



Review

Jean Cruveilhier (1791–1874), a Predecessor of Evidence-Based Medicine

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Abstract: This article focuses on Jean Cruveilhier and particularly on his book *Anatomie descriptive*, which was a great success during the author's lifetime. (Notwithstanding this, it is pertinent to point out that the five editions of *Anatomie descriptive* were surpassed in number by others of the Cruveilhier's creations, such as *Anatomie pathologique* and *Traité d'Anatomie pathologique*.) Unlike other texts of the time and later, *Anatomie descriptive* presents the anatomy of the human body in a way that can be applied both by students and medical professionals. The objectives of *Anatomie descriptive* were to make understand how the functions of an organ can be inferred from its structure, and to encourage students and professionals to investigate the anatomical origin of health and disease phenomena. Depending on which sections of the book, the parts of the body were described with morphological, topographic or functional criteria. Many of Cruveilhier's contributions influenced anatomical eponymy and keep today's *Terminologia Anatomica* alive. All of this has made consider Jean Cruveilhier the most outstanding anatomist in France of the first half of the nineteenth century. Due to the scientific rigor Cruveilhier always applied and asked to be applied in the investigation of the anatomic changes linked to pathological processes, he could certainly be considered a predecessor of the objectivity sought by evidence-based medicine.

Keywords: 19th century anatomy; 19th century anatomists; anatomical terminology; anatomo-clinical method; clinical-pathological method; Cruveilhier



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1. Anatomy in the Time of Cruveilhier

The late eighteenth and early nineteenth centuries, so revolutionary in socio-political aspects, marked the end of the Vesalius revolution and the influence of the *naturphilosophie* in the world of anatomy. New exploratory techniques and conceptual changes emerged [1]. We highlight two aspects on the technical side: the thorough study of anatomopathological lesions that, when done systematically, showed specific morpho-functional “systems”, and the experimental induction of lesions to study the morpho-functional consequences. On the conceptual side, both the anatomical–comparative paradigm and the anatomical–tissue paradigm spread. The first one, derived from the comparative zoological morphology of the eighteenth century, had a non-evolutionist orientation during the first half of the nineteenth century which turned into two versions, the speculative and the positive. The speculative version, initiated by J. W. von Goethe (1749–1832) and pursued by some *naturphilosophen*, put embryology at the service of comparative anatomy. The positive version of the anatomical–comparative paradigm—which was supported by zoologists, such as G.

Cuvier (1769–1832), E.-G. Saint-Hilaire (1772–1844), and J.-B. de Lamarck (1744–1829) in the post-Revolution France—became one of the basic disciplines of modern Biology [1].

Under M.-F.-X. Bichat (1771–1802), the anatomical–tissue paradigm was initially sensualist and vitalist—that is, following the doctrine that sensations and perception are the basic and most important form of true cognition, on the one hand, but also the belief based on the premise that living organisms are fundamentally different from non-living entities because they are governed by different principles, on the other—and afterwards it became cellular under F.-G.-J. Henle (1809–1885). M.-F.-X. Bichat studied wide homogeneous components of the organism, the so-called *uniform parts* (*'ta homoiomere'*) by Aristotle (384 B.C.–322 B.C.) or *'tissu muqueux'* by T. de Bordeu (1722–1776). From M.-F.-X. Bichat's sensualist and vitalist mentality arose the concept of *'tissue'* considered a major anatomical unit in the explanation of the physiological properties and pathological changes of the organism. F.-G.-J. Henle, in his *Allgemeine Anatomie* (1841), integrated the concept of tissue into M.-J. Scheiden's (1804–1881) and T. Schwann's (1810–1882) cellular theory [1].

2. L'École de Santé de Paris

The *Révolution française* proclaimed academic freedom and destroyed the whole medical organization of the *Ancien Régime*, in all its healthcare, professional, educational, and institutional aspects. Alleging that disease had to disappear in a well organized society, it also abolished hospitals, faculties (18 August 1792), and academies (1793), including various local *sociétés de médecine* and the unifying *Société royale de médecine* (recently driven by F. Vicq d'Azyr, in 1778), as well as the slightly older *Académie royale de chirurgie* (1731). The latter would awake and merge with the five Academies working in all fields of knowledge and the arts into the *Institut de France* (25 October 1795). After this revolutionary storm, reality imposed. Hospitals were reorganized and became places where physicians co-operated with surgeons in professional equality, opening the way to merge both into a unified profession and an equally unified teaching not under state control, but as civil societies run by municipal administrations.

Three *Écoles de santé* were created in Paris, Montpellier, and Strasbourg (12 April 1794), which would eventually become their respective *Facultés de médecine* (17 March 1808). The initial purpose of the *Écoles* was to train surgeons for the armies of the Republic, but then this training was extended to civil assistance physicians. The new medical education was based on four principles: the fusion of medicine and surgery, as they are two branches of the same science; the setting up of a clinical teaching practice in hospitals; the competitive selection of students and teachers through examinations; and the obtaining of a doctorate of universal value [2–4].

The pedagogy of medical teaching was rebuilt, based on the sensualist paradigm of E. Bonnot de Condillac (*l'Abbé de Condillac*; 1714–1780). In the words of P.-J.-G. Cabanis (1757–1808), friend and follower of Condillac, *"the true instruction of young doctors is not received from books, but at the bedside"*. Thus, the medical student should be trained in chemistry experiments, anatomical dissection, and surgical interventions. *"Read little, see much, and do much"* [5,6].

The *Révolution française* also promoted the foundation of independent higher education institutions. The *Société philomatique* (founded in 1788) served as a meeting point to F. Vicq d'Azyr (1748–1794), J.-B. de Lamarck (1744–1829), M.-F.-X. Bichat (1771–1802), G. Cuvier (1769–1832), E.-G. Saint-Hilaire (1722–1844), F. Chaussier (1746–1828), G. Dupuytren (1777–1835), J.-G. Cloquet (1787–1840), F. Magendie (1783–1855), E.-R.-A. Serres (1786–1868), and A.-A.-L. Velpeau (1795–1867), among others. P.-A. Beclard (1785–1825) was an independent professor before he occupied a chair at *l'École de santé* of Paris in 1818. Private anatomical amphitheaters proliferated. There were up to fifteen in Paris before their abolition in 1813 [3].

