

# Jules-Bernard Luys and his brain atlas

John S. McKenzie

In 1976 I was on sabbatical leave, working with colleagues of the Institut Marey directed by Professor Alfred Fessard of the Collège de France, in the Laboratoire de Physiologie des Centres Nerveux headed by Professor Denise Albe-Fessard of the Université Pierre et Marie Curie. One day I bought a second-hand book from a tray outside a medical bookseller's near the Odéon Metro station. It was an atlas of the human brain in 40 lithographic plates, by Jules-Bernard Luys, who was known as the discoverer of the subthalamic nucleus within the basal ganglia of the brain related to movement disorders, and on which I was at the time doing neuro-physiological research. It was dated 1865, and turned out to be part of a large book on the central nervous system, its structure, functions and diseases.<sup>1</sup>

J.-B. Luys was born on 17 August 1828 into a wealthy Parisian family, and educated in Paris, where he studied medicine. He was appointed *interne des hôpitaux* in December 1853, Doctor of Medicine in 1857, but was failed for *agrégation* in the Faculty of Medicine, despite submitting theses on puerperal fever (1860) and hereditary diseases (1862). He succeeded in the competition for appointment to the senior rank of

*médecin des hôpitaux* in 1862, and was attached to the Salpêtrière, where the great neurologist Charcot practised, and then to the Charité hospital, rue des Saints-Pères, until his retirement in 1893. In 1864 he took an additional appointment as Director of the Ivry-sur-Seine mental hospital.

When an intern, Luys had undertaken assiduous research in microscopy applied to clinical medicine. His first reports to the Société de Biologie, in 1855, concerned ossification of the dura mater of the brain in a 68-year-old woman, and multiple brain tumours. The next year he received a prize from the Académie de Médecine for a memoir on the microscope and its applications to pathological anatomy, to diagnosis, and to the treatment of diseases. The following year he defended his doctoral thesis, on studies in pathological histology concerning the manner of appearance and evolution of tubercles in pulmonary tissue. In about 1860 he began the research that earned him his fame: on the anatomy, physiology and pathology of the nervous system, publishing various neurological articles on the pathology of locomotor ataxia in syphilis, of progressive muscular atrophy, dementia due to brain haemorrhage, and physiological and pathological



anatomy of the cerebellum. Wishing to cover the central nervous system in its entirety, he published the major work of his scientific life, *Recherches sur le système nerveux cérébro-spinal: sa structure, ses fonctions et ses maladies*.

This 660-page tome was accompanied under the same title by a separate volume: *Atlas de 40 planches* (drawn from nature by J. Luys, lithographed by Lèveillé), with 80 pages of copious explanatory text. For this major treatise, Luys received prizes, of 500 francs from the Académie de Médecine, and 2,500 francs from the Académie des Sciences.

This was the atlas found by chance in a second-hand tray, and now, restored, belonging to the Special Collections of the Baillieu Library. The large parent text was not with it; its table of contents and some pages of its text became available thanks to the University's interlibrary loans service, but it would be better that the Library obtain an entire copy.

