoracic viscera, including the pathology of these various affections.”

An American medical undergraduate at La Charité, James Jackson, Jr., a contemporary there of Oliver Wendell Holmes, read a paper in 1833 before Louis’ “Société Médicale d’Observation.” He described for the first time the early tuberculous sign of a prolonged expiratory sound.

On the cardiovascular side, the spectrum of student contributors ranges from Galileo to Helen Taussig. The “pulsilogia” Galileo (1564-1642) designed at age 17, was produced for the physicians of his native Pisa. It consisted of a small pendular weight, on a thread whose length could be varied. As the excursions of the little pendulum became harmonized with the pulse, the physician was able to read on a dial or scale the exact rate per minute.

Scarcely 20 years later William Harvey, at Padua, was laying the foundation for his great generalization on the circulation of the blood. While a student helper to his teacher, Fabricius of Aquapendente, who was famous for his work on the valves in veins, Harvey grasped the meaning of these valves. Whereas Fabricius imagined their function to be

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that of regulators of the rate of flow, Harvey saw them as evidence of "one-way traffic" in the vascular system. Also, as Harvey helped Fabricius with his experiments on the embryology of the chick he witnessed the rudimentary heart which he later described as a "throbbing point of blood, so trifling that it disappeared on contraction and was lost to sight, while on relaxation it appeared again like a red pin-point."

Harvey died in 1657, still preaching the importance of the circulating blood as against the heart itself. Within a year a Dutch premedical student, Jan Swammerdam (1637-1680), applied his microscope to the blood of a frog and observed "the serum in which floated an immense number of rounded particles." While a medical undergraduate he showed that if respiration has been established in the newborn the lungs will float.

Another Leyden medical student gained immortality for the description of the coronary arteries in his graduation thesis in 1708. A. C. Thebesius (1686-1752), using injection methods, succeeded in tracing the course of these vessels in what is still referred to as the "Thebesian system."

Astley Cooper (1768-1841) spent much of his time as a student dissecting at the home of the great St. Thomas' surgeon, Henry Cline. There he tied off main arteries, and through injection methods was able to trace out collateral circulation. After a brief sojourn in Edinburgh, Cooper returned to London to resume his undergraduate work, and invaded the field of respiration. When he became a teacher he was eager to have students learn their surgery from patients, not from lectures.

The measurement of blood pressure owes much to the work of J. L. M. Poiseuille (1799-1869). In his graduation dissertation "Recherches sur la force du coeur aortique" (Paris, 1828) he described his "haemodynamometer." Seventy years later the graduation thesis of Rudolf Magnus (1873-1927) at Heidelberg presented his new method of measuring blood pressure in an exposed artery.

Our scene now returns to England, where Joseph Hodgson (1788-1869) was entering medical school in Birmingham. At the age of 18 he witnessed the first ligation of the external iliac artery, by John Freer, and drew the plates which were incorporated into a book which described the operation (Fig 1). It is little wonder that in his graduation year he wrote an outstanding Jacksonian Prize Essay for the Royal College of Surgeons on "Wounds and Diseases of Arteries and Veins." Greatly amplified, this became in 1815 his classic A Treatise on the Diseases of Arteries and Veins, containing the Pathology and Treatment of Aneurysms and Wounded Arteries. The volume of illustrations which he had drawn himself contained cases going back to his earliest undergraduate years. Besides aneurysms the illustrations showed aortic valvular endocarditis and what is said to have been the first on aneurysmal dilation of the arch of the aorta. Coronary occlusion was well described also.

A schoolboy injured in a gunpowder explosion was treated so successfully by Hodgson that the patient, William Bowman (1816-1892), took up a medical career. At age 19 Bowman was reading papers to the newly formed Birmingham Medical Students' Debating Society on spinal paraplegia, influenza, emphysema, and hemorrhage from external injury. Bowman's other student efforts encompassed the measurement of the orifices of the heart at autopsy for Peyton Blakiston, who presented him with a superb microscope, later to be used in Bowman's shower of original discoveries.

Bowman's first publication was "A Treatise of the Diseases and Injuries of the Larynx and Trachea" (1837). In the same year he transferred to Kings College Hospital, London, in order to become eligible to write the qualifying examinations of the College of Surgeons two years later. At Kings he met the famous professor of physiology, Robert Bentley Todd (of Todd's paralysis). Together they undertook a four-volume Cyclopedia of Anatomy and Physiology. Bowman was charged with the investigation and description of the microscopic anatomy of all the internal organs of the body, plus muscle, bone, cartilage, the nerves, sense organs, and the skin. The output of new discoveries by this student was prodigious, and it is little wonder that he was made a Fellow of the Royal Society at age 25.
In early 19th century James Hope (1801-1841) submitted his graduation thesis at Edinburgh on "Aneurism of the Aorta," which preceded by six years his major contribution A Treatise on the Diseases of the Heart and Great Vessels. In Paris, a first-year medical student from across the Channel in Kent, A. V. Waller (1816-1870), was watching under the microscope the peregrinations of blood corpuscles through the walls of capillaries in the tongue of the frog (Fig 2). It was several years later that he was to describe "Wallerian degeneration" in the severed nerves of the frog's tongue. In Vienna, a one-time lens grinder, David Gruby (1810-1890) was looking into a microscope of his own construction at the coagulation of blood and the formation of new capillaries in inflamed tissue. His graduation thesis "The Morphology of Pathological Fluids" was written after his teacher Rokitansky loaned him a Ploessl microscope, through the use of which Gruby was able to make 103 illustrations for his dissertation.