In close concord with the revolutionary political changes, but also with the changes in the way of practicing and teaching medicine that occurred not only in France, but also in other countries (in particular, in the union of medicine with surgery and in the need to

perform dissections to better know the human body, a need that emerged from warships and battlefields) it was founded *l'École de santé de Paris* in 1794. In operation since 1750, *l'École pratique de dissection de Paris* is one of the few higher education establishments that has not changed its name from Louis XV to the present day. *l'École pratique de dissection de Paris* was highly appreciated when the events of this historical review occurred because it opposed the practical learning and free discussion that took place in it to the corseted activities of the other educational institutions [7]. These facilities were widened in 1813 by the annexation of the former *Collège de chirurgie* and the purchasing of contiguous buildings [4]. In *La Charité* and the *Hôtel Dieu* hospitals, teaching began focusing on the study of the patient from the bedside [5]. In these hospitals, the coexistence between physicians and surgeons enabled to tie clinical observations together with the anatomical lesions found postmortem. This fact served to develop the anatomo-clinical mentality of the first half of the 19th century and led to the birth of a new discipline: pathology (in France and other countries, but only developments in France are discussed in this review). M.-F.-X. Bichat was the cornerstone of this discipline. To him, the clinical symptoms and their nosographic arrangement should be related to the anatomical lesion that originated those [8]. This idea was initially developed in clinical practice by J.-N. Corvisart (1755–1821) and his disciples R.-T. Laënnec (1781–1826) and G. L. Bayle (1774–1816) [6].

In 1800, the *Société de l'école de médecine* was founded, which was based on the *l'École de santé de Paris*. The *Société*, apart from being a centre of scientific research, served as an advisory body to the French government until the foundation of the *Académie nationale de médecine* in December 1820 [4].

The Revolution also polarized the relationship between professionals and professors [2]. During the *Ancien Régime*, professionals were educated either in the *Facultés de médecine* or in the *Collège de chirurgie*. The rivalry then was between physicians and surgeons. The Revolution brought about another conflict: both the independent professors and the new hierarchies of the hospital (whether they were physicians or surgeons) accused the school/faculty professors of not taking courses or publishing, and therefore questioned whether the new academic hierarchy was qualified enough to teach medicine and surgery [3]. In 1810, the designation of school professors was established by public competition, which was removed by the Restoration (1814–1830) and then re-established again in 1823. Mateo Orfila (born in Mahón, Spain, 1787; died in Paris, 1853), often called the 'father of toxicology', was dean of *l'École de Paris* between 1831 and 1848. He reorganized the *l'École de santé de Paris*, raised educational requirements for admission, and instituted more rigorous examination procedures. He also helped to establish hospitals and museums, specialty clinics, botanical gardens, a center for dissection in Clamart, France, and a new medical school in Tours, France (<https://www.nlm.nih.gov/exhibition/visibleproofs/galleries/biographies/orfila.html>, accessed on 5 July 2023). He abolished the *titre d'Officier de santé* and made mandatory the obtain the *Baccalauréat dès sciences* to achieve the title of *Docteur en médecine*. As a result of Orfila's reform, the access to the membership and chairs of the *Écoles de médecine* was invigorated. Student selection was also competitive [2]. *L'École de Paris* admitted about 300 students each year (a not always respected number), and among them was Jean Cruveilhier (quoted as J. Cruveilhier henceforth) (Figure 1), the most outstanding anatomist in France in the first half of the nineteenth century.



Figure 1. A portrait of Jean Cruveilhier (1791–1874).

3. His Life and Work

J. Cruveilhier was born on 9 February 1791 in Limoges, France [9]. For two centuries, the members of the Cruveilhier family were born and buried in Limoges. His grandfather Joseph (1726–1762) was a master surgeon and his father Léonard (1760–1836) was an important military surgeon, an attending surgeon at *l'Hôpital Saint-Alexis* in Limoges, and also a revolutionary Jacobin fanatic [10]. His mother, Anna Reix was a devout Catholic and extremely pious woman from whom J. Cruveilhier inherited an indelible sense of the catholic mysticism that he maintained throughout his life. His uncle, Jean Reix, was a priest expelled to Spain in 1792 for refusing to take the oath to the Civil Constitution of the Clergy. After his return to France, Jean Reix was the Vicar of the *Cathédrale Saint-Étienne* in Limoges [11].

J. Cruveilhier studied in *l'École Centrale de Limoges* (formerly, the Chapel of the Visitation) and after that, at the *École impériale* where he received an award of excellence and various prizes of honour (Latin, Literature, Mathematics, and Chemistry).

Until 1809, J. Cruveilhier, together with G.-L. Bayle and R.-T.-H. Laënnec, used to frequent the *Congrégation de la Sainte Vierge*, founded in 1801 by the Jesuit J.-B. Bourdier. Against his religious vocation, his paternal insistence led him to begin medical studies in Paris, although he abandoned them because of the disgust and horror he felt at the dissecting rooms. These events exacerbated his religious vocation so that he took refuge at the *Séminaire Saint-Sulpice* to study Theology. There he met D.-A.-L. de Frayssinous (1765–1841), who later became Bishop of Hermopolis *in partibus* and Minister of Public Instruction [12–14]. Again, paternal intervention forced him to resume his medical studies in Paris. As a student, he obtained several prizes (Table 1). He spent his whole intern period at the hôpital *Hôtel-Dieu* along with G. Dupuytren (1777–1835), for whom he developed a great empathy and high admiration, despite their ideological differences. Dupuytren was a Freemason, a member of the *Sainte-Catherine du Grand Orient Loge* in Paris; however, he protected the career of his pupil J. Cruveilhier, despite his independent nature and Catholic devotion [14].

On 24 January 1816, J. Cruveilhier defended his doctoral thesis (Table 2), dedicated to his father Leonard and his master G. Dupuytren. Influenced by the works of M.-F.-X. Bichat and his friend R.-T. Laënnec, J. Cruveilhier showed his special interest in the study of the anatomical lesion [12]. Once he obtained his doctoral degree, J. Cruveilhier returned to

Limoges to succeed his father. He married Jenny Grellet des Prades de Fleurette (1801–1849), daughter of a notable banker from Limoges and the manager of *l'hôpital Saint-Alexis*. In October of that year, the prefect of the Haute-Vienne (France) asked him for a report about the major epidemic of typhoid fever, a disease that J. Cruveilhier called '*enteromesenteric fever*' [15] while masterfully describing the anatomical lesions of the ileum. Between 1818 and 1821, he applied for the direction of the Childbirth Course of the Limoges Hospital and then for the charge of chief surgeon, without any success [11].