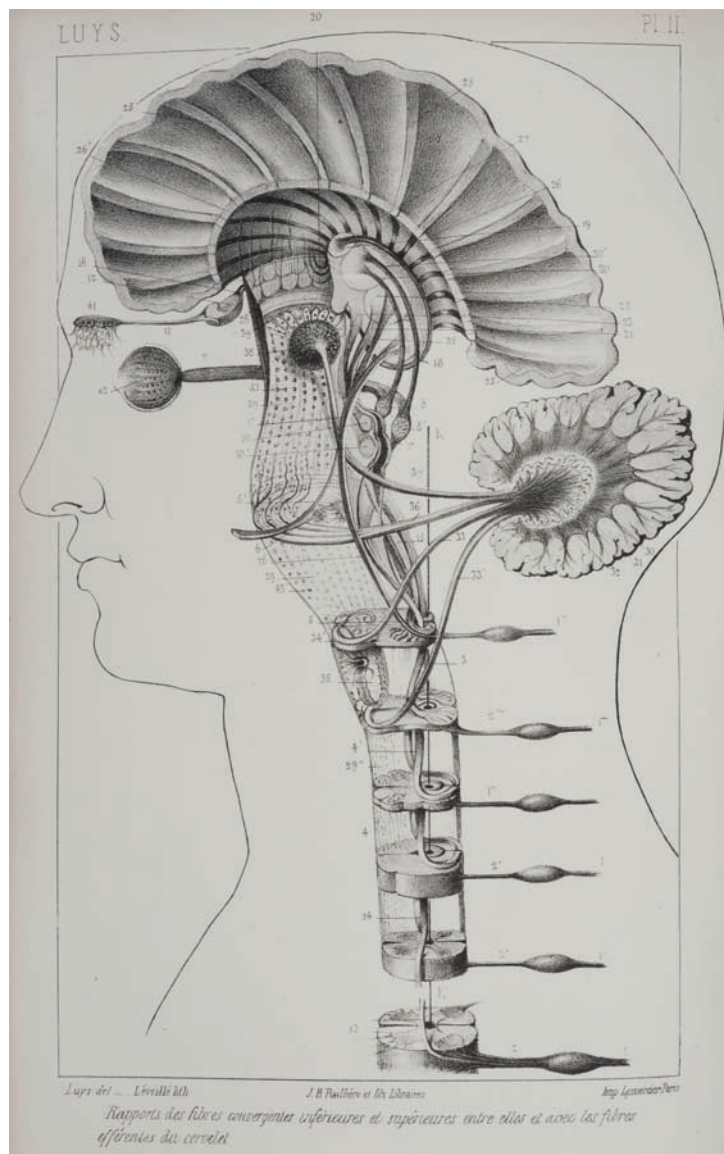
The anatomy of the central nervous system is covered systematically, in categories derived from the author's mid-19th century view of the brain, a view partly distorted by inadequate technical methods then available for hardening brain tissue and cutting thin slices for detailed examination. Within ten

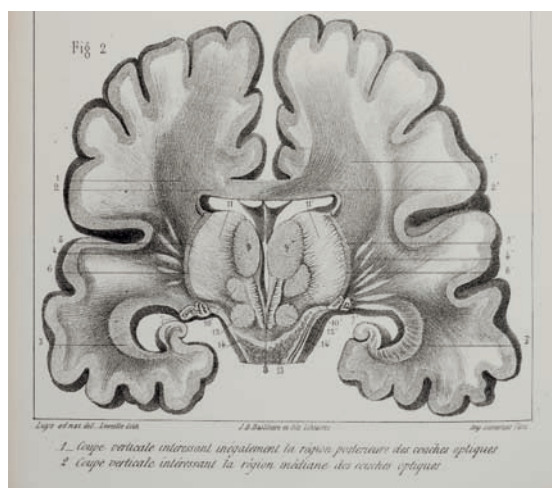
Opposite: *Monsieur le Docteur Luys (de Paris)*, n.d.  
Collection of the Bibliothèque  
Inter-Universitaire de Médecine, Paris.

Below: Plate II, a semi-diagrammatic impression  
of the human central nervous system, showing  
some cranial and spinal nerve pathways,  
cerebellum, and 'inside-out' view of cerebral  
hemisphere, from Jules-Bernard Luys, *Recherches  
sur le système nerveux cérébro-spinal: sa structure, ses  
fonctions, et ses maladies: atlas de 40 planches*,  
Paris: J.-B. Baillièrre et fils, 1865.  
Gift of Dr John S. McKenzie, 2009,  
Special Collections, Baillieu Library,  
University of Melbourne.

years, others such as Forel in Switzerland had improved methods to a level approaching modern standards. Nonetheless, Luys was the first to describe certain sensory, neuroendocrine and motor brain structures: the centro-median nucleus of the thalamus, the hypothalamic grey matter close to the third ventricle, and the subthalamic nucleus, although he made many mistakes in describing their connections in the brain and in the functions he proposed for them; the subthalamic nucleus he seriously misnamed and inconsistently described, but it now bears his name as the 'Luysian Body', conferred in 1877 by Forel (who also corrected his errors).

