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Cahier de feuilles d'autopsies pour l'étude des lésions du névraxe, by J. Dejerine

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ABSTRACT

The anatomoclinical method underwent intense development during the 19th century. Its main contributors were Bichat, Cruveilhier, and Laënnec. The Société Anatomique de Paris and its well-known Bulletins also had a major influence on the development of this model. By the 20th century, the anatomoclinical method had come to play a crucial role in medicine, and important advances came from the Austrian and German schools. In neurology, the anatomoclinical method was promoted by Charcot most of all as he and other researchers conducted studies on cerebral localisation. This article is a commentary on Dejerine's *Cahier de feuilles d'autopsies pour l'étude des lésions du névraxe*, a topography of nervous system lesions providing descriptions and illustrations of different cerebral localisations. In his book, Dejerine describes a series of sections and the method he applied in anatomical pathology studies; he also establishes correlations between anatomical lesions and their clinical manifestations. *Cahier de feuilles d'autopsies pour l'étude des lésions du névraxe* is remarkable as a clear, precise, and systematic treatise on nervous system lesions.

KEYWORDS
Anatomical pathology, Joseph Jules Dejerine, nervous system, anatomoclinical method

Introduction

In *De sedibus, et causis morborum per anatomen indagatis* (1761), Giovanni Battista Morgagni (1682-1771) established a correlation between clinical manifestations and anatomical lesions by introducing the anatomoclinical method in medicine.[1,2]

Subsequent contributions by Xavier Bichat (1771-1802), Jean Cruveilhier (1791-1874), and René Laënnec (1781-1826) were crucial for developing this clinical concept of anatomical pathology. In 1803, the French capital witnessed the founding of the *Société anatomique de Paris,* where clinical cases were presented with the corresponding anatomical samples and discussed to corroborate the findings. The Société's *Bulletins* were published from 1826 to 1898.[2,3]

Anatomical pathology became a fundamental part of medicine and the Second Vienna Medical School grew to be one of the main international academic centres under the directorships of Karl von Rokitansky (1804-1878) and Joseph Skoda (1805-1881).[2]

Von Rokitansky laid the groundwork for anatomoclinical correlation in medicine, which was mainly based on systematically performed clinical autopsies linked to each subject's medical records. He personally performed more than 30 000 autopsies at the Wiener Allgemeine Krankenhaus and introduced the modern concept of pathogenesis. Between 1842 and 1846, Von Rokitansky published *Handbuch der pathologischen Anatomie* in three volumes; the treatise was highly influential at that time.[2]

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Rudolph Virchow (1821-1902) revolutionised medical and scientific thought in Berlin by applying cell theory to anatomical pathology using microscopic examination (histopathology) and recognition of cellular alterations to give rise to the field of cellular pathology (*omnia cellula e cellulae*). In this line, his books *Die Cellularpathologie* (1858) and *Die krankhaften Geschwülste* (1863-1865) are fundamental for establishing the scientific basis of modern anatomical pathology.[2]

At the same time, autopsy techniques became more systematic and standard, and the methods developed by von Rokitansky, Virchow, Ghon, and Letulle remain in use today with a few modifications.[4]

In the late 19th century, knowledge of the nervous system started to expand with the heyday of the anatomoclinical method and studies on cerebral localisation by such authors as Charcot (1825-1893), Broca (1824-1880), Wernicke (1848-1905), Dejerine (1849-1917), and Marie (1843-1940), among others.

The main promoter of the anatomoclinical method in the field of neurology was Jean Martin Charcot (1825-1893).[5] The first step in this method consisted of documenting clinical signs using longitudinal observation. The second step was performing the autopsy examination of the brain and spinal cord to identify anatomical lesions and establish any correlations to the subject's clinical manifestations.[6]

19th century techniques for sectioning the brain

During the 19th century, the most important anatomists used various techniques for macroscopic studies of the brain. Virchow's method, the most widely used, consisted of separating the two hemispheres by sectioning the corpus callosum; this permitted a full view of each of the lateral ventricles. Just beneath the posterior corpus callosum, the anterior and posterior corpora quadrigemina and the pineal gland can be observed. The vertical section continued downwards to reveal the two cerebellar hemispheres showing the forth ventricle and the cerebral aqueduct.