Two clinical contributions were made by the French medical students Paul-Louis Duroziez (1826-1897) and Maurice Raynaud (1834-1881). The former won the Corvisart Prize for his undergraduate essay on "Therapeutic Properties and Physiologic Action of Digitalis," Raynaud, two years before graduation, was assigned a female patient aged 27, who was hospitalized because of unexplained spontaneous gangrene of both hands and both feet. By the time he wrote his graduation thesis, "De l'asphyxie locale et de la gangrène symétrique des extrémités" (1862), he had collected five cases personally and had details of 20 others which had been reported in the medical literature. His clinical descriptions are classics of clarity and brevity. He wrote, in part: "Under the influence of very moderate cold, and even at the height of summer, she sees her fingers become ex-sanguine, completely insensitive, and of a whitish yellow colour... The feet, more impressionable even than the hands, are regularly attacked at meal times and whilst digestion is going on... The complete disappearance of attacks of local syncope has always been noted by this lady as the first index of a commencing pregnancy."

When William Osler, a medical student at McGill in 1871, studied The Science and Art of Surgery by Sir John Erichsen, he probably was unaware of the student contribution by that eminent English practitioner of Danish descent. Actually, at the age of 24 Erichsen wrote his thesis "On the Influence of the Coronary Circulation on the Action of the Heart." His interest had been aroused in ventricular fibrillation in circulatory failure.

A Canadian undergraduate who contributed to the cardiovascular field was the meteoric John Bruce MacCallum, who was born in Ontario in 1876 and died a short 30 years later of tuberculosis. Osler wrote this note on his copy of MacCallum's poem "Spirit of Death": "One of the most brilliant young men it has ever been my lot to teach... He had a mind of singular acuteness, a clear judgment, and he had caught from Mall some measure of that investigating spirit which has made the anatomical school of the Johns Hopkins University so famous. When the news of his death reached me one morning as I sat at breakfast, I broke down in an irresistible paroxysm of regret, and had to leave the table."

From his entry into Johns Hopkins Medical School until his death ten years later, MacCallum produced 27 original papers, five of them before taking his M.D. degree. Of these, four concerned the anatomy and pathology of the heart. He drew his own illustrations. Like Gerdy, a Paris medical student 75 years previously, he worked on the embryology and architecture of the muscular wall of the heart.

In recent years it has been Helen Taussig who

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**Figure 2. A. V. Waller's undergraduate illustration of the capillaries in the tongue of the frog (from Gibson, W. C.: Young Endeavour, Fig 3d; Springfield, Charles C Thomas Co).**
has epitomized the contributions which undergraduates still can make to medicine. While a first-year student at Boston University Medical School she took up the suggestion of Dean Begg, who was also Professor of Anatomy, that a study of one of the major organs of the body would be a good investment of time throughout her medical training. After working on the muscle bundles of the heart in Boston she transferred to Johns Hopkins in Baltimore to study cardiac physiology and pathology, with what epoch-making results we all know today. It has been said truly that “she has done for the clinician what Dr. Maude Abbott did for the pathologist, namely, made the malformations of the heart understandable and accessible.”

Finally there is the example of Martin Flack, who like Harvey and Waller came from Kent. The village of Borden was agog when in 1903 the celebrated anatomist Sir Arthur Keith took up weekend residence there. With some sixth sense he learned that the butcher’s boy had just completed his preclinical work at Oxford and was about to select a teaching hospital in London for his clinical studies. In a twinkling the student found himself admitted to the London Hospital and scheduled for weekend research in Borden with Keith.

The drudgery of cutting serial sections of 130 moles’ hearts, staining them, and studying them under the microscope was relieved by daily games of golf, learned from James Braid’s manual. One evening Sir Arthur came back from cycling to be told by Flack that he had spotted a new structure in the right auricle. It appeared consistently in all other hearts examined as something resembling an electrical conducting system. Thus was discovered the sinoauricular node or cardiac pacemaker.

So we come to the end of what can be only a cursory treatment of an important subject. The outlook of these student pioneers is perhaps best expressed by one of them, Oliver Wendell Holmes, when he wrote home to Boston from his clinical work at La Charité in Paris: “My aim has been to qualify myself . . . not for a mere scholar, for a follower after other men’s opinions, for a dependent on their authority—but for the character of a man who has seen and therefore knows; who has thought and therefore has arrived at his own conclusions.”

In a world strangling itself in publications, today’s medical students must wonder what there is left to them to discover—as students. The literature breaks over their heads as one wave after another, and they, and their teachers, have to hide in order to think. Everything may seem to them too massive, too computerized to ever permit them to make even a small contribution. Nothing could be farther from the truth. All students should have their hopes and self-confidence reinforced by the words of John Shaw Billings, who as a student vowed to set up the world’s greatest medical library and, in fact, did just that: “There is nothing really difficult if you only begin. Some people contemplate a task until it looms so big it seems impossible. But I just begin and it gets done somehow. There would be no coral islands if the first bug sat down and began to wonder how the job was to be done.”