The Development of Physical Diagnosis: Historical Perspectives

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ABSTRACT

The history of physical diagnosis started with Hippocrates. History taking, inspection, palpation, and examination of the urine were then the fundamental diagnostic tools. The Hippocratic Corpus and Galen's authoritative theoretical writings dominated medical thinking for over 1,000 years. Clinical examination advanced through Vesalius's and Morgagni's discoveries on human dissection (1543) and pathologic anatomy (1761) respectively. The actual beginnings of physical diagnosis occurred with the discovery of percussion by Auenbrugger in 1760, by Corvisart who popularized percussion in 1808, and by Laennec who invented the stethoscope in 1816. These achievements commenced the development of physical diagnosis.

HIPPOCRATIC SCHOOL

The development of physical diagnosis starts with what our five senses teach. The organs of the senses are "the body's gateways to the mind" according to St. Augustine. For him, sight is the principal sense by which knowledge is acquired; sound is something to be enthralled by; and smell, taste, and touch are created by God and thereby to be cherished. As medicine is a practical science, one relies on the five senses in performing the four methods of physical diagnosis: looking (inspection), feeling (palpation), tapping (percussion) and listening (auscultation). As observers, doctors seek to understand how the senses work. As students, they are taught how to use their senses to interpret the clues they have picked up. [1] As an evolving science, medicine is portrayed in a variety of ways through the subjects ranging from empirical reasoning, anatomical dissections, and treatises to scenes of triumph effected by the "fathers" of medicine. [1] The history of physical diagnosis recounts a rich history of achievements with the use of the senses.

Medical history generally looked at Hippocrates (460-370 BCE) as the Father of Modern Medicine. [2] Through his precepts, medicine became an art, a science, and a profession [3] An enduring contribution of the Hippocratic school was the conviction that disease was a natural process and not by magical causes, superstitions, and the supernatural. As a result, the doctor would no longer be an intermediary with the gods but the bedside friend of the sick. [4] This change was considered to be a major conceptual leap. [3,5] Because if the disease is natural, it could be studied, and its course predicted. This provided significant importance for medical epistemology (What do we know about the disease? What is the basis of knowledge? What are its sources?). [6] *This concept was a necessary prerequisite to the development of physical diagnosis.* [3]

From such a concept (that diseases are natural), medicine became patient-centered with direct observations at the bedside rather than disease-centered. This was referred to as the first incarnation of scientific medicine as bedside medicine. [6] This Hippocratic tradition provided an observation model for medicine invoked as a living force in early

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nineteenth-century Paris when the French capital was the Mecca of the medical world. [7]

The collection of medical writings known as the Hippocratic Corpus consists of about 60 treatises and 42 case histories. The case histories contained in Books I and III of *Epidemics* are by far the most celebrated remarkable records of observations. (8) This is an example of a passage worth mentioning in *Epidemics I* chapter 23. [8] After saying that one should take into account "the nature of man in general and of each individual and the characteristics of each disease", the writer proceeds:

> *Then we must consider what food is given to him and who gives it…, the conditions of climate and locality both in general and in particular, the patient's customs, mode of life, pursuits and age. Then we must consider his speech, his mannerisms, his silence, his thoughts, his habit of sleep or wakefulness and his dreams, their nature and time. Next, we must note whether he plucks his hair, scratches or weeps. We must observe his paroxysms, his stools, urine, sputum and vomit. We look for any change in the state of the malady, how often such changes occur and their nature, and the particular changes which induce death or a crisis. Observe, too, sweating, shivering, chill, cough, sneezing, hiccoughs, the kind of breathing, belching, wind, whether silent or noisy, haemorrhages and hemorrhoids. We must determine the significance of all these signs.*

The cardinal concept of the Hippocratic corpus was that health was equilibrium and illness an upset. [4] Accordingly, humans were believed to be made up of the same fundamental elements that comprise all of the cosmos – fire, water, air, and earth. Furthermore, these elements could have qualities of being hot, cold, dry and/or moist. [9] In the course of digestion, food and drinks are converted into body juices or humors namely blood, phlegm, yellow bile, and black bile respectively. In the Hippocratic Corpus, notably, *On the Nature of Man,* the body was viewed as stable until illness subverted it. An imbalance would produce illness or disease if it resulted in an undue concentration of fluid in a particular body zone. In a sense, the Hippocratic school can be considered the originator of the notion of "homeostasis". [9] The chief role of the physician at that time was to aid the natural resistance of the body in order to maintain equilibrium and to overcome metabolic imbalance through surgery, bloodletting, purges and enemas, baths, ointments, diet, and exercise.