The illustrations Luys prepared for the 1865 atlas are ingenious, but quaint even by the standards of a few years later. He attempted to convey three-dimensional impressions of deep brain structures, and diagrammatically of the whole nervous system (illustrated). Some of his figures were based on dissection and microscopic examination of nerve fibre bundles (in which he was a pioneer), but with assumptions or poorly based conclusions as to their origins and terminations, which were often proved wrong subsequently. In the figures, structures of concern are





Luys, *Recherches sur le système nerveux cérébro-spinal*, plate XXIII, (detail), illustrating vertical section through mid-thalamus to brain stem. Shows paired red nuclei (wrongly named 'superior olives' by Luys), centres medians (an original discovery by Luys), and medial hypothalamus: grey matter lining the third ventricle.

numbered with fine lines leading from outside the image; unfortunately, not only are the numbers often too small for sure identification, but also the terminations of the excessively fine lines are sometimes undetectable against the background. As already stated, he faced the obstacle of as yet inadequate techniques in neurohistology; in some instances he appeared not to distinguish between nerve cell clumps and nerve fibre bundles.

In 1873 Luys published a second atlas of the human brain, entitled *Iconographie photographique des centres nerveux*.<sup>2</sup> With improved fixation and staining, thin slices were presented in photographs, each coupled with a detailed drawing made from the relevant section. This method also was invented by Luys: the photographs provide objective delineation of major structures, while the drawings enabled more accurate detail to be defined within them; this is still usually the case today, even with the advent of modern techniques including more specific stains and tomographic scanning methods.

After 1873 Luys produced many reports correlating pathological locations of brain damage with neurological signs such as general paralysis, Parkinson's syndrome, or

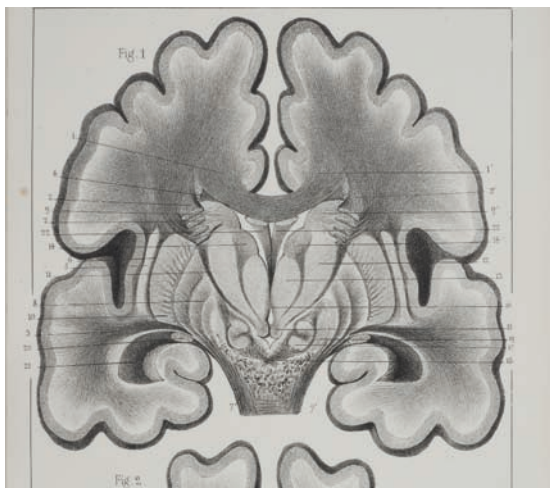
congenital idiocy. He also became increasingly concerned with mental diseases, and with states of hysteria and hypnosis. He continued to present speculative inferences about brain mechanisms, and published a book *The brain and its functions* in 1876,<sup>3</sup> which was received with reserve by his fellow neurologists, but enjoyed considerable success among the general public. The book offered an interesting plan of attack. First he set out the main lines of brain anatomy, then in several chapters outlined the properties of nerve cells: reactivity, storage of experienced activity, and automatic activity. (Some of these features are now directly observable but were at the time only unproven inferences from behaviour.) He then expanded on this base to explain attention, personality, ideas, even the formation of judgements. Finally he discussed brain outputs to internal body processes and to skeleto-motor action in the external world. This ambitious plan was developed using many poorly grounded or quite speculative mechanisms, in an overblown style with facile metaphorical arguments. The writing often betrays a conceit in his own achievements and priority.