The French method, conceived by Albert Pitres (1848-1928) was more suitable for locating brain injuries and also facilitated microscopic examinations of such lesions. This technique consisted of separating the two cerebral hemispheres after removing the pia mater and immediately performing two coronal sections: the first, 5 cm anterior to the Rolandic fissure and the second, 1 cm anterior to the parieto-occipital sulcus. This way, each hemisphere was divided into 3 sections: prefrontal, occipital, and frontoparietal. The last was subdivided with another four cuts: pediculofrontal (at the bases of the frontal convolutions), frontal (ascending frontal convolution), parietal (ascending parietal convolution), and pediculoparietal (at the bases of both parietal lobes).

This method was modified by Carl Wilhelm Hermann Nothnagel (1841-1905). After separating the two hemispheres, that researcher divided each of them using partial incisions running top to bottom and parallel to the Rolandic fissure. The starting point of the incision was the genu of the corpus callosum. In all, six incisions were made with the centrum ovale between two of them. These incisions resulted in seven regions named as follows: pars occipitalis, pars parietalis, pars posterior, pars centralis anterior, pars frontalis posterior, pars frontalis media, and pars frontalis anterior. The Pitres-Nothnagel method was the one most frequently used to study internal lesions.

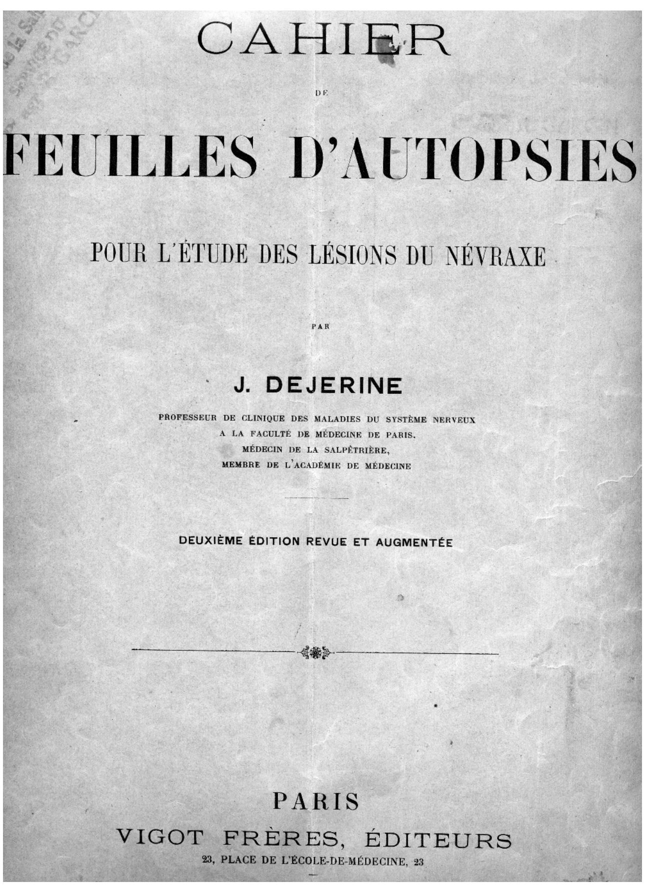
Theodor Hermann Meynert (1833-1892) developed a method for weighing the different parts of the brain to study comparative anatomy. He made the incisions from the inferior face of the brain to display the ventricles.

The development of better hardening techniques smoothed the way for new studies of both normal and pathological anatomy. The most frequently used technique, created by Carlo Giacomini (1840-1898), consisted of placing the brain in a 10% zinc chloride solution and then in alcohol. Some days later, the alcohol-hardened brain is fixed in glycerine, and 1% carbolic acid is then added. By this method, brain morphology can be preserved for years.[7]

Cahier de feuilles d'autopsies pour l'étude des lésions du névraxe

Joseph Jules Dejerine was born in Plain-Palais (Geneva, Switzerland) on 3 October 1849. During the Franco-Prussian war, he volunteered at a hospital in Geneva, but in 1871 he moved to Paris to continue his studies under Vulpian (1826-1887). In 1880, he became *chef de clinique* at the Hospice de la Charité; in 1882, he rose to *médecin des hôpitaux*, working at Bicêtre (1886-94) and La Salpêtrière (1895-1900). In 1886, he earned the title of *professeur agrégé* and one year later, he became *médecin en chef* at the Bicêtre. Five years later, he was awarded the chair of history of medicine, and from 1910 until his death, he chaired the department of neurology at Université de Paris.