Despite the greatness of the Greek system, the Hippocratic school developed little anatomy and pathology: the sine-qua-non of physical diagnosis. [5] For one, human dissection was a controversial issue during the Hippocratic period. The belief was that human dissection will disrespect the human body or an intact body is needed in life after death. [3] Secondly, there was no incentive for physicians to search for localized signs of a disease as treatment can only be achieved by restoring the previous balance in the body fluids as a whole consistent with the humoral philosophy. [5] Despite this shortcoming, their case studies demonstrated a high level of medicine that included a careful history, inspection, palpation, direct auscultation, and examination of the sputum and urine. [5] Furthermore, one is impressed by the clinical acumen of the Hippocratic school in the face of a nearly complete ignorance of the relation of disease to the localized organ and function of the human body. [9] Thus, the Hippocratic writings support the conclusion of Korn that 'the golden age of physical diagnosis started with Hippocrates." [10]

The Hippocratic school dominated Western medicine for the next 500 years until another Greek came into the scene, Claudius Galen (CE 130-201). He was born in Pergamum (now Turkey) but spent most of his adult life and rose to medical fame in Rome. [9] While Hippocrates was content with careful observation, Galen went further offering anatomical (dissected on pigs and monkeys but not on humans) and physiological accounts of what happened in health and disease. [11] Building on the works of the Hippocratic School, he wrote more than 400 volumes containing over 8 million works on all aspects of medicine: diagnosis, therapy, regimen, and philosophy of medicine. He is a model for conceptual thinking in making diagnoses through the good use of his five senses (smell. taste, hearing, touch, and sight). [12] To cite, with the sense of touch, he introduced sphygmology (the scientific study of the pulse) following the observations and findings of a Greek physician, Praxagoras, (who first established a link between pulsation and disease) and Herophilus (who invented a water-clock to measure pulsation). This was perhaps Galen's single most important diagnostic aid in his repertoire

and the technique to his theoretical expositions of medical practice. [12] Through his whole series of sixteen books on the pulse, he instructs doctors to observe the following: strength, frequency, speed, and rhythm.

Although more than 500 years separated Galen from Hippocrates, Galen acknowledged the achievements of Hippocrates and developed extensive tracts on humoral pathology. which included *On the Black Bile and On the Elements according to Hippocrates*. [13] Aside from Greece and Rome, humoral pathology made its way into Islamic medicine, was adopted by medieval practitioners, and also featured in Ayurvedic medicine in India. Indeed, Greek humoral medicine became the most powerful explanatory framework of health and disease available to doctors and laymen for some 1,500 years until scientific medicine gradually replaced it in the late 19th century. [11]

The power of the Western Roman Empire ended in the year 476 CE. The orderly regime of hygiene, literacy, and medical practice also faded. [13] Ideas and practices of medicine came to be dictated by the church. Autopsy and dissection were still banned. In Europe in the 5th to the 10th century (described as the medieval period), progress in medicine and science virtually grounded to a halt with no organized medicine. The medical practice still followed the precepts of Hippocrates and Galen on humoral pathology. *The physical diagnosis could make little real progress*. [5] However, Europe in the 13th century (towards the end of the early medieval period) witnessed a revival of medical learning from ancient Rome with renewed interest in human dissection. [13] Several events set the stage for lifting the taboo against dissecting the human body (legislative changes, decline of religious teaching, reactions to criminal violence). [14] One of them was an imperial decree by Emperor Frederic II (a former Holy Roman Emperor) in 1238 authorizing the performance of public demonstrations on the bodies of executed criminals for teaching purposes. [3] This paved the way in 1315 for the first recorded public dissection performed by Mondino de' Liuzzi (CE 1270-1326) in Bologna, Italy. The following year, he wrote the first book exclusively on anatomy, *Anatomia Corporis Humani* (Anatomy of the Human Body). [14] The pace quickened with more dissections and more work devoted to human anatomy. Renaissance art [13] contributed to knowledge of anatomy as exemplified by Leonardo da Vinci. [14] However, the influence of Galen and Hippocrates was so great and influential that most medical authorities saw no need to follow the new anatomical findings as well as to think of localized disease and strictly adhered to the principles of humoral pathology. [14]

