History of the Department of Anatomy and Cell Biology I: Beginnings to Stevenson

1. Introduction

As the oldest of the Basic Science Departments in McGill’s faculty of Medicine, our Anatomy department has played a prominent role in the history of the medical school. This work examines the long history of our department in terms of its two primary missions: research and teaching. Our department goals have always been to continuously extend the frontiers of knowledge in the field of Anatomy and to pass on of that knowledge to new generations of students. In recent years, the addition of “Cell Biology” to our departmental name reflects the broadening of our research focus to investigate the structure and function of organs, tissues, cells and even molecules. The past century has seen spectacular achievements in these fields, and yet the deeper we probe, the more we realize how much more remains to be understood.

In terms of teaching, the discipline of Anatomy has always been central to the education of students in Medicine, Dentistry and other health related disciplines. In recent times, with an ever-increasing realization of the importance of science as a basis for medical practice, the training of science undergraduate and graduate students has formed a prominent additional part of our mission.

This work describes the often fascinating individuals who played a role in our department’s development and the conditions in which they worked. All major departmental faculty members are listed in chronological order with the dates of their stay in the department listed in brackets. Other members are listed in an appendix.

2. Beginnings of the McGill Medical School (1829)

At McGill University, the reason that Anatomy and the field of Medicine have played such an important role in our history is related to the unique events surrounding the university’s founding. In most universities, including McGill, the Faculty of Arts (and Science) is considered to be a core facility of the institution since these subjects form the basis for the all of the other disciplines. Frost 2:144. At McGill, however, the first Faculty to exist was Medicine, starting in 1829, and the Arts faculty was established only in 1843. Thus our first students were medical students, and Anatomy was a key element in their instruction. Indeed, throughout McGill’s whole history,
Medicine has remained our largest and most prominent faculty. To the rest of the world, McGill has always been known primarily for its outstanding medical school and especially for its most famous medical personage, Sir William Osler.

This unique situation at McGill University relates to the intriguing situation of its founding. In his will, the University’s founder, James McGill bequeathed his beloved country estate, Burnside Place, as well as a sum of $10,000, for the endowment of a college or university to bear his name. The money was willed to the Royal Society for the Advancement of Learning, a body that had been initiated by the Anglican Bishop, Jacob Mountain, in an attempt to establish public non-religious schools and institutions of higher education in the Province of Quebec. Hanaway 1:3; Frost 1:35
In this largely Catholic and francophone province, the Catholic Church was basically antagonistic to the creation of any non-religious schools, and opposed any governmental action in this regard.

Knowing that the government authorities might drag their feet indefinitely, McGill’s will had stipulated that the University must begin to give classes within ten years of his death (which occurred in 1813), or the money was to revert to his son-in-law Francis Desrivières. After years of religious wrangling and legal battles in the British courts, the “University of McGill College” finally obtained an official charter by the time of this deadline in 1823. Physically, however, the university consisted of just an empty farm. There were no students, and the five designated professors (of Divinity; Mathematics and Natural Philosophy; History and Civil Law; Moral Philosophy; and Medicine) lived not in Montreal but in Quebec City or Toronto! Thus McGill was a university in name only.

In this emergency situation, the university turned to the only English institution of higher learning already existing at this time in Quebec. This was a small newly-formed private medical school, the Montreal Medical Institute, which had been created in 1823 by four physicians: William Caldwell (at McGill: 1829-1833), William Robertson (1829-1844), John Stevenson (1829-1842), and Andrew Holmes (1829-1860). These same men, just five years earlier in 1819, had joined a group of Montreal businessmen in founding the English-speaking Montreal General Hospital.
Even the opening of this English hospital had not been a popular move in the eyes of the majority francophone catholic community since it considered itself well served by its own Hotel Dieu Hospital. One catholic member of the Quebec Legislature, Michael O’Sullivan had been vehemently opposed to the move, and an intense argument developed between himself and William Caldwell. This ultimately led to a duel being fought between the two men! After firing five shots each, both individuals were severely wounded and the duel ended. Neither of the men died, and, as emotions subsided, the creation of the new hospital ultimately went forward Hanaway1: 10; Frost1:130.

The merger between the Montreal Medical Institute and McGill University was truly symbiotic. The Institute had applied to the Quebec Government for a charter as a recognized medical school but this had been denied since it was not associated with any institution with a degree-granting charter. McGill University, on the other hand, had the required charter but lacked any students or real faculty. The four instructors of the McGill Medical Institute were thus adopted as the first faculty members of McGill’s Faculty of Medicine. The university was officially opened in 1829 in an elaborate ceremony in James McGill’s Burnside Place Hanaway1:16. The first academic session took place in 1829-30 and the first M.D. degree was conferred four years later in 1833 upon William Leslie Logie Hanaway 1: 22.

The four members of the medical school’s initial teaching staff had all received training at Edinburgh University. This was considered the most advanced medical school in Great Britain during the first quarter of the 1800’s, and was renowned for its Anatomy teaching Hanaway1:18,149. Both William Caldwell and William Robertson were Scotsmen who obtained their medical training at Edinburgh University and then immigrated to Canada to practice medicine. Caldwell became McGill’s first lecturer in Medicine from 1824 to1833 Hanaway1:143. He died unfortunately at the young age of fifty-one. Robertson succeeded Caldwell as Professor of Medicine from 1833 to 1844 Hanaway1: 144.

The two younger men, Andrew Holmes and John Stephenson, were born and received their early education in Canada. Both men did medical apprenticeships in Canada and then went to Edinburgh for the remainder of their medical education.

Commemorative crests for each of the above four founders of our medical school are displayed in the east main entranceway to our Strathcona Anatomy and Dentistry Building. A similar plaque exists at the University of Edinburgh.

The Scottish origin of McGill’s four founders reflects a thread that runs through the whole identity of our university. James McGill himself was a Scotsman, along with most of the other founders of Montreal’s fur-trading commercial economy. These included Simon McTavish (founder of the Northwest Company), Simon Fraser, and Alexander MacKenzie.
The Calvinist reformation in Scotland had translated the Bible into a book readable to all, and this had led to a huge increase of literacy. Most Scottish emigrants to North America, even the poorest, had more skills and education than other Europeans Herman 16, 23, 346. Their religion taught them that only patience and hard work brought success, and their firm work ethic and moral discipline were their strongest characteristics. Unlike the English, they did not expect preferential treatment, and they were not deterred by the harsh winters of the Canadian north. Herman: 387.

These features were epitomized in James McGill, himself. A strong, strapping, tall youth who prided himself on his toughness, he had emigrated from Scotland to the Carolinas and then had canoed from New York all the way to Montreal to try his luck in the risky and dangerous Canadian fur trade Frost- McGill: 6. Upon his arrival in 1766, he hiked from downtown to Lachine, and then engaged with a fellow Scot as a trader on one of the huge forty-foot canoes embarking for the Canadian west. This was a land of enormous distances, immense hardships, and of unforgiving perils. The paddling of the canoes by the “voyageurs” was an exhausting occupation equaled only by the toil of the galley slaves of antiquity Newman - Caesars: 25. James McGill joined the men in paddling all of the way, wanting to show them that he could hump a pack and paddle a canoe with the best of them Frost- McGill: 16.

On his first trip, he spent the winter in the Canadian west, the supreme test of a fur trader, which entitled him to become a member of the famous Montreal Beaver Club Frost- McGill: 12. The motto of this club, emblazoned on the gold medal which he proudly wore, was “Industry and Perseverance”, illustrated by a beaver at work on a tree Frost- McGill: 23. This mentality is reflected in McGill University’s own heraldic crest, which reads: “Grandescunt Aucta Labore” (by work, all things increase and grow). This work ethic was maintained by McGill’s founders, faculty members and supporters such as William Dawson, Donald Smith and William MacDonald. For many of its first years, the university was literally in a survival mode financially, and only the determined faith and persistence of these Scottish individuals saved it from an early failure Hanaway1:xxi.

3. Teaching and Student Life in the Early Years (1829-1855)

The teaching of medicine in McGill’s early days closely mirrored the approaches used at the University of Edinburgh. Instruction was carried out almost exclusively by lectures, and students would spend up to seven hours per day listening to lecture presentations Hanaway1: xxi, 19. Anatomy was the only subject in which students had any laboratory experience Han: 1: xviii. This laboratory experience was considered, then as now, a very strong point of the curriculum Han1:47.

In the initial two years of the four year curriculum, students studied Anatomy, Physiology, Chemistry, Materia Medica (Pharmacology), Therapeutics, and the Institutes of Medicine
Each of these major courses had to be taken for two years Frost:131. This was the first real science most students had encountered, since in their public school experience, they had mainly taken classics, languages and history Hanaway:1:22.