His contributions to anatomoclinical studies and the functional disorders of the nervous system are noteworthy. His most important books were *Anatomie des centres nerveux* (1895), written with his wife Augusta Marie Klumpke, and *Sémiologie des affections du système nerveux* (1914), one of the main classic texts in neurological literature. That work was actually a second edition of his contribution to *Traité de pathologie générale*, edited by Bouchard in 1901.[8]



CAHIER
DE
FEUILLES D'AUTOPSIES
POUR L'ÉTUDE DES LÉSIONS DU NÉVRAXE
PAR
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DEUXIÈME ÉDITION REVUE ET AUGMENTÉE
PARIS
VIGOT FRÈRES, ÉDITEURS
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Figure 1. Cover of the second edition of *Cahier de feuilles d'autopsies pour l'étude des lésions du névraxe* by J. Dejerine

In 1895, the first edition of *Cahier de feuilles d'autopsies* came to light, followed by a second revised and extended edition in 1911 (Figure 1).[9-11] The first edition includes 36 life drawings on 25 plates intended to provide a systematic record of the precise location of nervous system lesions found in autopsies. The author mentions in the first edition that when a pathology specimen is sliced with a microtome, the scope and depth of the primary lesion will often change. In addition to the cortical lesion, a second, generally central, lesion is also frequently observed; this lesion modifies the interpretation of the symptoms observed in the living patient, and may explain some types of secondary degeneration that appear as anomalies. The most appropriate specimens are to be selected for microscopic examination. Using the drawings in this book would make it quicker and easier to locate degeneration secondary to the lesion.

In the preface, the author highlights that the study of cerebral localisations has reached a new level thanks to expanded knowledge of normal brain anatomy. The study of localisations cannot be mere naked-eye observations of the central lesion. In cases of cerebral or cerebellar lesions, it is necessary to study the scope, depth, and especially the state of the bundles adjacent to the injury. Lesions had to be studied using serial slices performed with a microtome once tissue had been hardened and stained with the methods used at the time (Weigert, Pal, carmine, nigrosin, etc.). Systematic use of this method permitted pathologists to confirm that cortical or central lesions, regardless of their localisation, are always larger than what visual inspection would suggest. Central or cortical lesions with no underlying white matter involvement are unusual.

In the first edition of *Cahiers*, Dejerine recommended, contrary to what was common practice at that time, removing the spinal cord before extracting the brain when sectioning fresh tissue. This avoided loss and destruction of tissue as a result of the oblique incisions performed to remove the brain, while also making it possible to study serial slices of the upper cervical and lower bulbar regions.

Sections varied according to the localisation of the lesion: cerebrum (cortical or central), cerebellum, pons, or spinal cord.

In cases of a cerebral lesion (cortical or central), tissue must be sectioned following a line parallel to the base of the brain running above the trigeminal nerve root and below the posterior corpora quadrigemina. This way, the brain is divided into two parts: an upper part including the cerebral hemispheres, the peduncles, the upper part of the pons and the corpora quadrigemina; and a lower part consisting of the cerebellum, the lower part of the pons, and the medulla.

If the lesions are cortical, the brain must be hardened without removing the pia mater. The procedure called for 2 vertical incisions: the first one through the genu of the corpus callosum (Figure 2, AB) and the second through the splenium (Figure 2, CD). Next, a horizontal incision joining the two previous sections was made passing through the upper edge of the thalamus (Figure 2, EF).

