

# Franciscus Sylvius on Clinical Teaching, Iatrochemistry and Brain Anatomy

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**ABSTRACT:** Born in Hanau, Germany, in 1614, Franciscus (Dele Boë) Sylvius received his medical doctor diploma from Basel University in 1637 and became Professor of Practical Medicine at Leiden University in 1658. One of the founders of medical biochemistry, Sylvius was also an outstanding anatomopathologist, with contributions ranging from the first description of the pulmonary tubercles to that of the lateral fissure of the brain. Thanks to Sylvius, a gifted teacher and one of the greatest physicians of his time, Leiden became a major European medical training center. He died in 1772 after having served as *Rector Magnificus* at Leiden University.

**RÉSUMÉ:** Né à Hanau, Allemagne, en 1614, Franciscus (Dele Boë) Sylvius reçut le bonnet de docteur à Bâle en 1637 et devint professeur de médecine pratique à l'Université de Leyde en 1658. L'un des fondateurs de l'iatrochimie (biochimie médicale), il fut aussi un brillant anatomopathologiste, comme en fait foi sa découverte des tubercules pulmonaires ainsi que celle de la fissure latérale du cerveau. Professeur remarquable et clinicien célèbre, il fit de Leyde l'un des centres majeurs d'enseignement et de recherche médicales en Europe. Il s'éteignit en 1772 après avoir occupé le prestigieux poste de *Rector Magnificus* à l'Université de Leyde.

**Keywords:** Neuroscience history, 17<sup>th</sup> century neurology, François Deleboë, Sylvius, Lateral fissure, Cerebral aqueduct, Cerebral convolutions

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This historical review is devoted to Franciscus (Dele Boë) Sylvius, one of the greatest physicians of the 17<sup>th</sup> century. His ascendants belonged to the Flemish Protestant nobility of Cambrai (Kamerrijk), in the northern part of France. They lived in the *Dele Boë* lordship that was part of the illustrious House of Oisy-Crevecœur that ruled over the Cambresis since the 11<sup>th</sup> century.<sup>1</sup> The lordship was located in the woody area surrounding the beautiful Abbey of Vaucelles near Cambrai and its name *Dele Boë*, an archaic form of the French word “Dubois” (“Woods” in English or “Sylvius” in Latin) was progressively adopted by its inhabitants. Being Protestant during the Reformation, Sylvius’s ancestors progressively lost their lands and titles. They eventually left to settle down as merchants in the small Protestant town of Hanau, near Frankfurt-am-Main, Germany, where Sylvius was born on March 15, 1614.

Sylvius was sent to the Calvinist Academy of Sedan in the Ardennes region, where he studied philosophy and medicine. He pursued his medical studies in Leiden under the tutorship of Adolphus Vorstius (Adolf Vorst, 1596-1663) and Otho Heurnius (Otto van Heurn, 1577-1652) from 1632 to 1634. Before leaving Leiden, he submitted a thesis for the degree of bachelor in medicine in which he fervently defended the theory of blood circulation formulated six years earlier in 1628 by William Harvey (1578-1657).<sup>2-4</sup>

Sylvius complemented his medical training by a study tour of Europe, the typical *peregrinatio medica* of the time. During these travels, Sylvius focused principally on issues related to anatomy and chemistry, which he thought could help decipher the solid component of the human body as well as its humoral content.<sup>5</sup> He obtained the degree of medical doctor at the University of Basel

on March 16, 1637, with a short thesis on animal motor activities and their perturbations in which he distinguished rest tremor – which he called *tremor coactus* – from action tremor, a contribution that was deemed sufficiently important to be quoted by James Parkinson (1755-1824) in his famous 1817 essay on shaking palsy.