Classes began late in the year by current standards - the first Monday in November - and all of the above subjects were taught five days a week for just six months of the year Hanaway:1:44. All of McGill’s Medical Faculty members were practicing general practitioners, and this teaching load of five lectures per week was no small task in their busy schedule Hanaway:1:49. Then, as now, the prestige of being associated with the medical school compensated for the time spent teaching. The last lecture routinely took the form of an oral examination. A roll call was taken, and those absent forfeited their certificate of attendance. The teachers were paid directly by the students, who purchased a course ticket from each teacher.

The Montreal Medical Institute (the forerunner to McGill’s medical school), had been located at 20 St James Street in the downtown core of Old Montreal which was located along Notre Dame Street near the waterfront of the St Lawrence River.
This location was conveniently close to the Montreal General Hospital and to the homes of the students. When the McGill Medical School was founded in 1829, the lectures continued to be given in the St James Street building, and then at nearby St Georges Street until 1845. Due to an absence of government funding, McGill University had a continuous shortage of money, and every year its deficit increased. Therefore, in 1845, to save on renting quarters in downtown Montreal, the lectures were moved to the newly completed McGill buildings on the University Campus. Unfortunately, the campus, consisting of James McGill’s country estate, was located out in the country to the northwest of the city whose northern limits stopped at Dorchester Street, (now Boulevard René Levesque).

This property was bounded by Dorchester Street on the south, University Street on the east, McTavish Street on the west, and by Dr. Penfield and Pine Avenue on the north. None of these roads actually existed at that time and the estate was out in the open fields. McGill’s country home, Burnside Place, was located on Burnside Street (now Boulevard de Maisonneuve). The street was so named due to its location beside a brook (“burn” in Scottish).
McGill campus

City of Montreal 1830
The new university buildings were located in the northern portion of the campus, some distance north of Sherbrooke Street. They were reached by a dirt driveway which was dusty and rutted in summer and snowbound in winter. The two buildings consisted of the Main Building (now the Arts Building) and a separate east Wing (now Dawson Hall). They were built in the comparatively new style of cut stone and the Arts Building had its famous cupula. In addition to class rooms, the principal and some students lived in the Main Building, while other students and the vice principal, the bursar, and their servants lived in the east Wing.
McGill Campus in 1859 – Arts Building and Dawson Hall

Campus Seen from the Mountain (northwest) in 1852
McGill University continued to have serious financial difficulties. Since the University had always had illusory prospects of government funding which never materialized, they had, perhaps unwisely, never appealed to the general Montreal public for supporting funds. The Montreal General Hospital, on the other hand, had made such appeals and was generously funded from its very beginning. In 1854, lacking other income, the University felt that, in order to maintain its very existence, it had to sell the lower part of its campus below Sherbrooke Street (including James McGill’s family residence Burnside Place). The city of Montreal was growing, and this land had been a major barrier to its westward expansion. It had thus by now become quite valuable.

Having moved to the McGill campus, the Medical Faculty was forced to share the Main (Arts) building with the Arts faculty, whose students and professors were not thrilled about sharing their building with a smelly dissecting room. In addition, the boisterous medical students often disturbed the quiet academic calm of the McGill Arts College.

A second more serious problem for the medical students was the very inconvenient distance between the new location and their downtown homes as well as the Montreal General Hospital. During winter, the roads from Montreal to the rural McGill campus were frequently almost impassable with snow. Each day, the students had to rise before daylight and walk from their downtown lodgings to their 8:00 a.m. morning lecture on campus. One professor took pity on the students and carried as many as possible to school on his sleigh. At noon, the students had to hike back downtown to the hospital for clinical lectures and hospital work, and then needed to return to the campus by for afternoon lectures lasting until 8:00 p.m. Even this was followed by an evening dissection period until 10:00 a.m. The dissection took place in a foul-smelling, unheated, and unventilated room. The room was lit only by candles which barely supplied sufficient light in the surrounding darkness. Finally, in the late evening, the students had to walk home to the city, only to return at 8:00 a.m. for the next morning’s classes. The class prosector routinely continued his work alone in the deserted lab until midnight in order to prepare dissections for the professor’s next morning lecture. He remembered the piercing and vicious shrieks of fighting rats, the thumping of their bodies against the walls and floor of this isolated country building, and the rattling produced by their rush over loose bones. By and large, most of the medical students tried to accommodate to this life without complaining, but the extreme inconvenience was difficult for both students and staff members.

By 1851, student discontent had reached a crisis, and this was compounded by the founding of two other private medical schools which were competing with McGill for students. One of these was the Montreal School of Medicine and Surgery (l’Ecole de Médecine et de Chirurgie de Montréal). This initially bilingual school rapidly became totally francophone and attracted most
of McGill’s French-Canadian students. The other school was the St. Lawrence School of Medicine, founded to take care of the Irish Catholic population Hanaway 1: 34. For the McGill Medical School to survive, it obviously had to move back to the downtown area. To solve the problem, a new Medical building was constructed by three McGill professors on Côté Street and leased to the University Frost 1:143. The St. Lawrence School closed soon after this time. The Ecole de Médecine et de Chirurgie de Montréal, became temporarily affiliated with McGill, and then with the University of Victoria in Coburg, Ontario. Finally it became the Faculté de Médecine de l’Université Laval à Montréal which evolved into the current Faculté de Médecine de l’Université de Montréal.
The McGill Medical Building on Côté Street had two large lecture rooms, an Anatomy and Pathology museum, a 3000-volume library, and a second floor dissecting room with five windows. Teaching was still mainly carried out by lectures, with anatomy dissection being the only laboratory experience.\(^{Hanaway\ 1:36}\)

In 1857, the daily schedule of lectures was as follows: Material Medica (Pharmacology) at 8:00 a.m., Institutes of Medicine (Histology, Physiology, Embryology and Pathology) at 9:00 a.m., Midwifery (Obstetrics and Gynecology) at 10:00 a.m., Surgery at 11:00 a.m., Clinical Medicine and Surgery at 12:00 p.m., Anatomy at 2:00 p.m., Practice of Medicine at 3:00 p.m., Medical Jurisprudence or Botany at 4:00 p.m., Chemistry at 7:00 p.m., and finally Anatomy dissection from 8:00-10:00 p.m.\(^{Hanaway\ 1:38}\) In spite of this arduous schedule, the students found time for some pleasure activities. Each first-year student had to pay a “footing” fee, and each year there was a “footing spree” evening party in the dissecting room. A barrel of beer was brought in, along with cheese and biscuits, and the students spent a hilarious evening along with women of rather “loose” reputation. These footing sprees finally became too rowdy, and the Faculty replaced them with “footing suppers” held in proper restaurants. The house-surgeons of the hospital (i.e. a few specially selected fourth year medical students) were honored guests. These suppers were supposedly alcohol-free, but Dr. Shepherd recalled that the “ginger ale tasted very much like brandy”\(^{Bliss\ 65}\) Much drunkenness prevailed, and battles frequently occurred between the students and with the police.\(^{How:\ 29}\)

In spite of such episodes of frivolity, a medical career was seen as a particularly honorable and responsible calling. Robert Craik, one of McGill’s most brilliant medical graduates, was Demonstrator of Anatomy from 1856-1861.\(^{Hanaway\ 1:166}\) In his valedictory address, he commented on medical practice at the time: “The stern realities of a doctor’s life. What a life of anxious troubled unrest, what exorbitant expectations are made upon his resources, what unthinking demands upon his time and vital energies? By day and by night, sunshine and storm, on work day and the day of rest, for rich or for poor, with or without recompense, he must ever obey the call of suffering humanity.”\(^{Hanaway\ 2:41}\)

The importance of Anatomy for medical students at McGill was understood from its very beginnings. This is partly due to the fact that, Anatomy was the only field in which any real “scientific” understanding had been achieved over the centuries. Physiology was greatly advanced with the work of Harvey in the 1600’s, but only with the tools of the modern scientific revolution of the 1800’s was real scientific knowledge obtained in the fields of Physiology, Embryology, Biochemistry, Microbiology, Immunology and Genetics.

This importance of Anatomy was stressed one hundred and forty years ago in a speech to by Dean George W. Campbell to the medical students in 1869. He stated that: “It will require no lengthened arguments to prove the paramount importance of a knowledge of Anatomy to the
cultivation of the healing art. It is assuredly the only certain foundation of a proper medical education; without such knowledge little progress can be made in the more advanced branches. If structure is not known, disease can neither be understood nor treated scientifically nor successfully. We ought to be intimately acquainted with the nature and structure of the human machine before we intend to repair it. I would advise you therefore, during the first years of your studies, thoroughly to master the details of Anatomy, and these will never be properly impressed upon your memory without dissecting for yourselves, and witnessing the dissections made by your fellow students" How: 12.

In today’s world, this same statement could apply to not only to the gross anatomical structure of organs as seen with the naked eye, but also to the tissues, cells, organelles, and even molecules visualized by light and electron microscopes and other modern tools of cell and molecular biology.