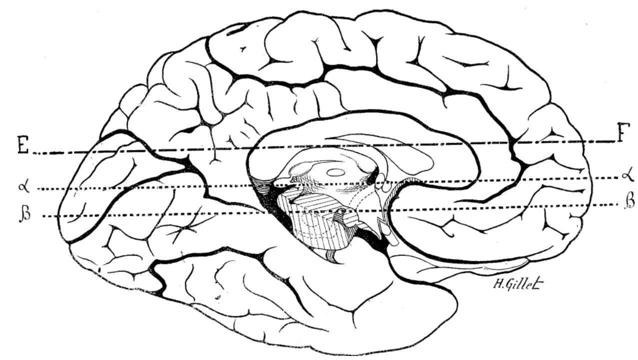

Figure 3. Horizontal incision performed to study central cerebral lesions

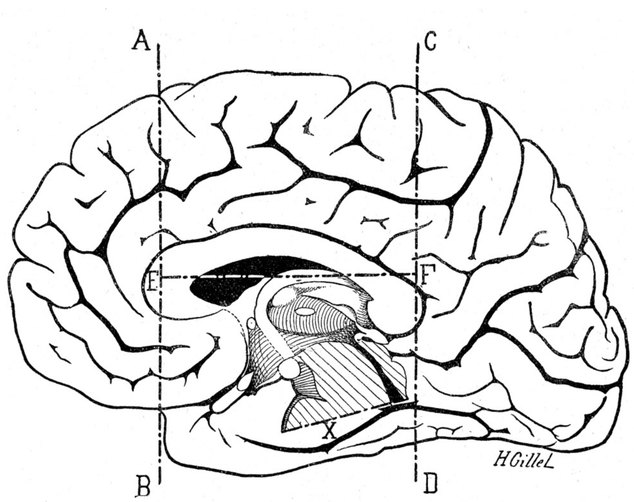

Figure 2. Incisions to be made in a brain presenting a cortical lesion

Clinical manifestations with an apparently normal cortex meant that an internal lesion must be suspected, and examining the ventricles and the optical thalamus with its surrounding white matter was recommended. Ventricles might be enlarged, and the thalamus might show signs of atrophy. A horizontal incision was performed from the occipital pole to the frontal pole, passing above the optical thalamus. If the focal lesion was not crossed by that slice, additional parallel sections were made (Figure 3).

If the lesion was cerebellar, a horizontal incision passing above the trigeminal nerve root was made. For pontine lesions, sections ran perpendicular to the pontine axis. For spinal cord injuries, the incision was made between two spinal roots.

In 1911, a second edition of *Cahiers* was published. This edition provided more simple technical instructions, especially since formalin was now used for fixing nervous tissue (Figure 4). First described in 1859 by Aleksandr Mikhailovich Butlerov (1828-1886) and identified in 1869 by August Wilhelm von Hofmann (1818-1892), formalin was introduced as a means of fixing anatomical tissue in 1893.[12] This substance, thanks to its hardening action and quick penetration, let pathologists make more precise sections and minimised the deformation of samples collected for microscopic study.

This edition six new plates to make it easier to document secondary lesions in different segments of the medulla and spinal cord, and to locate motor lesions in the spinal cord.

A perpendicular section is performed to separate the brain from the hindbrain, as well as a sagittal section at the level of the corpus callosum. This way, degenerated bundles and fibres from higher lesions can be observed. If there are lesions in the occipital and parietal lobes, coronal sections should be performed providing a view of the ventricles and the sectioned part of the corpus callosum. The same coronal section was also performed to study frontal lobe lesions.

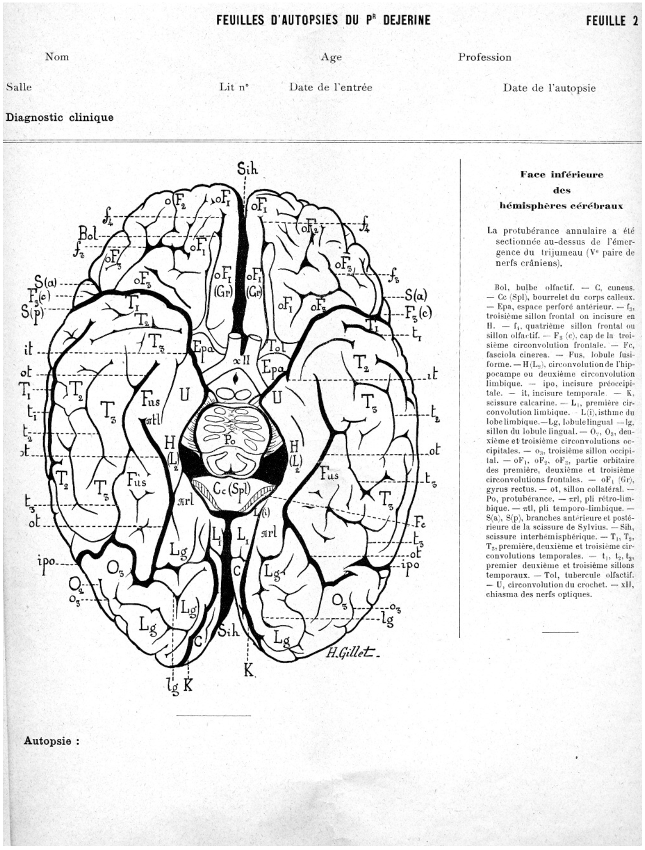

Figure 4. One of the illustrations included in the second edition

The importance of this book resides in its clear, precise, and systematic approach to the study of nervous system lesions, highlighting the importance of serial slices for macro- and microscopic examinations.

Conflicts of interest

The author has no conflicts of interest to declare.

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