Laennec and Auscultation

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René-Théophile-Hyacinthe Laënnec invented the stethoscope in 1816 while trying to examine a young female thought to have a heart problem, improving the diagnosis of disease and establishing objectivity in clinical medicine. This invention came while physicians were struggling to correlate post-mortem pathology with clinical symptoms. Until 1816, symptomatology was the only means to diagnosis. The stethoscope not only connected post-mortem findings with clinical findings but also helped identify illnesses that were asymptomatic. Laennec’s invention furthered the study of physiology, and he used it to study the lung and heart. This paper discusses both his life and his pivotal contribution to medicine.

Biography
René-Théophile-Hyacinthe Laennec was born on February 17, 1781 at Quimper, Brittany, the first born in a respectable family. After his mother’s death from tuberculosis in 1786, he and his brother were sent to live with relatives and eventually ended up with Guillaume-Francois Laennec, a physician at Nantes, a second father to them, and a positive influence in René’s life.2

Through his uncle, René received the finest education during the revolution, and got a job as a medical aide in the army at the age of 14. He learned clinical work, surgical dressing, dissections and patient care. By 1799, after 34 months of service, René had decided on a career in medicine. However, the revolution had closed the medical faculty in Nantes, bringing René to Paris for his medical education.3

On coming to Paris, he enrolled in the École de Sante, a school which received a huge boost in surgical studies from Napoleon. He was able to sharpen his clinical skills and broaden his knowledge by studying with some of the best: Jean Nicolas Corvisart des Marets, later Napoleon’s personal physician, and Jean-Noel Halle, professor of hygiene and a mentor.3 It was Laennec’s work with Corvisart that would have implications on his study of the chest and invention of the stethoscope.

Around this time, Laennec became interested in the new science of pathological anatomy. He wanted to connect presenting symptoms with physiological and pathological processes.4 He is reputed to have written roughly 400 case reports during his first few years in Paris, including important information on peritonitis, amenorrhea and liver disease.1 He eventually transferred to École Pratique de Dissection in 1802.

In 1803, he received first prize in surgery and runner up in medicine from the Grandes Écoles of Paris. He was the first to win two awards in one year, an acknowledgement of his skill as a surgeon. Hoping to make more money and use his own organization of pathological anatomy, Laennec started his own anatomy class at the age of 22. He was also working as a ghostwriter on
many medical texts, but stopped when remuneration was scarce.\textsuperscript{5}

In July 1804 he successfully defended his thesis on Hippocrates and his support of pathological anatomy. This successful defense made him part of the Société de l'Ecole, to whose journals he made many contributions. He was still active as editor, contributor and reviewer in the 'Journal de médecine', in which he had been publishing as a student.

Laennec managed to accomplish much at a young age, and had hoped that his research, impressive publications and prizes would garner him a position - but this was not so. He had little political influence as a devout catholic and proud royalist at the time when Napoleon was taking over. It wouldn’t be until 1816 before that dream would be realized.

Following his graduation he pursued work in many different specialties, such as parasitology, pathological anatomy, nosology (classification of disease) and philology (study of ancient texts and authors). He also wrote a two-part treatise on pathological anatomy that was never published. The classification system from this treatise is important because his future work relied on this framework. He tried to distinguish between benign and malignant tissue growth without describing the process behind their production.\textsuperscript{3}

In 1810, he applied for the chair of Hippocratic medicine, but the chair was dissolved in 1811 and he focused on clinical medicine instead. He also found that most of his income came from the care of patients. However by then, he was showing signs of tuberculosis infection, believed to have been acquired through a needle-stick injury during an autopsy in 1803 (he did not acknowledge his illness until the end). He also felt a change of work style would do him good.

He carried on his practice in Paris for a few years and took care of such prominent figures as Napoleon’s uncle before accepting a position at the Necker Hospital in Paris in 1816. His most important contribution to medicine, inventing the stethoscope, would be made there.

In 1819, Laennec published the first edition of his book, entitled De l’Auscultation Médiate. Two years later it was reorganized, translated into English, and published by John Forbes under the title A Treatise on Disease of the Chest.\textsuperscript{2} These books described in exquisite detail many lung diseases, especially tuberculosis. A second edition with many additions was printed in 1826.

Figure 2: Laennec’s stethoscopes\textsuperscript{6}

A few months after the book’s release in 1819, he returned to his native Brittany due to failing health. His health improved and his recognition grew. He became a professor of medicine at the College de France and was put in charge of Hospital Charite in 1822. In 1824, he was made Chevalier of the Legion of Honor of France and was married. His health deteriorated in April 1826 and he returned to Brittany, to pass away in August. His physician may have used Laennec’s own invention to diagnose him, but kept the diagnosis from him until the end.\textsuperscript{3}

Auscultation

As Laennec and others moved toward correlating post-mortem findings with clinical disease\textsuperscript{1}, physical examination became an exciting new area of clinical medicine. Given that Laennec’s mother, uncle, brother and friend Bayle succumbed to tuberculosis, he did considerable investigations in chest medicine. During his early days with Corvisart, he learnt of percussion, which was being re-introduced into medical practice. Percussion was initially introduced by Leopold Auenbrugger in 1761, who applied the
technique to examine a wine barrel towards the thorax, surmising that a normal thorax would resonate, but one filled with secretions would sound low-pitched.