After a short stay as a practicing physician in Hanau, he left for Leiden, where he worked as a private-docent in anatomy from 1638 to 1641.<sup>6,7</sup> At that time, he met the French philosopher René Descartes (1596-1650), who was then living in Leiden. The two men were to depart significantly from one another on the basis of their respective theory of brain function, but they retained a strong mutual respect. Descartes’ mechanical theories about the working of the human body inspired Sylvius, who played a major role in developing the mechanical-chemical way of thinking that pervaded medical studies throughout the 17<sup>th</sup> century.<sup>8</sup>

Despite the popularity of his anatomical demonstrations, Sylvius was unable to secure an appointment at Leiden University and, at the end of 1641, he moved to Amsterdam, where he rapidly became famous as both clinician and teacher. His contemporaries described him as a remarkably handsome, tall and commanding individual (Figure 1), with a sweet and amicable disposition,

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**Figure 1:** A portrait of Franciscus Sylvius, at age forty-five, by Cornelis van Dalen the Younger (1638-1664), a highly prestigious artist who engraved the portrait of some of the most prominent personages of his time. Note the coat of arms of the Dele Boë-Crevecoeur family in the upper left portion of the portrait, which appears as a frontispiece on virtually all editions of Sylvius's *Opera Medica*.<sup>21</sup> Sylvius probably commissioned the portrait when appointed Professor at Leyden University in 1658. (Stichting Iconografisch Bureau. The Hague.)

which gained him many faithful and lifelong friends.<sup>9</sup> In 1649, Sylvius married Anna de Ligne (ca. 1611-1657), a young Amsterdam native, who unfortunately died eight years later of intermittent fever. In 1658, he accepted the prestigious chair of Practical Medicine at Leiden University. Sylvius remarried in 1666 to Magdalena Lucretia Schletzer (1648-1669) of German origin, who gave birth in February 1669 to a daughter named Theodora Elisabetha Dele Boë, Sylvius's only direct heir. Earlier that month, Sylvius, then at the height of his career, was honored with the office of *Rector Magnificus* at Leiden University. Unfortunately, the plague took the life of his wife on March 1669 and his daughter died six months later. In the same year, Sylvius himself suffered from a serious illness, probably relapsing fever, from which he never really recovered. He died at age 58 during the night of 15 November 1672 and was buried in the Pieterskerk in Leiden with full academic honors. Although his grave has been cleared since, the walls of St-Peter Church still display the epitaph he wrote himself seven years before his death.

#### TEACHING AND MEDICAL PRACTICE

Sylvius occupies a crucial position among the highly gifted scholars who, in the middle of the 17<sup>th</sup> century, undertook a major reform of medicine, which progressively departed from the highly theoretical scholastic Galenism to become a much more practical

field of knowledge based on Vesalian anatomy and Harveyan physiology. In his inaugural address as Chair of Practical Medicine at Leiden University, Sylvius argued that significant medical advances are much more likely to occur when gifted scholars actively collaborate with one another, leaving behind their prejudices and vain ambitions to the benefit of direct and objective observations of natural phenomena. Sylvius considered medicine as a search for self-knowledge and, as a promoter of the new experimental philosophy, he was entirely committed to gathering knowledge about nature through the senses.<sup>10</sup> He saw medical learning as being based on three major pillars: bedside observations, autopsy of deceased patients, and animal experiments. The first two were part of Sylvius's daily work as teaching physician, whereas live animal experimentation was considered an extracurricular activity. Through his clinical and experimental observations, Sylvius was able to demonstrate blood circulation and convince his Leiden colleagues of the validity of Harvey's theory. Even Johannes Walaeus (1604-1649), perhaps the most stubborn of the Harveyan skeptics among Sylvius's colleagues, radically changed his mind in face of Sylvius's demonstrations. At that time (1638-1641), Sylvius's private teaching and animal experimentation took place not at the University but in the *Ambulacrum* of Leiden's botanical garden, which harboured lecture rooms as well as laboratories and dissection facilities.<sup>8</sup>

Later, as Chairman of Practical Medicine, Sylvius used the modern system of diagnosis, prognosis and therapy and he is one of the first physicians to have established daily bedside teaching as a regular part of the medical curriculum. Sylvius's highly instructive clinical rounds took place at the Caecilia Hospital (*Caecilia Gasthuis*), Leiden's municipal hospital for the poor.<sup>6</sup> His student and later colleague, Lucas Schacht (1634-1689), describes his Socratic method of instruction as follows: "When he came with his pupils to the patient and began to teach, he appeared completely in the dark as to the causes or the nature of the affection the patient was suffering from, and at first express no opinion upon the case; he then began by questions put to different members of his audience to fish out everything and finally united the facts discovered in this manner into a complete picture of the disease in such a way that the students received the impression that they had themselves made the diagnosis and not learnt it from him."<sup>11</sup>