When the McGill medical students attended their first class in Anatomy, they were inheriting a fascinating history accumulated over thousands of years, which included both great traditions and great controversies. Although details of this history are beyond the scope of the present work, it is worthwhile to recall some of the highlights.

4. The Anatomical and Medical Background

a. Anatomy, Medical Therapy, and Training: Prehistory

Anatomy can justifiably claim to be one of the oldest subjects studied by mankind, as documented by cave paintings seen in southern France and Spain around fifteen thousand years ago. One painting shows an elephant with a valentine-shaped heart drawn in its thoracic region, while another shows a bison with arrows pointing to the same region. These images would not only have provided a clear indication of the target for a hunter’s arrows Singer: 1, but would also have highlighted the vital nature of the heart, an earliest rudiment of physiological knowledge.
We now appreciate that a knowledge of Anatomy is essential for the diagnosis and treatment of diseases. But what value might have been placed on such knowledge in ancient times? Some anatomical knowledge would obviously have been useful in the surgical treatment of wounds or bony fractures (Knight: 8). The oldest evidence of surgery goes back to pre-history, e.g. Egyptian excavation sites have revealed strips of bark splints used to splint fractures. There is much evidence of trephination of the skull in various parts of the world (i.e. holes bored in the skull with, surprisingly, subsequent healing). Evidence of this procedure has been found as far back as 4900 B.C., but of course it not known whether it was carried out to relieve intra-cranial pressure or evil spirits (Duffin: 212-13; Hae: 11, 12; Ellis 12).

In any procedure, a breakthrough in new knowledge is often achieved by some technological innovation. In the case of Anatomy, the first innovation was the use of dissection – indeed the very word “Anatomy” comes from the Greek “cutting up”. There is striking evidence of animal dissection even in prehistoric times. A bone carving shows three stages of dissection of a horse’s head, i.e. an undissected specimen, a superficial dissection with the skin and superficial fascia removed to reveal the muscles, and finally the bones of the skull itself. Even at these earliest stages, there was an appreciation of the layered structure of the body (Singer: 2; Knight: 8).

In the earliest stages, therapy for illness was undoubtedly carried out by all manner of self-taught people. With time, two classes of trained individuals developed: surgeons and physicians.

Treatment of wounds or bony fractures was carried out by surgeons. The name “surgery” derives from the Latin word “chirurgia” which in turn comes from the Greek “cheiros” (hand) and “ergon” (work) and designates ‘hand-work’ Hae: 9. The earliest historical evidence of surgery is found in images of circumcision in Egyptian art and in descriptions of circumcision in the Old Testament. Hae: 25, Ellis: 4.

In addition to cutting, surgeons also performed a multitude of other minor services such as bandaging wounds, removal of pus, application of ointments, lancing of boils, treating leg ulcers, patching up fistulas, cautery (heat sealing) of hemorrhoids, and trussing of ruptures.

Treatment of more complex diseases was usually carried out by physicians or their equivalents. These diseases often related to internal regions of the body, and the practice was referred to as “internal medicine”. The practitioners were called “physicians” since they prescribed medicines (physic) as part of their therapy.
In most early civilizations such as Mesopotamia and Egypt, these complex diseases were attributed to supernatural causes. Treatment consisted of appealing to the appropriate god or wearing a magic amulet. A medicine man or priest carried out appropriate magic rituals. Evil spirits were sucked out of the body using evacuation techniques such as vomiting, purging, enema, or blood-letting. Some drugs were used, but these were based on their supposed magical properties rather than on any and most were useless except for their placebo value. In ancient Greece, supernatural medicine was practiced at the shrines of Asclepius. Sufferers would stay overnight in the temple and receive healing in a dream from the God Asclepius or his priest Porter. Because of their association with religion and philosophy, physicians always had a much higher social status than surgeons.

Over time, disease slowly came to be regarded as having natural rather than supernatural causes. This was the beginning of modern rational medicine. Lacking today’s scientific tools, the Greek physicians had no real understanding of the causes of diseases, but they were able to make excellent detailed descriptions of the signs and symptoms occurring during the course of illnesses.

In their quest for understanding, the Greek physicians turned to philosophy, and lacking any appreciation of the importance of scientific method, fabricated concepts purely from philosophical speculation. To the Greek mind, Physiology was more important than Anatomy in the causes of disease. Empedocles (504-433 B.C.) and other classic writers thus speculated that all non-living material matter in the universe consisted of four basic elements: fire, air, water, and earth. In living bodies, these four elements were identified with four constituent humors of the body, and these were in turn associated with four organs. This fire (hot and dry) was identified with blood from the heart; air (hot and wet) with yellow bile from the liver; water (cold and wet) with phlegm from the brain; and earth (cold and dry) with black bile from the spleen. A person’s personality was determined by these humors.

Disease was usually attributed to an imbalance of the four humors in the body, and treatment consisted of remedies to restore this balance. Drugs were not used if possible, although alcohol and opium were used to reduce pain. The main treatment used by these humoral physicians was diet. It was felt that nature itself had a strong healing power, and the physician’s main role was to assist nature in this process. Nonetheless it was also considered very important to expel bad humors from the body by administering emetics to induce vomiting or laxatives and purgatives to cause defecation. Blood-letting by surgeons had the same intention. Patients with serious diseases of the heart, lungs and gastrointestinal tract would have only been made worse by this violent purging by physicians and the blood-letting carried out by surgeons. Many would simply have died quietly from blood, chemical and fluid deficiencies.
This humoral theory formed the basis of most medical treatment throughout the Greek and Roman civilizations. It was especially embraced by the last of the great Greek physicians, Galen, near the end of the Roman Era, and, via his influence, it persisted through the Middle Ages and beyond. Most humeral therapy was based on past practice, and the term “Traditional Medicine” has been applied to this non-scientific therapy which persisted throughout most of the history of medicine until modern times.

As mentioned above, surgery lacked the prestige of internal medicine, and was often regarded as a treatment of last resort. Surgery was seen as a menial skill and practiced by craftsmen who were tolerated as a lower class. According to the Code of Hammurabi in Mesopotamia, if a surgeon was deemed to have caused a patient’s death, the surgeon could have his hands cut off. In Roman times, surgery also had a very low status with the curious exception of dental prosthetic work which had been developed initially by the Etruscans.

In of medical training, both Greek and Roman societies lacked universities as we now know them. Physicians and surgeons were essentially craftsmen and were trained through the time-honored method of apprenticeship. It should be mentioned, however, that some schools and centers of learning did exist in the ancient world, the most noteworthy being that in Alexandria (see below).


In societies in which illnesses were thought to have supernatural causes, knowing the detailed structure of the human body was not considered useful. Therefore anatomical knowledge was extremely poor. In Egypt, bodies were embalmed and internal organs removed and stored in special containers, but this was simply a practical ritual to ensure survival in the afterlife. Embalming was carried out by a special class of priests rather than doctors, and there was no interest in anatomical description. One religious image of an Egyptian fertility goddess shows the uterus and vagina correctly portrayed in a midline position, but a second image shows a uterus and vagina being carried on either side. In Mesopotamia, certain body organs were felt to possess magical qualities of prophecy, and a fairly accurate knowledge of the liver and gall bladder is shown in a clay model used for divination.

Even in Greece, where supernatural medicine and, later, humeral medicine were practiced, it was not thought that treatment of disease required any detailed knowledge of the body, and the study of Anatomy was not considered to be important.
Dissection of the human body was almost never carried out in these early societies. This was partly because it was not considered useful, and partly due to a strong natural revulsion to the idea of cutting up dead bodies. There were also religious taboos based partly on the fear of upsetting the spirits of the dead Duffin 12. Often grave stones were placed over the grave to prevent the spirits from escaping.

During the Golden Age of Greek culture in the 5th century B.C. the magnificent statues indicate a close study of surface musculature, but it appears that the human body was never opened to reveal its internal structure Singer: 14. On the other hand, comprehensive dissections of animals was carried out by Aristotle (384-322 B.C.). He was the first great biologist of antiquity, and the founder of Comparative Anatomy and Developmental Biology. Yet appears that Aristotle never dissected a human body Singer: 20.

Only in the later Hellenistic period of Greek history (300-250 B.C.), away from the dogmatic influence of mainland Greece, did things change. Alexander the Great defeated the Persians and conquered Egypt. In the Egyptian city of Alexandria, located at the commercial crossroads of Asia, Europe and Africa, a more utilitarian attitude brought about great progress in the sciences Hae: 45. Alexander’s general, Ptolemy, declared himself pharaoh and founded a great learning center with a magnificent library of 700,000 volumes Ellis: 24. In this intellectual milieu, Anatomy, based on human dissections, became an acceptable discipline Ack: 65; Hae: 45; Persaud 1:44. Two physicians, Herophilus and Erasistratus, dissected hundreds of bodies and made significant contributions to our knowledge of the skeletal, nervous and circulatory systems Singer: 28. Herophilus gave good descriptions of the eye, brain, blood vessels, and named the duodenum, while Erasistratus noted the existence of separate sensory and motor nerves Ack: 65-67; Hae: 46; Porter: 60.