PADUAN SCHOOL

The Paduan School in Venezia, Italy was quoted by a prominent was quoted by a prominent historian in Medicine, Henry Sigerist, as "the cradle of modern medicine" as it played an extraordinary role in the development of medical knowledge between the 15th and 16th centuries. [15] The year 1543 represents a turning point in the modern history of medicine. Andreas Vesalius (1514-1564), born in Belgium but a professor of anatomy and surgery in Padua, brought human anatomy to the next level of science with the publication of *De Humani Corporis Fabrica* (On the Structure of the Human Body) barely two centuries after the public dissection of Mondino de' Liuzzi and 50 years after Leonardo's drawings. [3,4,13-14] His book was based on his meticulous observation and accurate description in the form of exquisitely detailed anatomic plates. [3,16] He was familiar with the precepts of Galen which dominated the practice of medicine for over 1,000 years and was aware that his precise anatomic observations in *De Fabrica* contradicted many of Galen's zoological cherished tenets. *This publication was pivotal in jolting medicine out of the stagnation of the medieval period* (CE 476CE-1485) *in Europe*. [3,5,13,16] "*Vesalius provided the accurate anatomic base upon which physical diagnosis could be built.*" [17] William Osler called the *Fabrica* the "greatest book ever written from which modern medicine dates." [5]

Despite Vesalius's anatomic dissection, it had only little effect on the advancement of bedside medicine. It was physiology, rather than medicine, that benefited from Vesalius's work. [9,13] There was a revival in physiology with William Harvey's (1578-1657) work on the circulation of blood in 1628. This young Englishman arrived in Padua to further his studies and received a doctorate degree in medicine in 1602. The outstanding discovery of William Harvey is recognized as directly connected with his Paduan education because here he

learned of the existence of the valves of the veins, a unidirectional structure, and a connection between mathematics and research. [9,13] Harvey's classic work was *Exercitatio Anatomica de Motu Cordis et Sanguinis in Animalibus* (Anatomical Essay on the Motion of the Heart and Blood in Animals) commonly referred to as *De Motu Cardia*. He compiled many concepts on the circulatory system some dating back to Greece and Rome and integrated them with some of his theories and evidence. In particular, he understood that there were 2 circulations: from the heart via the lungs and back (pulmonary) and from the heart through the body and back (systemic). [13] This eradicated an existing dogma from Galen that the blood in the left ventricle came directly from the right ventricle through pores in the interventricular septum. [9] Because of his work, William Harvey is considered "the father of modern physiology." [9]

17TH-18TH CENTURY

Gradually in the 17th century, doctors began to distinguish disease on the basis of symptoms. As examples, Hippocrates and Galen had described fever with or without rash and fevers with diurnal variations. [16] Pointing out what makes one disease different from the other based on careful observation and description can be seen as a kind of turning point in clinical thinking. What therefore constitutes a disease? Such a question was raised by an English physician, Thomas Sydenham (1624-1689). The definition of disease by Sydenham established nosology (derived from the Greek words for "disease" and "theory about"). Nosology is the branch of medicine that deals with the concept, definition, classification, and nomenclature of disease. [3]