In 1823, he took the restored '*Concours d'agrégation*' (competition for professorship) (Table 1) again under the guidance of his father and supported by G. Dupuytren, J. Cruveilhier was the first of the five promoted *agrégés* over the twenty-six candidates presented, among them being A. Velpeau. Following G. Dupuytren's recommendation, J. Cruveilhier chose to be *agrégé de médecine opératoire* (professor of Surgical Medicine) in Montpellier, where he went in July 1824. Nevertheless, this place did not please him and J. Cruveilhier returned to his native town resolved to dedicate himself to the most unfortunate sick people. When everything was ready for this return to Limoges, P.A. Béclard (1785–1825) died. Thereafter, J. Cruveilhier received this message from G. Dupuytren: '*Beclard passed away, come to Paris, you have a chance*' [11,13]. D.-A.-L. de Fraysinous, who was already *Grand Maître de l'Université*, also encouraged him to go to Paris to seat in the Chair of Anatomy left by P.A. Béclard. However, G. Breschet (1784–1845) and J. Cloquet also applied for this position. The designation of J. Cruveilhier was considered as an act of ministerial authority. J. Cruveilhier was received with hostility by the students when he presented at the *grand amphithéâtre* of the Faculty of Paris on 10 November 1825. His personality and sincere modesty quickly conquered his audience [12]. Thinking of his students, J. Cruveilhier began to compose his work *Anatomie descriptive* (see below). Among his partners in *l'École pratique de dissection de Paris* were E.-P.-M. Chassaignac (1804–1879), C.-L. Bonamy (1812–1887), P. Broca (1824–1880) [16–18] and the artist Emile Beau (1810–1872), who also assisted in drawing anatomical atlases by authors such as A.-L. Foville (1799–1878) and his *Traité complet de l'anatomie, de la physiologie et de la pathologie du système nerveux cérébro-spinal* (1844), which is regarded as one of the best works on the subject before the invention of the microscope [19].

In 1826, J. Cruveilhier was appointed chief physician of the hospitals of Paris, which was followed by his success in a series of clinical appointments until 1849. (Table 1). On 12 October 1826, he restored the '*Société d'anatomie*', founded in 1803 by G. Dupuytren and dissolved in 1808 under the chairmanship of R.-T. Laënnec. J. Cruveilhier was its president until 1866 when G. Breschet was appointed [20].

In 1835 G. Dupuytren died. His last volition was to endow funding for the creation of the Chair of Pathological Anatomy of Paris, and designed his disciple J. Cruveilhier as its first holder. Appointment that he accepted. In 1836, G. Breschet succeeded J. Cruveilhier to the Chair of Anatomy at Paris University.

J. Cruveilhier's professional life shared two culminations: a religious devotion to the sick and the development of a rigorously scientific career with many honours [12]. Along with his work at the *Charité* and *Salpêtrière* hospitals, he was involved in a very active clinical practice in Paris under the rules of a very strict ethic that he summarized in his speech *Des devoirs et de la moralité du médecin* (Table 2). J. Cruveilhier founded a charity to help humble people. He had significant customers, national and foreign, and from all social classes to whom he gave equal treatment. When he was invited to be the physician of Napoleon III (1807–1873), J. Cruveilhier answered '*... qu'je le soignerait comme mes maladies d'hôpital*' / '*... I would take after him as I do with my patients at the hospital*'. On a separate occasion, he was advised to make a courtesy visit to the emperor, and so he said: '*... s'il n'est pas malade, ma visite est inutile*' / '*... if he is not sick, my visit is useless*'. Cruveilhier's attitude upset Napoleon III, who vetoed his election to the *Institut de France* [14].

In 1866, at the age of 75 and at the insistence of his family, he retired. He left Paris on 18 September 1870, a day before the siege of Paris by the Prussian forces and went to

Sussac (Haute-Vienne, France) where he died of pneumonia on 7 March 1874. The funeral was held in the church where he had been baptized.

The scientific authority of J. Cruveilhier was widely recognized both in France and abroad. J. Cruveilhier's academic career, distinctions, and prizes are shown in Table 1 (as collected from the *Académie nationale de médecine* [8]; Orcel and Vetter [11]; Androutsos and Vladimirov [12]; Vayre, [13] and Huard, [19]). The only lack in his brilliant career was not to become a member of the *Institut de France* due to the personal veto of Napoleon III [14].

Table 1. Jean Cruveilhier's academic career, distinctions and prizes.

Year	Academic Career, Distinctions and Prizes
1811	Major du concours de l'internat des hôpitaux de Paris
1812	Prix des hospices civils de Paris
1813	Prix de l'école pratique Prix de médecine opératoire
1816	Dissertation
1823	Major du concours d'agrégation en médecine Professeur agrégé de médecine opératoire à Montpellier
1824	Membre associé non-résidant de l'Académie royale de médecine (<i>Académie nationale de médecine nowadays</i>)
1825	Professeur titulaire de la chaire d'anatomie à Paris
1826	Président de la Société anatomique (until 1866) Chef du département de médecine à l'hôpital de la Salpêtrière
1828	Médecin suppléant à la Maison royale de la santé Médecin chef de la maternité de Paris
1830	Chirurgien chef du service des hôpitaux de Paris
1833	Medaille recompense epidemie cholera
1836	Premier professeur titulaire de la chaire d'anatomopathologie de Paris Membre élu de l'Académie royale de médecine
1843	Membre de la Société de chirurgie de Paris
1847	Chef du service de chirurgie de l'hôpital de la Charité
1848	Membre du comité consultatif d'hygiène
1849	Medaille recompense epidemie cholera Chef de service de chirurgie de l'hôpital de la Salpêtrière
1855	Medaille recompense epidemie cholera
1856	Docteur émérite des hôpitaux
1859	Président de l'Académie impériale de médecine (<i>Académie nationale de médecine nowadays</i>)
1863	Commandeur de la Légion d'Honneur
1866	Professeur émérite

Table 2. The Key publications of Jean Cruveilhier (according to Orcel and Vetter [11]; Androutsos and Vladimirov [12]; Vayre [13]; Huard [19]).