Unfortunately, this brief episode of discovery declined over the following centuries and ended when Egypt was conquered by Rome. The Romans made virtually no accomplishments of their own in the field of medicine. Medical practice was considered beneath the dignity of Roman citizens, and virtually all physicians were Greek Ack: 69; Hae: 48. The last, and most important, of these Greek physicians living in the Roman Empire was Galen (130-201 A.D.). He stands out, along with Hippocrates, as the supreme figure in ancient medicine Hae: 56; Porter: 61. Galen was a first-rate anatomist, and with him medicine took a great step forward, especially in our knowledge of muscles and bones Ack: 73; Hae: 56; Ellis: 24. The noted historian, Charles Singer, regarded Galen as one of the greatest biologists of all time - a man who made a tremendous contribution to our knowledge of human anatomy during a period of intellectual decline Singer: 47. In Roman times, human dissection had again become strictly prohibited, and Galen was forced to do all of his work on animals, including Barbary apes. In attributing features from these animals to human Anatomy, Galen’s anatomical descriptions of structures often included significant errors.
In addition to his anatomical skills, Galen was a pioneer experimental physiologist. He established the function of the recurrent laryngeal nerves by cutting them and producing loss of the voice. By cutting the brain stem at the medulla he obtained arrest of respiration. Similarly by cutting the spinal cord at certain levels he obtained paralysis and loss of sensation to the regions below. By ligating the femoral arteries he showed that they contained blood whereas previously they had been thought to contain only air. Finally, by tying the ureters he demonstrated that urine was produced by the kidney rather than the bladder.

The great flaw in Galen’s overall physiological contribution came from the fact that he was still unquestionably accepted the Greek humoral theory. In his fanciful scheme of the cardiovascular system, nutrients from the intestines were carried to the liver by the portal vein and turned into venous blood by the addition of a pneuma (“the natural spirit”). Most of this blood travelled via the inferior vena cava to the right ventricle of the heart, and from here, impurities in the blood were carried by the pulmonary arteries to the lungs and exhaled from the body. The purified blood in the right ventricle was distributed throughout the body by ebbing and flowing within the venous system. An additional key feature of Galen’s scheme, however, was that some blood in the right ventricle passed through tiny pores in the interventricular septum to the left ventricle. Here the blood interacted with air which had travelled to the left ventricle from the lungs via the pulmonary veins. This formed a higher type of pneuma (the “vital spirit”) which was distributed to the body through the arteries. Finally, some of this blood which had travelled to the base of the brain, became charged with yet a third pneuma (the “animal spirit”). This was distributed by the nerves (which were thought to be hollow) where it operated the muscles and conveyed sensation. All of this theory was purely speculative and not based on any scientific observation.

The passage of blood across the heart via tiny pores would seem to be a trivial detail, but as discussed below, it led to an ongoing controversy over the following centuries in which more modern anatomical findings challenged the authority of the past.

d. Medical Therapy and Training in the Dark and Middle Ages (400 - 1400 C.E.)

With Galen’s death in 199 A.D., all anatomical inquiry virtually ceased in the Western Roman Empire. With the fall of the Roman Empire in the West in 410 A.D., the barbarians were at the gate, and Medicine and Surgery entered the 1000 year period of the Dark and early Middle Ages. During this period, any semblance of rational medicine disappeared in the western civilized world except in the eastern part of the Roman Empire (mainly Greece and Turkey) and the Arab world. In Western Europe, any remaining Greek physicians left for the eastern part of the Roman Empire. Western Europe came under the grips of a tyrannical Church that was
totally averse to any enlightened progress Knight 14. Any innovative thinking was strongly discouraged by the church and condemned as heresy Hae 69.

Until the thirteenth century, the Arabs were the chief players in this transmission of classical medical knowledge to our world Ellis 31, Porter 66. The most important documents of Greek medicine were translated into Arabic and then later into Latin. Three writers, Avicenna, Hali Abbas and Rhazes played prominent roles. These men were internal physicians, and the Arab world remained especially prejudiced against surgery, which was reduced to a despised handicraft, a necessary evil used only as a last resource Hae 75. Much surgical knowledge that had been learned by the Greeks and Romans was forgotten. For example, the practice of ligating blood vessels to control bleeding was discontinued and replaced by the barbarous practice of using boiling oil or red-hot cautery to staunch the flow of blood Ellis 29.

In Europe, during the Dark and Middle Ages, surgery had the same low status as in ancient times. Under the influence of the Church, the status of the surgery was lowered even further. Some surgery was taught to physicians in the early universities (see below), but then the Church made the pronouncement that “Ecclesia abhorret a sanguine” (the church does not shed blood). Since most university physicians were clergymen, surgery was taken out of their hands and was left to barbers, bath-keepers, hangmen, and traveling artisans of every description Ack 88-89, Porter 205, Hae 80. This emphasized the division of medical therapy into separate castes of physicians and surgeons which remained so injurious for future knowledge.

As in former times, surgeons continued to treat wounds, fractures, ulcers, boils, fistulas and hemorrhoids. In these early days before anesthesia or antisepsis, serious surgical procedures were sharp and short, usually brutal and often lethal Porter 202. Usually they dealt with external regions of the body and avoided internal cavities except in the direst emergency such as caesarian section Porter 202.

One of the most common “surgical” treatments for all ills was the practice of blood-letting. In this procedure, the surgeon opened a vein in the patient’s arm or leg and the leaking blood drained into a special bowl. Those who could afford it often preferred the use of leeches Porter 207. Usually half a liter of blood was drained, but sometimes up to two liters were taken (if the patient had not fainted) Hae 127. Blood-letting provided an excellent source of income for surgeons even until the 1600s Hae 128, Porter 203, 207, 218. One surgeon received one thousand pounds per year for blood-letting at the English court and was also knighted Hae 128. Another common surgical practice was blistering, in which a heated glass cup was applied to the patient’s body. As the air trapped in the cup cooled, it created a vacuum and raised a blister. Another device with several blades was used to lacerate the patient’s skin. These procedures were carried out to create “laudable pus” which was thought to be necessary for any healing process!
The Medieval physicians, like their ancient counterparts, were primarily philosophers, and continued to practice non-scientific “Traditional Medicine”. They built up an extensive speculative system of humoral physiology based on absolutely no experimental data Ack:88. This often involved astrology and proposed that the structure of the human body (the “microcosm”) reflected and was influenced by the structure of the universe (the “macrocasm”). Images were common of “zodiacal man” in which a crudely drawn human figure was surrounded by signs of the zodiac, indicating that different parts of the body were influenced by these astrological configurations Singer:65. Uroscopy was the chief diagnostic tool of the time, and the urine bottle was the professional symbol of the medieval physician Ack:88; Knight:71. Countless subtle variations in the appearance of the urine were noted and correlated to different disorders in the humors Ack:89. Cloudiness at the top level indicated disease in the head region and cloudiness in the bottom levels indicated illness in the legs Knight:71. Such careful examination of the urine undoubtedly impressed the patients but was completely meaningless.

Even into the 1600’s, most physicians still subscribed to the humoral theories. They had not yet become men of science and their patients had not yet acquired any respect for science Porter:119. Of the drugs in a traditional doctor’s bag, almost none were of any real value. Totally ignorant of the causes of diseases, physicians often prescribed the weirdest and most expensive remedies. These included “mummy powder”, supposedly made of unicorn-horn powder and an awful-smelling root called asafetida. These “drugs” were prescribed to be taken under suitable astrological conditions (e.g. during a full moon) and while pronouncing certain charms Hae:127. Medical prescriptions often seemed to rely on their repulsiveness for their effect. Even in 1618, the official London pharmacopoeia recommended bile, blood, claws, cockscomb, fur, sweat, saliva, scorpions, snakeskin, woodlice and spider web as medicaments Will and Ariel Durant: The Age of Reason Begins: 167.

Amongst the general population, superstition was widespread and quackery was extremely successful. One very popular treatment for a wound caused by a weapon was a “sympathetic” weapon salve consisting of mummy powder, earth worms, iron oxide, pig brain, and moss from the skull of a man who had been hanged under the sign of Venus. This salve was applied not to the wound itself but to the weapon that had caused it Hae:131 Ack:127.