Corvisart used his physical exam findings of percussion to predict postmortem findings before the patient died. He then applied this to the heart and could detect an enlarged heart. He could also discern a thrill, which led him to believe “the palpitations of the heart are sometimes so intense that the sound of the heart can be heard beating against the chest wall”.

Direct auscultation (placing the ear on the chest wall) was another technique (Figure 3). This was known to Hippocrates and extensively used in ancient Greece. However, it was hard to perform this act on obese or heavily endowed females as it was socially unacceptable and unhygienic, and sounds would often be muffled and hard to interpret.

It was only a matter of time before the stethoscope would have been invented. Many glorified tales exist of how Laennec came to create it, but the consensus is that in 1816, he saw a young female presenting with generalized symptoms of heart disease. He was uncomfortable with direct auscultation, so he rolled up a paper notebook, applied one end to the chest, and listened to the heart. He felt that he could hear the heart more clearly than if he had used direct auscultation. He coined a famous double entendre “J’entends,” meaning “I hear and I understand” and named his instrument the stethoscope, from the Greek “to explore the chest”. He subsequently used his invention to identify many pathological lesions within the heart and the lungs.

Laennec needed a very good ear and wide vocabulary to create a classification system for his findings. He described what he heard by creating a common vocabulary to correlate anatomy and pathophysiology for others to use and understand. To describe what he heard, Laennec relied on imagination and the common sounds in nature. Examples include animal voices and pitch, music, and urban life.

In identifying what findings he considered to be a sign of the disease in question, Laennec used the basic concepts underlying sensitivity and specificity. Findings with high specificity (being present with just one disease) were deemed “pathognomonique,” while findings that were of low sensitivity (present in only some cases of a disease) were deemed less reliable. As an example, pericarditis can occur without friction rub, therefore making it not sensitive.

Pulmonary Signs
Although it was cardiac disease that led to the invention of the stethoscope, Laennec’s legacy arises from his work on the lung. Laennec set up the first categorization of these findings. His classification style relied on defining disease by its post-mortem characteristics. For instance, in his time, tuberculosis was defined by presenting symptoms. Laennec defined tuberculosis by the presence of lung caverns (tubercles) on autopsy. He used the stethoscope to identify these lesions
and to diagnose patients earlier, not waiting for late symptoms to give the official diagnosis.

Through percussion and auscultation, Laennec identified the pathophysiology of the cavitary lesions. He believed there was a change in tuberculous ‘matter’ from grey to yellow, which then liquefied (caseation) and expelled through the airways, leaving a cavity (often calcified) at autopsy.\(^5\) He was the first to use his stethoscope to identify tuberculosis in patients who had no signs or symptoms (latent tuberculosis), but had anatomic defects.

Laennec initially believed in a direct, one-to-one relationship between the sound heard and the pathology a patient presented with. He considered pectoriloquy, a change in the patient’s voice heard with a stethoscope, to be indicative of tubercles.\(^4\) Even if the patient did not present with the symptoms, if pectoriloquy was heard, the patient undeniably had tuberculosis.\(^5\) However, he soon realized that all cavities may result in pectoriloquy, but not the converse. By 1817 he thought that bronchiectasis (dilation of the airways) and the second stage of pneumonia (hepatization) also resulted in a similar sound. To maintain his “pathognomonique,” rule, he changed the name of the sound in the latter two lesions to bronchophony.\(^5\) He was initially resistant to this, and so this revision only appeared in the 1826 edition of his book.

Similarly, he claimed egophony was a variant of pectoriloquy but sounded like the bleating of a goat, and believed this to be synonymous with acute pleural effusion, refusing to be challenged. Ironically, he admitted having troubles differentiating between the two.\(^5\) He also believed rales (bubbling or silent respiration) was pathognomonic for bronchitis (1816-17), metallic clinking for pneumothorax with small quantity of fluid, and decreased breath sounds for emphysema (1818). He acknowledged the various sounds of rales, but attributed this to differing sputum color, quantity and texture.\(^5\)

His invention also helped him put physiology into practice.\(^5\) The first time he heard “puerile respiration”, he thought it was a physiologic response to increased oxygen demand in adults, and a normal variant in children. He later realized it was also a sign for asthma, but there was no post-mortem lesion to associate with this. He relied on physiology to explain the clinical presentation of shortness of breath: constriction of the bronchiolar muscles was separate from costal and diaphragmatic movements, leading to decreased air entering the bronchioles and reduced oxygen delivery. Patients had to increase their breathing rates to increase oxygen flow. In those without clinical signs of asthma, hyperventilation secondary to ‘white coat effect’ led to these findings.

**Conclusion**

The stethoscope made it possible to reveal physical changes before the patient died. The discoveries by auscultation of the thorax led to a frenzied search for pathognomonic signs in other parts of the body. The stethoscope allowed physicians to detect asymptomatic lesions and introduced objectivity to clinical medicine, but it shifted the focus of medicine away from the sick person.

Although active in establishing objective signs of disease, Laennec believed that patient’s symptoms were just as important when it came to diagnosis. Even when the stethoscope did not tell him anything, he continued to believe in the possibility of the disease, and paid his patient due respect. The work that Laennec did was indisputably amazing and accurate for his times.

**References**

6. Images from:
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