Year	Name of Publication
1816	<i>Essai sur l'anatomie pathologique en général et sur les transformations et productions organiques en particulier (2 volumes).</i> Doctorate thesis, Paris
1821	<i>Médecine pratique éclairée par l'anatomie et la physiologie pathologiques.</i> J.B. Baillièrè et fils, Paris
1824	<i>An omnis pulmonum exulceratio vel etiam excavatio insanabilis ? Concours d'agrégation en médecine thesis,</i> Montpellier
1825	<i>Discours sur l'histoire de l'anatomie.</i> Opening lecture of his anatomy course as professor of descriptive anatomy in Paris
1828–1842	<i>Anatomie pathologique du corps humaine, ou descriptions, avec figures lithographiées et coloriées, des diverses alterations morbides dont le corps humain est susceptible (2 volumes).</i> Illustrated Atlas. T.I: 118 plates [82 hand-coloured]; T.II: 115 plates [2 double, 85 hand-coloured]. J.B. Baillièrè et fils, Paris
1829–1836	In the <i>Dictionnaire de médecine et de chirurgie pratique</i> (15 volumes) the following articles: “Abdomen”, “Acéphalocystes”, “Adhérences”, “Adhésions” “Anatomie chirurgicale médicale”, “Anatomie pathologique”, “Artères (maladies des)”, “Articulations (maladies)”, “Entozoaires”, “Estomac”, “Muscles” and “Phlébites”. Ed: Gabon, Méquignon-Marvis, Paris.
1830	<i>Cours d'études anatomiques (2 volumes) chez Béchet Jeune,</i> Paris.
1833	<i>Traité de médecine pratique éclairé par l'anatomie et la physiologie,</i> Paris
1834–1836	<i>Anatomie descriptive (4 volumes).</i> Béchet jeune, Paris,
1835	<i>Deux cas d'anomalie dans la distribution de l'artère brachiale, Bulletins et memoires de la Société Anatomique de Paris, 1835: 2</i>
1836	<i>Académie royale de médecine: Trois rapports sur un mémoire de M. Jules Guérin, relatifs aux déviations simulées de la colonne vertébrale: faits à l'Académie royale de médecine, au nom d'une commission.</i>
1837	<i>Des devoirs et de la moralité du médecin, Discours prononcé dans la séance publique de la Faculté de médecine -de Paris-, le 3 Novembre 1836</i> <i>Académie royale de médecine: Mémoire sur les déviations simulées de la colonne vertébrale, et les moyens de les distinguer des déviations pathologiques, présenté à, le 31 mai 1836 / Précédé de trois rapports faits à l'Académie royale de médecine [par J.Cruveilhier] et suivi des comptes rendus des discussions soulevées à l'Académie à l'occasion de ce mémoire; 2^e mémoire sur les difformités.</i>
1838	<i>Auteurs: Jules Guérin; Jean Cruveilhier</i>
1838	<i>Anatomie du système nerveux de l'Homme</i>
1839	<i>Académie royale de médecine –Rapport fait à cette académie dans la séance du 22 octobre 1839 sur les pièces pathologiques modelées en relief et publiées par le docteur Félix Thibert, auteur d'un nouveau procédé</i>
1841	<i>Vie de Dupuytren. Ed. Béchet jeune et Labé, Paris</i>
1844	<i>Atlas the anatomy of the human body with Constantin L.Bonami y Emile Beau. H. Bailliere, London.</i>
1846	<i>Histoire de l'anatomie pathologique in Annales de l'anatomie et de la physiologie pathologiques (1846), 9–18, 37–46, 75–88.</i>
1849–1864	<i>Traité d'anatomie pathologique générale (5 volumes) J.B. Baillièrè et fils, Paris.</i>
1853	<i>Sur la paralysie progressive atrophique in Bulletin de l'Académie de médecine, 18 (8 March 1853), 490–502 (29 March 1853), 546–584.</i>
1858	<i>Communication a l'Académie impériale de médecine: De la fièvre puerpérale, de sa nature et de son traitement (30 March 1858), 127–155.</i>

4. Medical Work

J. Cruveilhier was at the same time an anatomist, a pathologist, and an experimenter [21]. He was a man with a wide humanist culture [17] who knew about the art of observation and expression; according to [22], this is visible in all his papers, but mainly in two booklets: *Vie de Dupuytren* and the so mentioned above *Des devoirs et de la moralité du médecin*. The latter is considered as a profession of deontological faith in which J. Cruveilhier's sense of duty appears in all its rigour [12].

His observational ability led him to realize the importance of isolation to prevent contagion. Thereby, from his stay in the Maternity and the large number of deaths due to puerperal fever, he encouraged the creation of small clinical units instead of large departments to limit the progression of infections, preceding this way to Semmelweis' concepts on nosocomial infections (1850) [23].

His injections of mercury into the blood vessels and the bronchial system of cadavers led him to support the theory of phlebitis, which, he said, '*dominates the whole of pathology*'. It made possible the concepts of embolism and infarction, which were developed by R. Virchow, beginning in 1846. Yet, while R. Virchow considered the vascular thrombosis to be the primary lesion and the lesion in the venous wall to be secondary, J. Cruveilhier thought that alteration of the venous wall generated the thrombosis [21].

In his doctoral thesis (1816) J. Cruveilhier worked on a methodology based on the correlation of medical history with anatomical causes [23]. He expressed this shift towards a 'scientific medicine', which was taking place in France and other countries, with the phrase, '*Les systèmes passent, les faits restent*' / '*The systems pass and only the facts remain*' [13]. In 1833, in his *Traité de médecine pratique* (Table 1) he justified his particular interest in detailed anatomical studies because of the necessity to simplify this knowledge to develop proper treatments. When J. Cruveilhier was appointed Chair of Anatomy in Paris, there was no laboratory of experimental surgery, so he turned the pavilions of the *l'École pratique de dissection de Paris* into a meeting point for young surgeons and a training centre for new techniques. For more than thirty years, J. Cruveilhier spent his days in those pavilions of *l'École pratique de dissection de Paris*, collecting all the information that allowed him to develop his scientific and anatomical work.