Great emphasis was still placed on exhaustive treatments to rid the body of unclean secretions or to correct an imbalance of the four humors Porter:119. These included sweating, emetics (to cause vomiting), laxatives (to cause defecation), cupping, blood-letting, and enemas Porter:132. The enema jug was seen as a necessary part of every household, and it was considered uncouth not to have regular enemas. Louis XIV had more than 200 enemas in his last year, and most members of his court followed suit Hae:12. As mentioned previously, these procedures were worse than useless since they would make the patients anemic, deplete them of fluids and valuable
electrolytes and sometimes poison them with compounds of heavy metals such as mercury and lead \textsuperscript{Porter:14, 124}.

In terms of Anatomy, both physicians and surgeons were especially ignorant of what was going inside the body (i.e. the peritoneal or other cavities). This is because entering a body cavity almost inevitably led to death from infection, and therefore surgical procedures were limited exclusively to the exterior of the body \textsuperscript{Porter:202, Han1:40}. The only exception to the rule of opening a body cavity was to perform a caesarian section in order to save an infant’s life, and this was almost always fatal for the mother.

It must be noted, however, that one “internal” pelvic operation could be performed without entering the peritoneal cavity. This was the procedure of “lithotomy” (cutting for stone) which involved the removal of bladder stones. This operation had been carried out since ancient times. It was dangerous and horribly painful, but the continuous and intense anguish caused by stones often drove patients to extreme measures in attempts to obtain relief. It is recorded that one patient introduced a long nail through his urethra into his bladder and stuck the stone with a blacksmith’s hammer to split it! Another disintegrated the stone in his bladder by nine months of steady work using a fine file \textsuperscript{Ellis 191}. If unable to stand the pain any longer, a patient would ultimately resort the surgeon’s knife. The lumen of the bladder was reached from below by cutting through the perineal region, thus avoiding the peritoneal cavity which was located above the bladder. The lithotomist was usually a self-taught travelling artisan who might perform the surgery in a village square \textsuperscript{Knight: 75}. Without anesthetic, the patient was tied up and held by four strong assistants. The lithotomist would insert his finger into the patient’s rectum and, palpating through the posterior wall of the bladder, he would push the stone downwards. Then he would quickly cut through the perineum between the urethra and anus and remove the stone with forceps \textsuperscript{Ellis185}.

Speed was essential in this horrifically painful procedure, and often the death toll was nearly fifty percent. One of the most famous lithotomists of this era was a travelling French practitioner called Frere Jacques de Beaulieu, the “Frere Jacques” of the children’s song, who wore the habit of a Franciscan friar to ensure safety on his travels \textsuperscript{Hae:146, Ellis: 186 Porter: 219}! Instead of the usual method of cutting through the midline, Frere Jacques did a “lateral cystotomy” in which he cut a couple of centimeters to one side, allowing safer access to the bladder with less damage to the midline organs. He reportedly performed some 4,500 lithotomies. Some centuries later, the famous British surgeon, William Cheselden, perfected this operation in a hospital setting in the 1720’s; he was able to complete the whole operation in less than one minute, reducing the amount of bleeding and shock \textsuperscript{Persaud 2:94, Hae:145, 147 Ellis: 187 Porter: 219}.

Other specialized surgical procedures in the Middle Ages were performed by a variety of travelling artisans. These included “hernia-masters” who reduced inguinal hernias, and “oculists”
who repaired cataracts by pushing the opaque lens out of the line of vision \(^{Porter: 220}\). Finally there were the itinerant tooth-pullers: the precursors of modern dentists, whose promise of painless dentistry is recalled in the wonderful French phrase “Il ment comme un arracheur de dents! (He lies like a tooth-puller)”!

e. Anatomy in the Dark and Middle Ages

While the Middle Ages in Western Europe were noted for some great intellectual advances, e.g. the architectural achievements of the inspired gothic cathedrals, no such progress was forthcoming in medicine. Under the influence of the Christian faith, for a prolonged period of over 1000 years, men viewed life on earth as simply a prelude to the life of eternal salvation. Even death was considered much less important than receiving the last religious rights. There were even instruments to administer baptism to a dying unborn infant within the uterus.

With this philosophy, the body, “a miserable tenement of clay”, was considered unworthy of serious study and anatomical knowledge sank to an all-time low \(^{Singer:63, Ellis:29, Porter 71}\). Even the dissection of a body was thought to jeopardize a person’s salvation since a literal interpretation of Scripture anticipated the resurrection of the soul only from an intact body \(^{Duffin: 18}\).

In the earlier parts of this period, the only remaining pockets of learning were the Christian monasteries \(^{Porter: 71}\). The most famous of these was the cloister of Monte Cassino in Southern Italy, founded in 549 A.D. \(^{Ack:80}\). In terms of medicine, disease was again thought of in supernatural terms, being considered as either punishment for sins, possession by the devil, or the result of witchcraft \(^{Hae:69; Porter: 73}\). Treatment consisted of prayers and the assistance of the saints for miraculous cures.

With the founding of universities in Europe, the teaching of medicine gradually passed from the monasteries to these institutions. The first of these arose in Southern Italy where some traces of classical learning remained. This was the University of Salerno, founded around 1080 A.D. and located near to the original Monte Cassino monastery \(^{Hae:73,75,78; Ellis:29,30; Porter: 73}\).

Since it was now taught in universities, medicine was referred to as “scholastic” medicine. In these institutions, the manuscripts of antiquity were being reintroduced to Western Europe. These were mainly Arabic translations of Greek documents that had been obtained from Christian scholars of the Eastern Roman Empire \(^{Ellis: 32}\). Translations of these Arabic works into Latin provided the main sources of information for Scholastic Europe for many centuries \(^{Singer:68,70; Ack:85}\).
Because, the relatively primitive medieval society was over-awed by the culture of classical antiquity, learning at these universities consisted exclusively of consulting authoritative sources from the past. Any concept of original investigation lay in the future, and observation of nature was wholly neglected Singer:70. If one wanted to know how many teeth a horse had, one consulted a book – there was no question of actually counting a horse’s teeth Hae:71!

In terms of Anatomy, the only accepted source of knowledge was Galen. Although not a Christian, Galen had been a monotheist who believed that every feature in the body had been specially designed by God for his purpose and could not vary. Singer:50; Ack:75. Indeed, for Galen, the creative design seen in the human body was the ultimate proof of the existence of God! Thus, the Christian Church adopted Galen as one of their own. The only teachings accepted were those of Galen, and any contradiction was considered heretical. Since Galen had not worked on human bodies, there were naturally several mistakes in his work, but when such mistakes were revealed in the process of dissection, they were ignored Singer. As is even the case in today’s world, one of the greatest obstacles to progress was the need to overcome the inertia of current orthodox knowledge. When this knowledge was given extra sanctity by religion, the obstacle was even greater. Thus in fear of incurring the wrath of the Church, the furthering of anatomic knowledge was hindered for many generations. Through no fault of his own, Galen was the bad guy in this scenario, and is perceived as having had a huge negative impact on the progress of science for many centuries.

**f. Anatomy in the Renaissance (1400 - 1600 A.E.)**

As the renaissance approached (between 1200 and 1330), universities with medical schools sprung up throughout Europe, especially in Paris (1110), Bologna (1113), Oxford (1167), Montpelier (1181), and Padua (1222) Porter:74. Human dissections were again carried out for the first time in over 1200 years. The church’s ban on dissection was becoming relaxed, and Pope Clement VII finally gave approval in 1537 Porter: 154. Surprisingly, the first dissections, those at Bologna, do not appear to have been carried out for scientific investigation, but were rather mainly for forensic medico-legal purposes since the University of Bologna was primarily a Law School Singer:70; Ack:90.

In most Universities, especially in northern Europe, the faculty consisted entirely of churchmen – in fact celibacy was required for medical men at the University of Paris until 1452 Ack:85 ! There was therefore a Christian bias in such institutions, and instruction consisted exclusively of lecturing from the works of the church’s favorite anatomist - Galen. The Scholastic tradition of authority prevailed. When a dissection was being carried out during a lecture, the professor (the “Chair” of the Department) sat in his professorial chair and read from Galen. It was more of a
ceremony to demonstrate the professor’s learning than an investigative experience. A student assistant pointed out features with a long stick, while a lowly dissector cut up the body. The professor noted the structures described by Galen, and if these were not evident, it was assumed that the body in question was abnormal or possibly had changed from the time of Galen.

For anatomical dissections and teaching, special anatomical theatres were built in various cities including Montpelier (1556), Leiden (1597), and Padua (1595). Since the bodies were not preserved in any way, tissue decay was rapid, and dissections had to be done in haste. Thus the procedure often continued day and night until it was finished. The subjects were mainly executed criminals, for whom dissection was a dreadful part of their punishment. Since the criminals were nearly all male, few female bodies were dissected.