For his work at the Ivry-sur-Seine *maison de santé*, on mental illness and its correlates, and for his books *Traité*

*clinique et pratique des maladies mentales*<sup>4</sup> and *Le traitement de la folie*,<sup>5</sup> Luys received recognition from both his academic peers (election to the Académie de Médecine in 1877), and the French government (made Chevalier in 1877, then in 1893 Officier of the Légion d'Honneur).

From about 1886, his interest in hysteria and hypnotism increasingly gave rise to reports of bizarre findings in hypnotised patients. These included purported 'action at a distance' of drugs, such as vomiting produced by an emetic held in a tube behind a subject; alleged ability of hypnotised patients to 'see' magnetic and electric fields with the poles in differing colours (magnetic south red, and north blue; electrical positive red, negative blue); to see 'emanations' from the body of normal, active humans or animals (right side red, left side blue); storage of emitted cerebral energy in magnetised metal crowns worn on the head and its transfer with the crown to other hypnotised subjects (along with the mental trouble of the first subject). He stated that the training of hypnotism subjects for this research required special methods ('to be reported at a later date'), and described them as 'living reagents' for the study of such phenomena. René Semelaigne, who was an intern at the Charité hospital





Luys, *Recherches sur le système nerveux cérébro-spinal*, plate XXIV, (detail), illustrating vertical section through anterior thalamus, showing subthalamic nucleus (wrongly named here 'accessory grey matter or accessory strip of superior olives', and elsewhere 'accessory grey matter of locus niger'), hippocampus and inferior temporal lobe.

where Luys conducted his experiments on hypnotic phenomena in public, wrote that several subjects of his acquaintance were known imposters, who coached each other in their responses;<sup>6</sup> and another former intern testified that such patients received special treatment in the hospital, and rehearsed their performances days in advance. However, Luys appeared to be quite sure of his subjects' truthfulness and dismissed objections. That he was duped by some patients points to a sad lack of scientific rigour, despite his continued energetic research activity; it is true that in his last few years he suffered from increasing deafness that prevented his appreciation of the meetings of the Société de Biologie he continued to frequent, and this could have left him susceptible to fraud on the part of his special patients and assistants. All reports witness his continued great amiability in relations with his colleagues, even in the face of his affliction. The roots of his poor rigour may also be discernible already in some of his earlier speculative interpretations concerning brain pathways and their functions. But unlike some of his late 19th century contemporaries, he did not try to explain his strange results by 'paranormal' phenomena, always

believing (though without independent evidence) that the state of hypnosis activated an increase in sensitivity of already existing physiological mechanisms in the visual system, particularly in the retina, to the extent of being able to pick up energy 'emanations' produced by bodily activity in others, including that in the brain.

In apparently perfect health, Luys died suddenly on 21 August 1897, while on vacation in Divonne-les-Bains, a country town where he had just arrived on vacation, a few days after turning 69. His obituaries described him as maintaining a kind affability to all his friends and colleagues until the last.

J.-B. Luys was not the first to make realistic illustrations of the brain. Predecessors like Willis in England began to produce good drawings of brain slices in the early 17th century. But Luys was probably the first to attempt a comprehensive depiction of the brain, brainstem and spinal cord. His 1865 atlas was cleverly executed, and included illustrations of cellular and tissue components as seen with the microscopes of the time, the use of which he adopted as a necessary part of normal and pathological anatomy (illustrated on page 24). The 1865 atlas constitutes a landmark in