In 1829, J. Cruveilhier began the composition of his atlas *Anatomie pathologique*, with 233 lithographed plates (Table 2), before holding the Chair of Pathological Anatomy in Paris (1836) (Figure 2). These plates were made by Antoine Chazal (1793–1854), French painter, engraver, art teacher at *Muséum National d'histoire naturelle*, and great-uncle of Paul Gauguin (1848–1903). The singularity of *Anatomie pathologique* consisted in showing the information about the clinical cases collected while the patient was still alive and relating them with the pathological findings observed systematically after the postmortem dissection of the same patients' body. This was the importance of the anatomical–clinical method developed in the nineteenth century [6]. In the same way as the comparative anatomy collections existing in the anatomical cabinets of the time, the first collections of clinical-anatomy specimens arose. In *Anatomie pathologique*, J. Cruveilhier made multiple contributions—either by description, by illustration, or both—such as the hypertrophic pyloric stenosis, the ulceration of the stomach due to hyperacidity and the dilation of the veins of the abdominal wall giving the appearance of the head of Medusa [24]; the latter condition was called Cruveilhier-Baumgarten cirrhosis. J. Cruveilhier was particularly innovative in associating the location of intracranial tumors with observed symptoms. Some examples are acoustic neuroma and the intercranial epidermoid, intracranial, and spinal meningiomas. J. Cruveilhier also provided an adequate description of disseminated sclerosis and progressive muscle atrophy [25–29].

J. Cruveilhier's histological knowledge was very limited. He only made a few histological allusions in the fifth volume of *Traité d'anatomie pathologique générale* which was edited by his students. As said above in Subheading 1, the anatomical work of J. Cruveilhier is sensualist, like M.-F.-X. Bichat's. However, J. Cruveilhier's anatomo-pathological work has

aged better than some recent authors' work, despite they were able to take advantage of the use of the microscope [21].

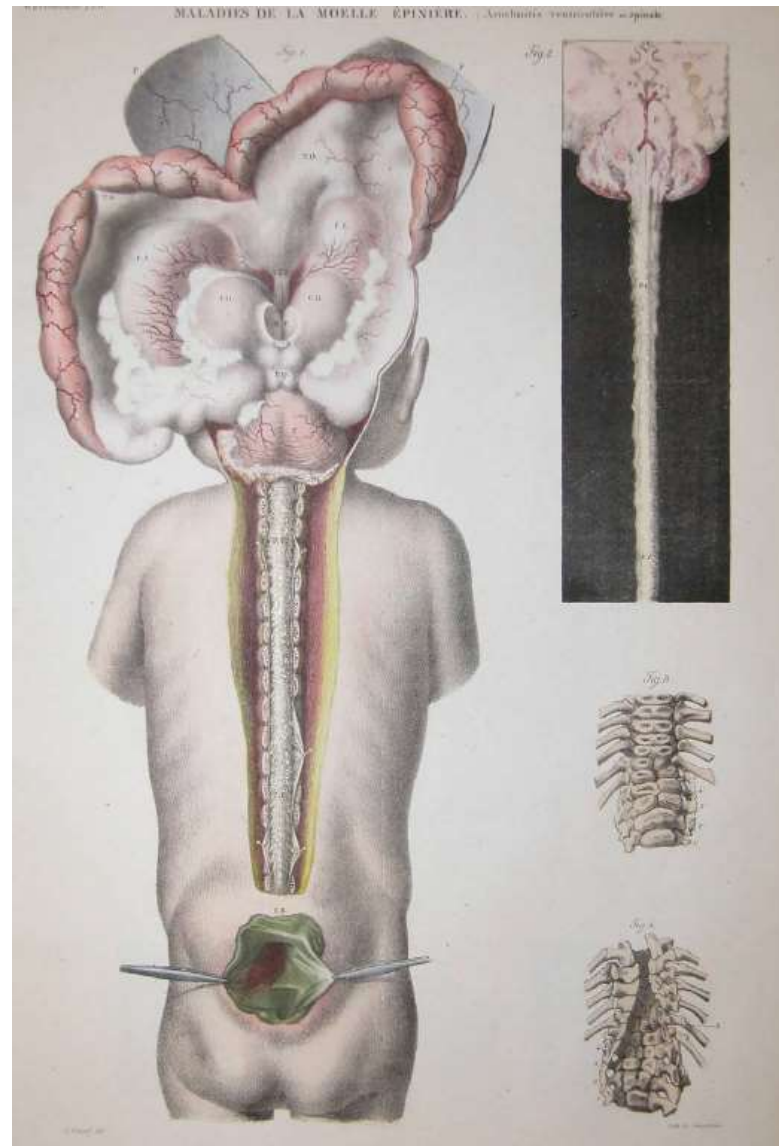


Figure 2. Diseases of the spinal cord: spina bifida and spinal and ventricular subarachnoid meningitis. Coloured lithograph by illustrator Antoine Chazal from *Anatomie Pathologique Du Corps Humain* (Pathological Anatomy of the Human Body) by Jean Cruveilhier, 1842.

Anatomie Descriptive

Anatomie pathologique du corps humain (1828–1842) and *Traité d'Anatomie pathologique générale* (1849–1864) (Table 2) are the best examples of J. Cruveilhier's work nowadays. This is well deserved, as seen above; however, it has obscured the other authoritative book of his authorship that merited multiple editions in his time. It is the case for Cruveilhier's *Anatomie descriptive*, which now is considered one of the best summaries of anatomy of the time [30].

The first edition of *Anatomie descriptive* was published between 1834 and 1836 (Figure 3). It was the result of an enlargement of the 24 lessons of the *Cours d'Etudes anatomiques*, which played an important role in the progress of anatomical studies at *l'École de médecine de Paris*. *Anatomie descriptive* had five editions, with successive variations in title and number of volumes (Table 3). The first two editions were entitled *Anatomie descriptive* and consisted of four volumes each. Édouard Chassaignac contributed to them [16]. The third edition,

published in 1851, also consisted of four volumes, but the title changed into *Traité d'anatomie descriptive*. It was revised by J. Cruveilhier himself and is considered the best and most complete edition of this work [21]. The fourth and fifth editions were reduced to three volumes with figures (Table 3); they involved Marc D. Sée (1827–1912), *professeur agrégé* to the Faculty of Medicine of Paris and his son Edward, who appears in the fourth edition as *aide d'anatomie* and in the fifth edition as *professeur agrégé* at the Faculty of Medicine of Paris.