The audiences consisted not only of medical doctors and students but also for scholars in other disciplines as well as invited municipal authorities and other notables of the community. These events were often special civic affairs attended by refreshments and gay festivities. It was felt that every ordinary person could benefit from a knowledge of Anatomy. Since these public dissections only occurred on occasion, scholars might travel from city to city to attend them. Reference is made to such an event in Molière’s “Le Malade Imaginaire” (1673) when Thomas Diafoirus (a medical student of ridicule in this comedy) invites the heroine Angélique to attend a dissection of a woman as a “divertissement”.

This opportunity for the public to attend dissections came to an end when the process of learning anatomy switched from viewing public dissections to private dissection in medical schools. The
dissection of a human body became a rite of passage and the exclusive privilege of medical students. Ordinary citizens could no longer view human dissections, although some dissected specimens remained available in anatomical museums, as described later in this work.

The Renaissance provided an extremely important stimulus to anatomical investigation since the authoritative Scholasticism philosophy was being replaced by the Humanist movement. This placed a new emphasis on man himself, and it was becoming realized that direct observation of nature, rather than “book-learning”, was a valuable source of truth.

Renaissance artists were no longer content to depict the human body in the stilted puppet-like forms of medieval times Knight:17. In attempts to improve their artistic portrayals of the human body, individuals such as Leonardo da Vinci, Michelangelo and Raphael carried out private dissections Hae:96, Singer 90. Then, being less connected to the church, they came to their own conclusions regarding anatomical structures.

Leonardo da Vinci was not only an outstanding artist, but also perhaps the first pioneer scientist in several fields, making many important discoveries. Working in the first years of the 1500’s, he created superb anatomical illustrations of individual dissected regions of the body rather than the whole, and these are closer in appearance to modern anatomical illustrations than any that were produced for several centuries later Persaud 1: 107; Knight:22. Unfortunately, Leonardo kept most of his results secret, perhaps not surprising in an age with no copyright protection. He intended to produce an illustrated anatomical textbook but his collaborator in this work died in 1512. The secret notes of Leonardo were bequeathed to a close friend who hid them for several years. They were then passed to a nephew who did not appreciate their value and they remained unpublished for 200 years Persaud 1: 111! Thus a great opportunity for the advancement of science was missed and Leonardo never had the influence on anatomical progress that he should have Singer 90; Ack:95.
The first truly modern academic anatomist came in the person of Andreas Vesalius (1514-1564). Born in Brussels and trained at the very conservative University of Paris, Vesalius moved to the University of Padua to achieve more freedom in his activities. Here, he abandoned the Scholastic practice of reading his lectures from the professorial chair and descended to the cadaver. Here he carried out his own dissections while lecturing and taught Anatomy as he actually saw it. At the age of 28, he produced by far the greatest treatise in the history of Anatomy. “On the Fabric of the Human Body” was published in 1543, and contained 659 pages, with 277 plates of magnificent illustrations. Vesalius depicts the dissected human body as if the person were still alive! Most of his illustrations show the whole body, in an upright and active position. They are often set against a background of realistic landscapes of medieval Italy, adding to their vitality and relevance to real life. The drawings of Vesalius are superb and are the first ones based on carefully studied dissections (those of Leonardo da Vinci being unknown to Vesalius).

The work of Vesalius is the foundation of modern medicine and the first great scientific achievement in modern times. Vesalius praised original observation and challenged Galenic teachings. Until his time, learning had consisted of slavishly agreeing
with the works of the old masters, i.e. “men saw what they believed” Elllis: 38. For individuals like Vesalius and Leonardo, on the other hand, they learned to “believe what they saw”, and to trust only their own observations Elllis: 38. Vesalius initiated the modern way of thinking based on observation and experimentation, and in one giant step, transformed inquiry from medieval book learning to the beginnings of modern science and research.
Not surprisingly there was bitter opposition from orthodox faculty members since the church continued to enforce adherence to the exact teachings of Galen. Vesalius’s former teacher, Jacques Sylvius at the University of Paris called him “Vesanus” (the madman).

A particular point of confrontation arose over Galen’s mistaken insistence that blood in the right ventricle of the heart passed through tiny pores in the interventricular septum to the left ventricle. In his first edition, Vesalius had cautiously exhibited skepticism about this point. Later on, he expressed even more doubt as to their existence \(^\text{Singer:132, 177; Persaud 2: 76}\). The successor of Vesalius at Padua, Realdo Columbo emphatically denied of the existence of the pores in 1559, but at great risk of being punished by the church. His colleague, the Spanish anatomist and theologian, Michael Servetus, also denied the existence of the septal pores in 1553, and for this heretical teaching, along with other radical theological views, he was burnt at the stake \(^\text{Ack:113; Persaud 2: 7}\).

But if these interventricular pores did not exist, how did the blood reach the left ventricle? Both Columbo and Servetus concluded that the blood passed from the right ventricle to the lungs via the pulmonary arteries, “mingled” with inspired air to rid itself of impurities \(^\text{Singer Biol:107}\), and then passed back to the left ventricle via the pulmonary veins. These authors were essentially describing what we now call the pulmonary circulation but they had no recognition of its importance. They were tantalizing close to the concept of the blood moving in a circular manner, but the great discovery of the circulation of the blood lay in the future several decades later with the work of William Harvey \(^\text{Singer:177 Persaud 2: 79}\).

h. Harvey, the Father of Modern Physiology (1620s)
The greatest milestone in the history of Physiology, came in 1628, when the British anatomist William Harvey proposed our modern concept of the circulation of the blood. Harvey’s publication of “De Motu Cordis” was one of the outstanding achievements in science. In our modern era, we think of this circulation as an obvious feature, but anatomists at the time had absolutely no idea that there was a continuous one-way circular flow of blood through the body. Part of the problem came from the fact that no mechanism was conceived that could power this flow. It appears that the mechanical water pump invented for mining purposes may have suggested such a mechanism to Harvey. Thus he states: “It is plain from the structure of the heart that the blood is passed continuously through the lungs to the aorta just as if it were driven by two water pumps.”

Harvey’s research was a perfect example of the application of observation, experimentation, and logical deductive thinking in the pursuit of scientific progress. Many of the anatomical clues were already in place: The presence of valves in the heart suggested that blood flowed in only one direction. Similarly valves in the veins indicated a one-way flow towards the heart. The expansion of the arteries (pulse) following contraction of the heart was seen to result from blood being pushed into the arterial system from the heart. The amount of blood flowing from the heart into the arteries was so great that it could not all be newly made. Instead it must have been continuously returned to the heart by means of the veins. Putting together all the evidence, Harvey concluded that blood must continuously circulate between the heart and the body by a greater systemic circulation and between the heart and the lungs via a (lesser) pulmonary circulation (previously hinted at by the work of Servetus and Columbo).

By Harvey’s brief tract, the whole modern scientific outlook on the human body was transformed. From now on men began to think in scientific physiological terms even when occupied in purely anatomical study. The use of old terms such as “humor”, “spirit” and “pneuma” began to disappear, and attempts at scientific thinking became the norm. Function was no longer guessed at, and empirical evidence was required to support any new theory. With Harvey, the passive observation of the previous century was supplemented by active experimentation. Medicine moved from an observational to an experimental science.

i. Anatomy during the 1600s and 1700s

During the 1600’s and 1700’s, gross anatomical studies were pursued by anatomists throughout Europe and Great Britain. Cities like Leiden, Paris, Berlin, Dublin, London and Edinburgh became great centers of learning. An anatomy lesson provided by the anatomist Nicolas Tulp to a group
of Amsterdam surgeons in 1632 has been immortalized in the famous painting by Rembrandt Ack 125, Persaud 2:44.

Following the practice of eponymy, hundreds of different investigators gave their names to anatomical structures. Thus Fallopius and Eustachius have their tubes, Willis has his arterial circle, Camper and Scarpa have their fascias, Douglas has his pouch, and Alcock has his canal Persaud 2: 248-249. Even Earnest Whitman, a Chairman of our McGill Department of Anatomy in the 1920’s, has his tubercle (on the edge of the orbit)! In the last one hundred years, this practice of eponymy came into official disfavor. An international committee, the Nomina Anatomica, chose the most acceptable name for any structure, and only a few eponyms are still used today. This has made the anatomical terminology more straightforward, but perhaps some of the romance and history has been lost! At any rate, many names are still familiar to today’s students and especially to older clinicians.
Medical Therapy and Training during the 1500, 1600 and 1700s

In University medical schools, the medical students followed a curriculum of lectures and anatomical dissection. At Oxford or Cambridge, future physicians, students enrolled in a medical course which lasted about 14 years and included a Bachelor of Arts degree. Students studied the ancient works of Aristotle and Galen written in Greek and Latin. If such training seems lengthy, it must be remembered that only a very small percentage of the population had access to these university-trained physicians, who catered to the most wealthy individuals.