Oxford educated, Thomas Sydenham was politically a radical (a Puritan, left-wing protestant who rebelled against the Crown in Civil war in England) as well as in his medical ideas. [6] Acclaimed as the English Hippocrates, he called for a rigorous return to observation of the patient using the senses and abandoning theory and pre-established medical systems. [4,6,11,13-14,18] He "first gave clinical observation its place of honor as a scientific method – one which for those who cultivate it effectively is still today a basic asset of the complete physician". [3,19] His prescription for medical practice was simple: medicine is a craft that would progress through the observation of patients and monitoring of therapies. [4] Drawing from his experience in treating intermittent fevers (malaria), his goal was to discover specific therapies. He discovered that quinine (Peruvian or Jesuit's bark) was effective against malaria. Traditionally, conventional remedies were meant to purge the body of the humors, but the bark seemed to cure the disease. This was an example of a first effective specific drug therapy (quinine) for a specific disease (malaria). Such discovery reinforced Sydenham's conviction that *diseases were specific entities and a disease has a specific treatment.* [4,11]His reflection can be seen as a turning point in clinical thinking. [11,13] Eventually, this encouraged doctors to classify diseases, find out the difference between the disease and the person suffering from the disease, and identify the specific therapy. [11] Although he did not totally reject humoral medicine as his practice was still influenced by Hippocrates, he believed that physicians should trust his own independent reasoning based on experience. *This historic development of nosology was fundamental to the evolution of diagnosis.* [14]

Alongside descriptive anatomy described by Vesalius was the start of pathologic anatomy. The great anatomists of the time were now interested in pathologic or morbid anatomy. There was a positive public reaction to autopsies in order to determine the cause of death especially in cases where the cause was undetermined or in criminal cases. Herman Boerhavve (1668-1738) of Leiden was largely responsible for correlating autopsy results with what was found at the bedside. He was a great clinician and a brilliant teacher in the 18th century. Although bedside teaching began in Padua and later brought to Leiden, Boerhaave's made bedside teaching an art form. [3,11] He made daily rounds with his students reviewing the history, inspecting the patient, and examining the urine. The students attended the autopsy of each patient who died to determine the cause of death. His postmortem examinations gave an accurate picture of his observations when his patients were still living. Such observations can be used for early diagnosis and treatment of similar cases in the future.

The next advance was the development of the discipline of pathologic anatomy by Giovanni Battista Morgagni (1682-1771). He received his doctor's degree in Bologna, Italy in 1701. In