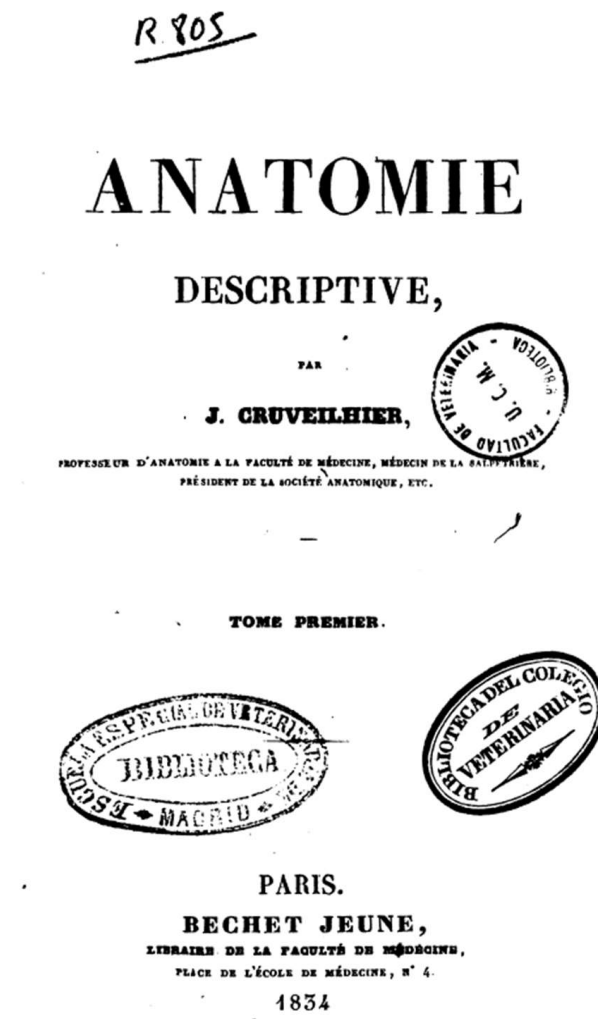


Figure 3. The cover of the first tome of J. Cruveilhier’s masterwork, *Anatomie descriptive*, Paris (1834).

Unlike the anatomy treatises of the time which showed an abstract, dry, and fastidious image of the anatomy, *Anatomie descriptive* was written not only “to exhibit the current state of the science of anatomy”, but also with the aim of teaching an applied anatomy, as it is said on its preface. For this purpose, J. Cruveilhier always added an applicative indication, whether it was functional, surgical, or medical, after the corresponding anatomical description. He tried to impress the student so that from the beginning of its medical studies he understood the immediate applications of the anatomy and dedicated himself fervently to its study. J. Cruveilhier also wanted the reader to understand that the functions of an organ are inferred essentially from its structure: ‘*physiology is nothing more than the interpretation of anatomy*’ (Author’s preface, page XI, first English edition).

Table 3. The main editions of Cruveilhier's *Anatomie descriptive*.

Year and Place of Publication	Title (Edition, Website, Volume, Contents, Year of Publication, Pages)
1834–1836 Paris First ed.	Anatomie descriptive (First edition) Vol. 1. <i>Osteologie, Arthrologie and Dens</i> (1834, 543 pages) Vol. 2. <i>Myologie, Aponeurologie, Splanchnologie (organes de la digestion, respiration, genito-urinaires, de la génération)</i> (1834, 830 pages) Vol. 3. <i>Angéiologie, organes des sens</i> (1834, 539 pages ***) Vol. 4. <i>Névrologie</i> , (1836, 528 pages ***)
1841–1842 London	Descriptive anatomy (First edition) Vol. 1. <i>Osteology, Arthrology, Odontology, Myology, Aponeurology, Splanchnologie</i> (1841, pp: 1–638, 190 figures) Vol. 2. <i>Angeiology, Neurology</i> (1842, pp: 639–1217, 112 figures)
1843–1845 Paris	Anatomie descriptive (Second edition) Vol. 1. <i>Osteologie, Arthrologie and Dens</i> (1843, 615 pages) Vol. 2. <i>Myologie, splanchnologie (organes de la digestion, respiration, genito-urinaires, de la génération)</i> (1843, 764 pages) Vol. 3. <i>Angéiologie, organes des sens</i> (1843, 730 pages) Vol. 4. <i>Névrologie</i> , (1845, 839 pages)
1844 New York	The Anatomy of the Human Body (First edition) 1 Vol. (1844, 907 pp, 302 figures)
1851–1852 Paris	Traité d'anatomie descriptive (Third edition) Vol. 1. <i>Osteologie, Arthrologie and Dens</i> (1851, 620 pages) Vol. 2. <i>Myologie, Description du Cœur et l'Artériologie</i> (1852, 7844 pages) Vol. 3. <i>Veines, Vaisseaux lymphatiques, Splanchnologie (organes de la digestion, respiration, genito-urinaires, de la génération)</i> (1852, 768 pages) Vol. 4. <i>Appareil des sensations, Névrologie and Ovologie ou Embryogénie</i> , (1852, 852 pages)
1862–1867 Paris	Traité d'anatomie descriptive (Fourth edition) Vol. 1. <i>Ostéologie. Arthrologie. Myologie</i> (1862, 860 pages) Vol. 2. <i>Splanchnologie (organes de la digestion, respiration, genito-urinaires), organes de sens</i> (1865, 728 pages) Vol. 3. <i>Angéiologie, névrologie</i> (1867, 712 pages)
1871–1877 Paris	Traité d'anatomie descriptive (Fifth edition) Vol. 1. <i>Ostéologie. Arthrologie. Myologie</i> (1871, 851 pages) Vol. 2. <i>Splanchnologie, organes de sens</i> (1876, 758 pages) Vol. 3. <i>Angéiologie, névrologie</i> (1877, 736 pages)

*** Page numbering is continuous along T3 and T4, T3 pages being 1–526 (index: 527–539) and T4 pages being 527–1034 (index: 1035–1046).