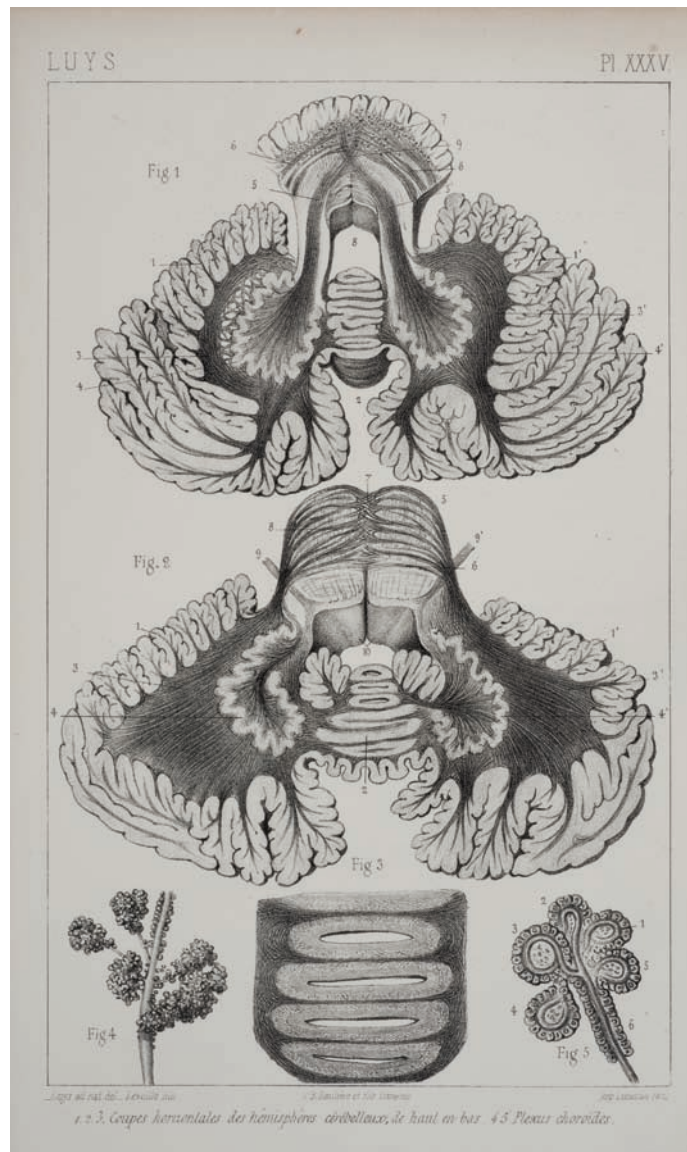
detailed brain science. His 1873 atlas was an improvement in terms of accuracy, thanks to his original invention of the photography of stained whole brain slices. Other anatomical neurologists also were by then starting to publish detailed illustrations of brain sections in successive planes, culminating in the superb body of work by J.-J. Déjerine and his wife, Augusta Déjerine-Klumpke.<sup>7</sup>

The broad approach made by Luys to the structure and function of the brain probably contributed forcefully, despite its deficiencies, to the flowering of brain science in the second half of the 19th century, which has since continued to expand in scope with new physical and chemical techniques for illustrating brain structures in health and disease. Such methods as computer-assisted tomography and magnetic resonance imaging are used to obtain virtual slices through a living brain with ever improving structural and functional detail; new histochemical and molecular biological probes can locate an enormous variety of specific chemicals active in the functioning of brain cells. Such advances inspire numerous specialised brain atlases, tools for experimental and clinical investigations.

In the context of Luys's

Luys, *Recherches sur le système nerveux cérébro-spinal*, plate XXXV, illustrating horizontal sections showing cerebellar cortex and deep nuclei (figs 1 & 2); choroid plexus of lateral ventricle at 15 and 250 times magnifications (figs 4 & 5).

photographic atlas of 1873, it is appropriate to mention the later and far more comprehensive photographic atlas of the human nervous system by Henry Alsop Riley of Columbia University.<sup>8</sup> The deep structures of the brain are illustrated in sections stained for the myelin of white matter, in their entirety and in detailed enlargements, using sets of transverse, horizontal and longitudinal planes oriented to the axis of the hemispheres or of the brain stem. This great work of 264 plates, with facing pages identifying labels on the figures, includes 370 pages where each structure is listed and discussed. Despite the modern atlases that provide accurate three-dimensional stereotaxic images of the intact brain with recent computer technology, that of Riley remains unequalled in detail and authority. Mention should also be made of the textbook by the Chicago neuroanatomist Wendell Krieg, who in 1953 provided an atlas of the human central nervous system in drawings from stained sections accompanied by remarkable three-dimensional sketches of internal structures and their connections, constructed in the same spirit as the Luys 1865 atlas.<sup>9</sup>





Left: The book in the condition in which it was received.