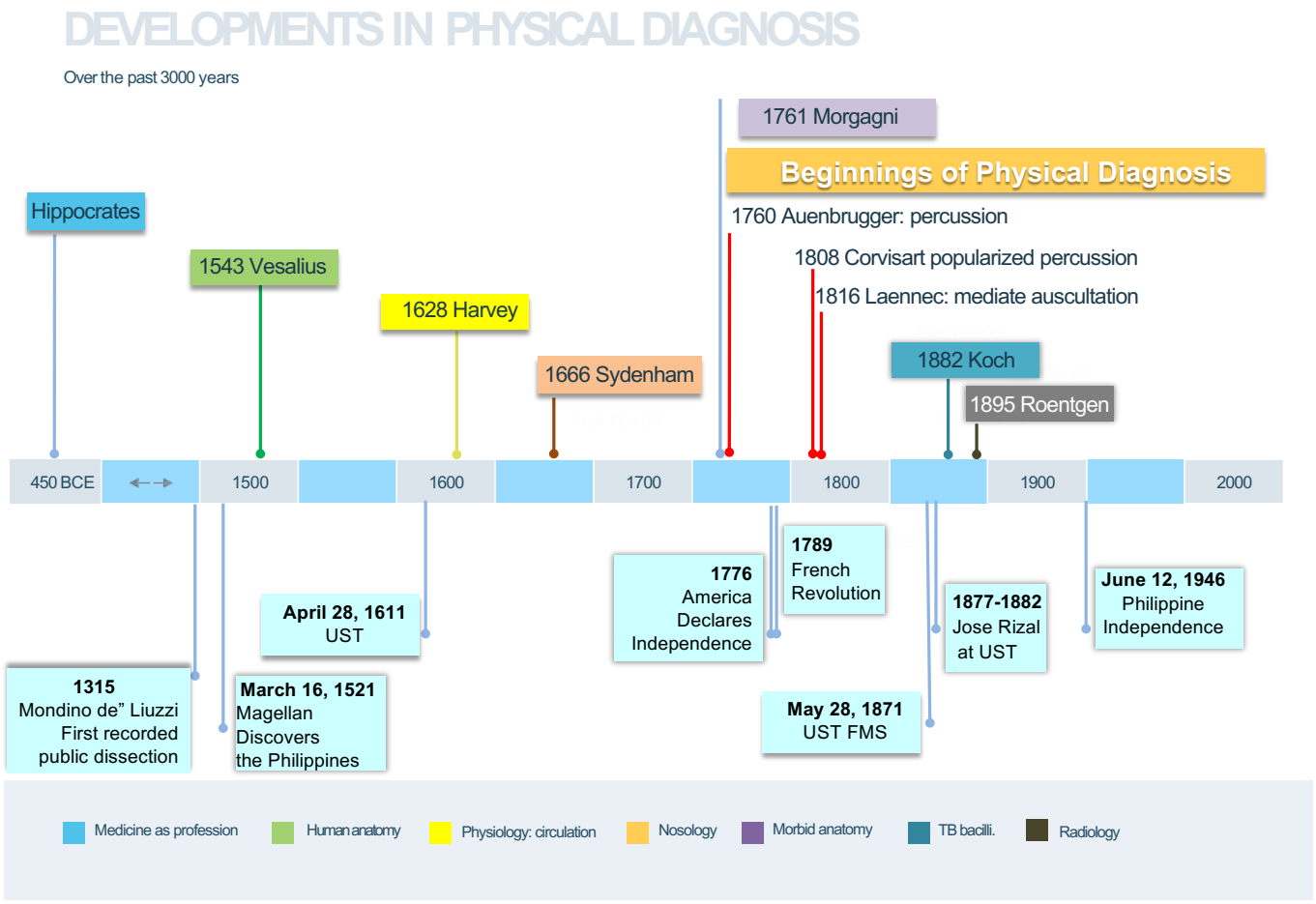

Figure 1. Timeline in the History of the Development of Physical Diagnosis

1715, he was appointed as the first chair in Padua, Venezia thus following the footsteps of illustrious predecessors such as Vesalius. [4,11,14,20] In Padua, he completed a monumental work on pathologic anatomy and published the important work of his life, *De Sedibus et Causis Morborum per Anatomen Indagatis Libri Quinque* (The Seats and Causes of Disease Investigated by Anatomy in Five Books), in 1761 at the age of 79 years. The work was a compilation of his pathologic observations from about 700 autopsy dissections. [20] Most of the patients described in his texts had been treated and ultimately dissected by himself. His pathologic anatomy stands apart from that of his predecessors in the precision of reasoning he applied to the subject.

He introduced the anatomo-clinical method, the correlation of clinical and specific organic lesions identified in the living patient by physical diagnosis and confirmed by postmortem examinations. [21] From these efforts, Morgagni reached a monumental conclusion: *disease had its "seat" in an organ (localized) and that postmortem study should confirm previous clinical observation when the patient was still living*. As a corollary, it elaborated a new concept: that it was the anatomical lesion in an organ (pathology) that leads to dysfunction of the anatomical mechanical device (human body), thus resulting in the expression of the disease (clinical symptoms). [20] His anatomo-clinical correlation served as a major development in the history of medicine as it helped clinicians to diagnose a disease based on history and physical examinations, analyze the prognosis of the disease, and decide the management of the disease. As Rudolf Virchow (known for Virchow's triad) [22] stated, "He introduced the anatomical concept into medicine. His work profoundly influenced the next century of medicine". [4]

The idea of a localized or a specific disease in an organ would not likely catch or impress practicing physicians unless improved tools of physical diagnosis can be discovered. For one reason, the vital organs, those in which disease produced significant morbidity and mortality, are

not accessible to the physician's senses. The heart, lungs, liver, and spleen were encased in bony boxes generally beyond the reach of inspection or palpation. Therefore, new methods *are needed at the bedside to provide objective evidence, and methods that would bring the vital but inaccessible organs to contact with the physician's senses.* [5]. Percussion and auscultation will provide the needed answer to this lack of clinical methods.

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