Most members of the public were treated by surgeons whose status remained far below that of the university-trained physicians. Most surgeons were in fact barber-surgeons who earned part of their living as barbers. Surgery was also practiced by bath keepers, lay healers of all descriptions, and even hang-men. Unlike the clean-handed, bewigged, and perfumed physicians, surgeons habitually dealt with diseased and decaying flesh, fractures, gangrene, syphilitic chancre, etc. In addition, their instruments, including the amputating saw and cauterizing irons, were terrifying. They were often compared to butchers and torturers.

In these unregulated times, many other individuals felt that they had the right to offer medical and surgical services. These included apothecaries (for the administration of drugs) and midwives.

With the coming of the Black Death (bubonic plague) in the mid 1300’s, the situation had become so serious that governments became involved in health care. This was the greatest medical disaster of the Middle Ages, killing perhaps 25 percent of Europe’s population. Florence lost almost three-quarters of its population at this time. Government committees developed which could impose quarantine, move the sick to isolation hospitals, clean streets, etc.

Medieval Guilds also began to regulate medical and surgical practice. Groups of physicians and surgeons throughout medieval Europe and England formed these guilds, such as the Guild of Surgeons within the City of London formed in 1368. In 1518, King Henry VIII of England established the College of Physicians, which confirmed the legal status of English physicians, and became the prototype for other European countries. In Scotland, King James IV endorsed the Guild of Barbers and Surgeons in 1505 and granted them the use of the corpse of one executed criminal per year for dissection. Similarly, in 1540, the English parliament under Henry VIII united the London Guild of Surgeons with the rival Company of Barbers to form the Corporation of Barber-Surgeons, and made the bodies of four executed criminals available to the new guild. Apprentices in this corporation were required to serve for seven years and then to attend the Barber-Surgeons Hall for examination. Even after...
qualification, members of the Company were obliged to attend lectures and dissections at the Hall Ellis 45.

With their university training, physicians always considered themselves to be better educated than the surgeons. Yet throughout the seventeenth century, the average physician tended to exhibit more sterile theoretical learning than useful clinical skill. In their practice of “Traditional Medicine”, they still used the old methods of bleeding, blistering or purging their patients to an early death. The most conservative medical school of the time was at the University of Paris, whose physicians were parodied in Molière’s great satire, “Le Malade Imaginaire” Ack:126. In this play, Moliere wrote: “One should never say a person died of fever or pneumonia, but rather that he died of four physicians and two apothecaries” Hae:131.

In surgery, an important breakthrough came in the person of a French barber-surgeon named Ambroise Paré Ellis:43, 129. Acting as a battlefield surgeon in the 1500’s, he observed the horrifically painful practice of pouring boiling oil on wounds of men shot in battle in order to cauterize them (i.e. stop the bleeding). This was done in the belief that gunshot wounds were poisonous and this was the only cure. On one occasion, Paré ran out of boiling oil and used instead a mixture of egg white, rose-oil and turpentine. Expecting to find his patients dead the next morning, he found them much better off than other soldiers treated with boiling oil. This was the beginning of the end for the boiling oil treatment and is indicative of Paré’s open-minded approach and his willingness to fight against obsolete surgical practices Hae:110. Single-handedly, Pare reformed the
practice of French surgery. An especially important contribution was his reintroduction of the use of ligatures (abandoned since ancient times) to control bleeding of blood vessels.\footnote{Porter: 206}

A second breakthrough for French surgery came in 1731 when King Louis XV established the Collège de Chirurgie in a splendid new building, and soon after, dissolved the link between barbers and surgeons. In 1768, surgical training by apprenticeship came to an end and was replaced by compulsory attendance at the Collège de Chirurgie leading to a Master’s examination.\footnote{Ellis 55; Porter 221} Surgeons became equal in status with physicians, and, with its accent on practical rather than book learning, surgery was seen as the most progressive branch of medicine. As a result of these changes, France came to lead the world in surgery.\footnote{Porter: 221} During the 1700’s, the image of surgery passed from the manual “cutter’s art” to a liberal science, and it became acknowledged that the surgeons learned their craft on a more rigorous scientific basis than the physicians.\footnote{Persaud 2:280; Porter 217}

Surgical progress did not move as swiftly in Britain. Surgeons in the 1700’s still learned their practice exclusively by means of a seven year apprenticeship, starting at the age of 14. Only at the end of this period, might they take a few anatomy lectures at a university such as Edinburgh. Most surgeons slavishly followed the procedures of their master without questioning, even though the patients often died. Operations had changed little since medieval times.

Things improved in Britain when a number of private Anatomy schools developed in addition to those in the universities. The first of these was founded in 1715 by William Cheselden, the skillful surgeon who had perfected the lateral cystotomy procedure for bladder stone operations (described previously).\footnote{Persaud 2:92; Hae:144 Ellis: 61} In addition, under Cheselden’s influence, the Company of Surgeons split from the barbers in 1745, ending their demeaning association with the latter.\footnote{Porter:224 Ellis 62}
A next advance in anatomical and surgical training in Britain came with the work of two Scottish brothers. William Hunter came to London and entered the new field of obstetrics. This field had been considered the lowly, unqualified labor of midwives, with which most physicians did not want to be associated. In addition, delivering children had long been the exclusive privilege of women and not open to men (A doctor in Hamburg had disguised himself as a woman in order to observe several deliveries, and when discovered, was burnt at the stake!) William Hunter was initially ridiculed as a “man midwife”, but he persisted and turned the field of obstetrics into a scientifically precise discipline under the supervision of doctors. In time he became the darling of London society, catering to the rich and powerful. Initially a surgeon, he was awarded a medical degree from Glasgow University and became physician extraordinary to Queen Charlotte. He also authored a classic book, the “Anatomy of the Gravid Uterus” which was an elegant contribution to the knowledge of embryology Persaud 2: 107,118; Hae 137, 152.

In 1746, William Hunter founded his famous Great Windmill Street School in London Persaud 2: 106, 109. According to his nephew, William was probably the best teacher of anatomy that ever lived. Despite his accumulated great wealth and fame, he worked incessantly and remained devoted to the field of anatomy with a passion matched only by that of his younger brother, John Hunter Persaud 2:119.
John Hunter was the first surgeon to apply the inductive system of observation and experimentation to the study of disease, and he is rightly considered the father of modern scientific surgery Ellis:64. His philosophy was “don’t speculate...do the experiment!”

John Hunter joined his brother William Hunter in London soon after the foundation of the Great Windmill Street School. This school also taught surgery, physiology, pathology, midwifery, and diseases of women and children Porter 225. Over a seventy-year period, this school trained thousands of individuals who ended up practicing all over the world Persaud2:144.

Under John’s direction, each student at the dissected a whole body on his own, a much greater exposure than that received in the university medical schools Hae: 152, Persaud 2: 109. It should be noted that being an anatomist in this era was not the safest of professions. John Hunter’s student and fellow instructor, William Hewson, died in 1774 from a septic wound incurred during dissection Persaud 2: 110.

John Hunter, unlike his bewigged brother, shunned the fancy life of London society, and disliked the pedantic aspects of university learning Herman 326. Nonetheless, he surpassed his brother and became the most famous and innovative surgeon in Britain. He was a key figure in the transformation of surgery from a mere craft into an experimental science Persaud2:120,143; Ellis: 64; Ack: 133; 151-155; Porter: 225.

In 1785, a coach driver was brought to Hunter with a large aneurism of the popliteal artery at the back of his knee (an occupational hazard of this profession as a result of pressure from the upper
The only standard surgical cure for this fatal condition was amputation of the leg above the knee. In these days, before anesthesia and antiseptics, this was a horrific operation in which the patient could die of shock, bleed to death, or die of infection on the filthy ward some days later. Even if he survived, he would be crippled, unable to work, and forced to become a beggar for the rest of his days. Contrary to all contemporary opinion, Hunter felt that amputation might be unnecessary. He had carried out experimental animal studies which indicated that if the femoral artery were blocked off in the thigh, greatly reducing flow to the popliteal artery, there would be enough other anastomotic arteries around the knee to keep the leg alive. The coachman fearfully consented to the operation, knowing that Hunter’s face might well be the last he would ever see. With a strong dose of whisky to dull the pain, the patient was held down by muscular assistants and his leg secured. Hunter then made a five-inch incision in the medial lower thigh, exposed the femoral artery, and tied ligatures around it to stop the flow of blood down to the popliteal artery. To the amazement of his critics, both the coachmen and his leg survived! This instance showed the fundamental clinical importance of anastomoses in the body. In honor of this successful surgery, the anatomical region of the femoral artery became known as Hunter’s Canal.

It was Hunter’s knowledge of Anatomy that saved the day. For most surgeons of this era, a knowledge of Anatomy was considered useful but not a vital necessity. For Hunter, on the other hand, Anatomy was the basis of all surgery. He also continually improved his surgery using the scientific method, i.e. trying out new procedures on animals, and checking the results of his operations in recovering patients or at autopsy.