He also wanted the medical professional to be always aware that without anatomy, medicine would always revolve around the same circle of conceptual mistakes (from mechanism, chemism and vitalism) and that “the study of the physiological or healthy state of organisation and of life should precede that of their pathological or diseased conditions” (Author’s preface, page VII, first English edition). J. Cruveilhier wanted students and professionals to get used to investigate eagerly the anatomical reasons for the phenomena in healthy or pathological states, and to comprehend the difference between the anatomical findings and the prior concepts of the philosophical anatomy. It could be said that J. Cruveilhier wrote *Anatomie descriptive* from the scalpel, ‘to exhibit the actual state of the science of anatomy’ (Author’s Introductory page, first English edition). In J. Cruveilhier’s words, ‘All the descriptions have been made from actual dissections. It was only after having completed from nature the account of each organ that I consulted writers, whose imposing authority could then no longer confine my thoughts, but always excited me to renewed investigations wherever any discrepancy existed’ (Author’s preface page XI, first English edition). Thus, J. Cruveilhier rectified the errors transmitted from work to work and year to year by ‘cabinet’ anatomists. His descriptions are usually of a great accuracy, and neither the purity nor the elegance of language are excluded. His first three French editions do not contain figures, just text. Although the concept established centuries ago that illustrations were convenient and necessary on the anatomy treatises for a better comprehension of the findings reported [31], J. Cruveilhier claimed scientific descriptions fix more deeply in memory when they are well written [22].

Numerous J. Cruveilhier’s contributions were collected by the anatomical eponymy of the time, and some of them still remain in the *Terminologia Anatomica* of our days [32]. Some examples are shown on Table 4, as said by various authors [9,16,32–34].

Table 4. Cruveilhier’s eponyms.

Terminologia Anatomica (Latin Language) FIPAT	Cruveilhier’s (C.) Eponimy
A02.1.05.047. Fossa scaphoidea	Cruveilhier fossa ¹ ; fossa navicularis C. ³
A03.2.04.001. Articulatio atlantoaxialis mediana	Cruveilhier joint ¹ ; articulation de C. ³
A03.3.04.010. foramen costotransversarium	trou de conjugaison postérieur de C. ²
A04.1.03.011. Pars alaris Musculi nasalis	muscle pinnal transverse de C. ^{2,3}
A04.1.03.012. M. depressor septi nasi	músculo pinnal radiado de C. ³
A04.3.01.005. M. transversus nuchae	músculo cutáneo suboccipital de C. ³
A04.5.04.016. Corpus anococcygeum; Ligamentum anococcygeum	ligne blanche de Cruveilhier ²
A04.7.02.026. M. adductor longus	m. segundo adductor superficial de C. ³
A04.7.02.027. M. adductor brevis	m. pequeño adductor profundo de C. ³
A04.7.02.028. M. adductor magnus	m. gran adductor profundo de C. ³
A05.3.01.027: Fascia pharyngobasilaris	Aponévrose céphalo-pharyngienne du C. ^{2,3} Aponeurosis pterigo-faringea de C. ³
A05.4.01.014. Tela submucosa	túnica fibrosa de C. ³
A05.7.03.013. Taeniae coli	brides musculueuses de Cruveilhier ²
A08.3.01.021. M. vesicoprostaticus	músculo vésico-prostático, de C. ³
A09.5.02.002. Fascia perinei; Fascia investiens perinei superficialis	Cruveilhier fascia ¹ ; fascia de C. ³
A09.5.03.004. M. transversus perinei profundus	músculo transverso anal de C. ³
A09.5.02.005. M bulbospongiosus	músculo contractor de la vagina de C. ³
A12.1.00.028. Tendo infundibuli	muscle compresseur de la valvule tricuspide de Sappey et C. ²
A12.1.04.006. Cuspides commissurales	Cruveilhier nodules ¹
A12.2.05.011. Arteria meningea posterior (arteria pharyngea ascendens)	artère méningée de C. ²
A12.2.05.036. ramus descendens arteriae occipitalis	artère cervicale postérieure de C. ²
A12.2.08.043. arteria thyroidea inferior	Cruveilhier artery ⁴
A12.2.08.053. arteria transversa colli; arteria transversa cervicis	artère trapézienne de C. ²
A12.3.05.103. confluens sinuum (sinus durae matris)	confluent occipital de C. ²

Table 4. Cont.

Terminologia Anatomica (Latin Language) FIPAT	Cruveilhier's (C.) Eponimy
A12.3.06.012. V. anastomotica superior (V. media superficialis cerebri)	vena de C. ³
A12.3.11.007. V. saphena accessoria (V. saphena magna)	veine saphène accessoire de C. ²
A12.3.11.020. V. marginalis lateralis (V. saphena parva)	veine dorsale externe de C. ²
A12.3.11.021. V. marginalis medialis (V. saphena parva)	veine dorsale interne de C. ²
A14.2.02.010. Plexus cervicalis posterior	plexus de C. ² Cruveilhier plexus ¹
A14.3.03.047. Nervus hypogastricus (N. presacralis)	cordon plexiforme de C. ²
A15.2.07.058. Pars orbitalis (Glandula lacrimalis)	glande lacrymale orbitaire de C. ²
A15.2.07.071. Plica lacrimalis (Ductus nasolacrimalis)	valvule de C. ²

As said by ⁽¹⁾ Bartolucci et al. [31]; ⁽²⁾ Académie Nationale de Médecine [8]; ⁽³⁾ Rodríguez–Rivero [14]; ⁽⁴⁾ Tubbs et al. [32] and Terminologia Anatomica (FIPAT) [30].

Conceptually, J. Cruveilhier's anatomy has Vesalius foundations. J. Cruveilhier skillfully combined what he called '*rapport physiologiques*' with the description of anatomical structures (*Avant-propos*, first French edition). J. Cruveilhier claimed in his work, '*sous le rapport de l'organisation, l'homme est du ressort de l'anatomie*' / '*the organization or structure of a man is the object of anatomy*' and '*sous le rapport des fonctions, l'homme est l'objet de la physiologie*' / '*the vital functions of a man are the object of physiology*'. In line with his eclecticism, he defended the necessity to resort to objects and geometric figures to facilitate the description of bones. Although he was aware of the inaccuracy of this procedure, so often used by the ancients, J. Cruveilhier claimed not to proscribe it entirely from science ('*si familier aux anciens, ne saurait être proscrié entièrement de la science*') [30]. J. Cruveilhier followed the of-the-time typical way of describing the body, which outlined the anatomical parts and their morphological accidents, sometimes with a topographic order and sometimes with a physiological order. Thus, he preferred the topographical order for myology but the physiological order for splanchnology. Whatever the structure employed, Cruveilhier always graduated from less to more difficulty in studying the structures described, '*for the great aim in a work of instruction should be to conduct the mind gradually, from simple and easy objects to those which are more complicated*' (Page 6, English edition). Besides, to facilitate dissections, J. Cruveilhier provided in his work summaries of the best way of preparing the organ before explaining it in depth. In many respects, J. Cruveilhier was a great follower of S.-T. Sömmerring. For this reason, many of the lines of work pointed to in S.-T. Sömmerring's work were further developed in *Anatomie descriptive* [30].