Below: The book following conservation treatment. This involved removal of old adhesive and paste; repairs to torn pages using starch paste and Japanese tissue paper; repairs, infill and re-attachment of the cover boards; re-attachment of loose illustrations and plates; reduction of stains caused by acidity; resewing of the sections and guards into the text block on hemp cotton sunken cords; lining of the spine with linen cloth; then re-attachment to the cover boards. The spine was replaced with black buckram book cloth, and the title stamped in 23 carat gold.

Dr John S. McKenzie is an honorary senior fellow in the Department of Physiology at the University of Melbourne, where he was employed as a senior lecturer until his official retirement in 1993. After graduating with a BSc, MSc and later PhD from Melbourne he embarked upon a research career focussing on the central nervous system and its disorders. He donated the book discussed here to Special Collections in the Baillieu Library in 2009, and also helped fund its conservation.

#### Other references

John S. McKenzie, 'The subthalamic region of Luys, Forel, and Déjerine', in H.J. Groenewegen and others (eds), *The basal ganglia IX*, New York: Springer, 2009, pp. 97–107.

A. Ritter, 'Necrologie: Dr J. Luys', *Annales medicopsychologiques*, series 8, vol. 6, 1897, pp. 321–323.

When Dr McKenzie donated the book, it was in a very damaged condition, no doubt caused by regular use by various owners and readers since its publication in 1865. In particular, the worn-out cloth spine had been poorly (and ultimately unsuccessfully) repaired with clear adhesive tape, which had left brown acidic stains. The book had also suffered other damage over the years, such as general soiling, staining, foxing, loss of the corners on covers, and tears to some of the pages. Conservation treatment was undertaken by Guy Morel of Morel Preservation.

### Conservation of the book

Dr McKenzie, as well as donating this book to the Baillieu Library in 2009, generously contributed to the costs of its conservation, thus making the volume useable again for library patrons without causing further damage.

#### Notes

- 1 Jules-Bernard Luys, *Recherches sur le système nerveux cérébro-spinal: sa structure, ses fonctions, et ses maladies: atlas de 40 planches*, Paris: J.-B. Baillière et fils, 1865. Gift of Dr John S. McKenzie, 2009, Special Collections, Baillieu Library, University of Melbourne.
- 2 Jules-Bernard Luys, *Iconographie photographique des centres nerveux*, Paris: J.-B. Baillière et fils, 1873.
- 3 Jules-Bernard Luys, *The brain and its functions*, 3rd edition, English language, London: Kegan Paul Trench, 1889. University of Melbourne Library.
- 4 Jules-Bernard Luys, *Traité clinique et pratique des maladies mentales*, Paris: Adrien Delahaye et Émile Lecrosnier, 1881.
- 5 Jules-Bernard Luys, *Le traitement de la folie*, Paris: Rueff, 1893.
- 6 René Semelaigne, *Les pionniers de la psychiatrie française: avant et après Pinel*, Paris: Baillière, 1930–1932, pp. 77–96.
- 7 Joseph-Jules Déjerine, with Madame [Augusta Marie] Déjerine-Klumpke, *Anatomie des centres nerveux*, Paris: Rueff, 1895 (vol. 1) and 1901 (vol. 2).
- 8 H.A. Riley, *An atlas of the basal ganglia, brain stem and spinal cord, based on myelin-stained material*, Baltimore: Williams & Wilkins, 1943, reprinted with revisions, New York: Hafner, 1960.
- 9 Wendell S. Krieg, *Functional neuroanatomy*, New York: Blakiston, 1953.