John Hunter also initiated the field of scientific dentistry in Great Britain. He wrote a major treatise: “The Natural History of the Human Teeth” in 1771 and he coined the terms “incisor, bicuspid, and molar.”

Both medicine and surgery flourished in Britain during the 1700’s, particularly after the union of Scotland and England. The most prestigious British medical school was at the University of Edinburgh. By 1800, this institution had become the world’s foremost medical center while the ultraconservative Oxford and Cambridge Universities remained intellectual backwaters.

The first professor of the Edinburgh Medical School was Alexander Munroe. He helped to found the Edinburgh Royal Infirmary Hospital which made Edinburgh famous throughout the world. Munroe’s lectures became legendary and marked the beginning of a famous teaching dynasty which lasted 120 years, and in which the Chair of Anatomy at Edinburgh was successively occupied by Munroe himself (designated Munroe Primus), his even more famous son, Munroe.
Secundus, and his grandson, Munroe Tertius. If these titles seem a bit pretentious, remember that most of the teaching was still carried out in Latin.

Alexander Munroe Primus was in fact a surgeon by profession, and he began teaching anatomy in 1720 to not only to medical students but also to surgical apprentices (including William Hunter) who were attracted by the opportunities to study surgery at the Royal Infirmary Hospital. He made the study of Anatomy central to the training of physicians and surgeons.

The increased prestige of surgery was reflected in the fact that from 1778 onwards, the Royal College of Surgeons of Edinburgh had awarded its own diplomas which were considered to be as valuable as a medical degree. In the end, the students in the Edinburgh Medical School began to equip themselves with surgical skills. It had long been obvious to some practitioners of both medicine and surgery that the separation of the two disciplines was a mistaken concept based on past pride and prejudice. Now, finally Edinburgh University was turning out a new kind of modern doctor, a general practitioner who was both physician and surgeon.

The Scottish Universities were also innovative in another way. Traditional English medical schools, such as Oxford and Cambridge, had discouraged their future physicians from having any kind of physical contact with their patients. Dressing a wound or cutting someone open was left...
to the menial barber-surgeons. The Scottish doctors, on the other hand, were taught to use a hands-on approach and apply treatment themselves. With their useful knowledge, in contrast to the ornamental learning of their English counterparts, these Scottish doctors came to occupy the majority of medical practices throughout Britain. During the early 1800’s, Scotland had a virtual monopoly on university medical education, and almost 95% of British doctors with a medical degree had been educated in Scotland.

5. Medical Therapy during the Early Stages at McGill (1829-1855)

It is difficult for today’s students to transplant themselves back to the mentality of the medical and surgical communities as well as to that of the general population at the time of McGill’s founding in 1829.

In Europe, at least until the later part of the 1700’s, medical practice consisted of “Traditional Medicine”, with its humeral theories and injurious treatments. This treatment, however was now beginning to change dramatically under the influence of new scientific ideas.

In Britain and North America, on the other hand, medical thinking was not as advanced as in Europe. In the McGill medical school, reflecting its origins from Edinburgh University, all of the medical school faculty members were general practitioners who considered themselves both physicians and surgeons. Even in the 1850’s, medical therapy at McGill was still essentially at the “Traditional Medicine” stage. Essentially, patient care was limited to the treatment of symptoms. On the whole, it was not based on any scientific rationale but simply on past practice. Almost every patient, regardless of diagnosis, was subjected to “evacuation techniques” to release bad humors and poisons from the body. These included bleeding, blistering, emetics, purgatives, laxatives, tonics, mercury, chalk, sweating agents, and local applications to produce counter-irritation. If the medications did not work, they were simply repeated by many doctors at higher doses (this was called “heroic medicine”). Such drastic treatment, often led to an unpleasant death, and caused many patients to fear all medical treatment by their traditional doctors with their “get them poisons out of there!” attitude. Patients were often driven to alternative practitioners such as homeopathic doctors, who at least seemed to cause no harm.

Over subsequent years, it became increasingly evident to many physicians that there was little that their drugs could do for many of their patients’ diseases. Before the twentieth century, infectious diseases dominated over all others, e.g. tuberculosis, syphilis, diphtheria, plague, meningitis, malaria, postpartum sepsis. These diseases ravaged the land with no understanding of their cause. In 1836, cholera epidemics struck the city of Montreal several
times, killing many thousands of citizens (6% of the population) Pasztor. Similarly in 1885, smallpox killed 2% of the population.

Most of the traditional treatments discussed above had no impact on the diseases being treated. William Osler, in his 1892 textbook, cautioned doctors not to engage in useless “heroic” therapies which would only worsen the patient’s condition. Personally, he limited himself to a handful of drugs, and said that for many diseases there was no treatment at all Porter. This did not satisfy many patients, however, who as in today’s world, craved some kind of medical treatment. These patients had to be pleased if the doctor was to remain competitive in private practice Porter. Thus a Kansas doctor stated: “Of course, I left some medicine...this was largely the bunk but someone had to pay for the axle grease, and just plain advice was never productive of revenue unless fortified by a few pills. It did no harm and was evidence of good faith.” Porter. Osler also emphasized the humanistic and psychotherapeutic values of medicine, teaching students that “the good physician treats the disease but the great physician treats the patient who has the disease.” Porter.

In the Montreal General Hospital in the 1890’s, much therapy still simply treated a patient’s symptoms, but it was now recognized that purging did more harm than good Hanaway. Also now there was scientific evidence that appropriate drugs could improve certain clinical conditions: i.e opium and morphine to control pain, choral hydrate as a tranquilizer, and sodium salicylate for arthritis and fevers. For everything else there was alcohol! Brandy, whiskey, rum and gin were used liberally in hospitals and at home to provide patients with a feeling of well-being Hanaway.

Major surgeries at McGill in the 1840’s and 1850’s numbered about thirty annually. These were performed in the hospital amphitheater with all students present. All of the staff members practiced both medicine and surgery, and the surgical and medical patients were intermixed. Common surgical practice included lancing of abscesses, boils, pimplles or running sores; paracentesis; removal of superficial lumps and tumors; burns; frostbite; gangrene; removal of cataracts, removal of bladder stones; tonsillectomy; treating stab-wounds from dueling; ligation of major arteries in cases of trauma or aneurism; and setting and casting of fractures and sprains Hanaway; Porter. Brain surgery was limited to trephining for depressed fracture Hanaway. In the thorax, the only operation was tapping, in which a trochar was used in the treatment of empyema. In these cases the patient almost always died. The abdomen was never opened except inadvertently since this was usually followed by septicemia and death - especially when the surgery was carried out in the hospital. Amputations were carried out for almost all compound fractures as well as for infected knee and ankle joints. The amputation sites usually became infected, and had to be left open to heal (if the patient survived). Paradoxically, in the absence of any real understanding of infection, the appearance of pus was still considered a good sign. This “laudible pus” was considered necessary for the healing process!
6. John Stephenson – McGill’s first Anatomy Professor (McGill: 1829-1842)

As mentioned previously, John Stephenson was one of the medical school’s founders. He became McGill’s first professor of Anatomy in 1829.

At the age of 14, John Stevenson served a medical apprenticeship with another of McGill’s founders, William Robertson, and then travelled to the University of Edinburgh. Upon completing his M.D. degree in 1820, Stephenson undertook a period of study in Paris. At this time, his teacher, the famous French surgeon, Philibert-Joseph Roux offered to repair a medical condition which limited Stevenson’s ability to speak, i.e. a congenital median cleft palate. This was an operation which Roux had never before attempted, and it was to be carried out without anesthesia or antisepsis - normal conditions during this era! Nonetheless, Stevenson agreed to the operation and it was a great success. Stevenson later published the story of this surgery as his doctoral thesis at Edinburgh.

Upon his return to Canada, Stevenson experienced a lack of the stimulating learning atmosphere in Edinburgh, London and Paris. As a result, he initiated the first lectures in Anatomy at the Montreal Medical Institute and then in McGill’s Faculty of Medicine. A singularly attractive personality, he was greatly admired by his students who considered him an able and eloquent
In addition to lecturing and his clinical practice, Stevenson started the Medical Museum collection in 1822, collecting normal anatomical and pathological specimens from the Montreal General Hospital. He also assembled a complete human skeleton which remains on display in our Department of Anatomy and Cell Biology.

Stevenson was also the most important figure in bringing about the incorporation of the Montreal Medical Institute into McGill as its Faculty of Medicine. He was instrumental in fighting for the money legally owed to McGill by the Desrivières family. According to the Honorable Peter McGill, a contemporary, Stevenson was “the man, of all others, to whom we owe the existence of McGill College” Hanaway 1: 147; Ben: 11. He died at the comparatively early age of forty-five, but had achieved more than most men achieve in a long lifetime Frost 1: 127.