J. Cruveilhier's interest in the nervous system shows to what extent he was concerned about the problems of the anatomy of his time: '*de tous les organes, il n'en est aucun dont la structure excite davantage notre curiosité, et malheureusement, il n'en est aucun dont la structure soit enveloppée de plus épaisses ténèbres*' / '*the structure of no other organ in the body excites so much curiosity, and, unfortunately, there is none whose structure is involved in greater obscurity*'. J. Cruveilhier's neuroanatomical observations, being of great interest, surely deserve a review apart from the brief one made in this article.

J. Cruveilhier separated '*de l'appareil locomoteur les muscles de la face; ces muscles, aujourd'hui mieux connus, constituent un appareil musculaire spécial lequel nous plaçons en tête des organes des sens*' / '*of the musculoskeletal system the muscles of the face; these muscles, now better known, constitute a special muscular apparatus, which we place at the head of the sensory organs*'. Muscles to which J. Cruveilhier specifically intended to dedicate the second volume of his *Anatomie descriptive du système nerveux de l'Homme*.

Meanwhile, J. Cruveilhier needed to contribute to the then current lines of work about the explanation of the anatomy of the adult human body by both *l'anatomie du fœtus* and the comparative anatomy ('*anatomie de l'évolution*'). He rarely dealt with '*that species of induction and analogical reasoning which, in a great measure, constitutes philosophical anatomy*', which he considered made of '*views almost always ingenious, but usually bold and speculative*' (Author's preface page XI, first English edition).

The English edition of Cruveilhier's *Anatomy* (Table 3) was published in London and had two volumes, and the first came to light in 1841, while the second did in the following year. It was translated by Dr. W. Herries Madden (?–1883) and reviewed by Prof. W. Sharpey of University College of London. This English edition encompassed 1232 closely printed pages and upwards of 300 illustrations. It is striking that this edition had illustrations while the French edition did not. As stated in the prelude to the English edition: *'The illustrations have been selected with great care from the best source, which will be duly acknowledged. For the selection of these illustrations, and for superintending their execution, as well as for much valuable assistance in preparing the work, the Editor begs to express his obligations to Mr. John Marshall'*.

The American edition (Table 3) was published in New York in 1844, and it was a partial translation of the second French edition. It was edited by G. S. Pattison, Professor of Anatomy at the University of New York, and Member of the *Société philomatique de Paris*. In the Editor's Preface, G.S. Pattison wrote *'Since the English edition of J. Cruveilhier has been published in London, the first and second volumes of a second edition of the work have been published by the author in Paris. The editor has carefully compared the second edition with the first, so far it has been published, and has incorporated in the American edition whatever he thought could increase its value. He has, however, only followed the second edition when he thought that the changes introduced were improvements'*. Pattison did not like the modifications that the second French edition incorporated in the myology section, the reason he kept the description of the muscles of the first French edition on his American edition. G.S. Pattison also noted *'... in the original work there are no engravings; this is a great desideratum, which has been removed in the English edition by the introduction of numerous woodcuts, selected with care from the best anatomical engravings, and marked with letters of reference. This greatly enhances the value of the work'*. And finally, he pointed out *'Systems of Anatomy generally offer little interest except to the anatomical student. This cannot be said of the system of Anatomy of Cruveilhier. It embodies a fund of information, in connexion with Physiology and Pathology ...'*

5. Conclusions

By the early 19th century, the key gross parts of the human body, considered within the Enlightenment man–machine paradigm, had been described and classified primarily through the dissection of human cadavers. As a result, anatomy was the first of the so-called 'basic' sciences throughout the 19th century, and there was no medical school in which anatomy was not thoroughly taught. During that century, France was one of the main actors in a particularly brilliant period in terms of the teaching and organization of medicine, which has been attributed to the intellectual freedom directly inherited not only from the Enlightenment but also from the Revolution. Several events allowed the development of the anatomic–clinical method and led to the birth of a new discipline, pathology. The first holder of the Chair of Pathological Anatomy in Paris was Jean Cruveilhier.

Jean Cruveilhier's anatomical work, similar to M.-F.-X. Bichat's, was sensualist. His six volumes on anatomical pathology were a perfect testimony to the use of the anatomic–clinical method during the 19th century, on the one hand, and laid the foundations for the birth of pathology as a medical specialty, on the other [33]. Jean Cruveilhier's pathological work eclipsed his contributions to descriptive, gross anatomy. He published these contributions to gross anatomy in his work *Anatomie descriptive*. Many of Jean Cruveilhier's contributions to descriptive anatomy were initially collected by the anatomical eponymy of the time, and some of them remain in the *Terminologia Anatomica* of today.

Anatomie descriptive was written with two targets: firstly, *'... to exhibit the actual state of the science of anatomy'*, and, secondly, to teach an applied anatomy. For Jean Cruveilhier, *'... anatomy forms the first link in the chain of medical science'*. As highlighted in Jean Cruveilhier's preface to *Anatomie descriptive*, *'... anatomy being the basis of medical science, we would greatly misapprehend its nature, did we not consider it the chief of the accessory sciences of medicine'*.

Besides, *Anatomie descriptive* offers all the clues of what descriptive anatomy will experience later. All this means that Jean Cruveilhier is recognized today as one of the

most outstanding French anatomists in the first half of the 19th century. His work *Anatomie descriptive* is considered one of the best anatomical treatises of the time.

Finally, —and not only because of Jean Cruveilhier’s scientific contribution but also because of the rigor that he always applied and that asked to be applied in the investigation of anatomico-clinical events linked to individual and systematic pathological processes—it is our contention that Jean Cruveilhier was a precursor of objectivity and applicability sought by evidence-based medicine today. Jean Cruveilhier, in parallel with other authors of the time, found a way to apply the scientific method in its practicality to cure patients and reform the teaching of medicine. Not using an abstract and theoretical deduction, but from direct observations beneath the bed, or in the operating room, or in the dissection room. This is the substance of Jean Cruveilhier’s excellence, in the opinion of the authors of the present article.

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