In addition to the emphasis he placed on ward instructions, Sylvius performed multiple dissections and autopsies as a means to verify clinical diagnostics and to provide clues as to the nature of various diseases.<sup>12</sup> He did himself most of the postmortem examinations of deceased patients at the *Collegium Medico Practicum*, an extension of Caecilia Hospital. The attendance at Sylvius's demonstrations was so large that the dissection room had to be modified to accommodate twice as many students.<sup>13</sup> Sylvius's dissections at the *Collegium* were much more than routine postmortem examinations. They regularly lasted more than a day and involved the analysis of more parts of the cadaver than just those affected by disease. Under Sylvius, the *Collegium Medico Practicum* became an important asset to medical training at Leiden University. It evolved from a simple postmortem set up into a very active research center, where several multidisciplinary teams devoted their effort to better understand the anatomical and physiological organization of the human body.<sup>8</sup>

Sylvius's anatomopathological studies of patients who had suffered from phthisis allowed him to detect the presence of

pulmonary nodules, which he termed *tubercula* (small knots), and to follow their evolution into lung ulcers (cavities). Sylvius was also one of the first physicians to recognize that skin ulcers caused by scrofula resemble tubercles seen in phthisis. In his treatise *Praxeos medicæ idea nova*, he wrote: “phthisis is the scrofula of the lung.”<sup>14</sup>

Sylvius was not only an experienced anatomist and outstanding clinician but also a gifted teacher and an eloquent orator. His fame rapidly spread and attracted many students from all over Europe. Among his most promising Dutch pupils were Jan Swammerdam (1637-1680), a microscopist who acquired fame for his pioneering work on insect development and muscle contraction; Reinier de Graaf (1641-1673), still remembered for his description of the human reproductive system and experimental studies on pancreatic secretions; and Florentinus Schuyl (1619-1669), who translated from French to Latin Descartes's *Treatise of Man* and served as an epistolary intermediate between Sylvius and Descartes. The English polymath Willam Petty (1623-1687) also spent some time in Amsterdam between 1643-1647, and it is largely through him that Sylvius's iatrochemical and neuroanatomical knowledge became known to Thomas Willis (1621-1675) in Oxford. Sylvius also influenced two brilliant Danish students, Thomas Bertelsen (Thomas Bartholinus, 1616-1680), who became one of the greatest anatomists of his time, and Niels Stensen (Nicolas Steno, 1638-1686), a multifaceted genius with major contributions to gland secretion, brain anatomy, geology, crystallography and paleontology.<sup>15</sup>

Sylvius's teaching at Leiden University influenced either directly or indirectly most of the famous anatomists of the second half of the 17<sup>th</sup> century<sup>12</sup> and Leiden progressively replaced Padua as the main European center for medical training. The fame of Leiden University was further increased when Herman Boerhaave (1668-1738), who became one of the most distinguished European physicians, decided to pursue Sylvius's efforts to improve clinical teaching and academic medicine in Leiden early in the 18<sup>th</sup> century.

## THE HUMAN BODY AS A CHEMICAL LABORATORY

In contrast to Descartes, Sylvius viewed the human body not as a machine but as a chemical laboratory. He was one of the founders of the so-called iatrochemical school, which used chemical concepts to explain physiological and pathological phenomena. First advocated by Paracelsus (ca. 1493-1541) and Jan Baptist van Helmont (1579-1644), these views were further refined and carried on in the heart of the 17<sup>th</sup> century by Sylvius in the Netherlands and by Thomas Willis in England. Rejecting the Paracelsian *Archeus* concept, Sylvius held that the physiological phenomena in the body are wholly chemical. His physiological theories were essentially based on the binaries of acid spirit (*spiritus acidus*) and alkaline salt (*sal lixiviosum*) and the effect of their effervescing fermentation. All physiological processes were understood according to the model of digestion – the inner alchemist of Paracelsus – and its processes as recreated in the chemical laboratory.<sup>6,9,16</sup> Sylvius considered diseases as the result of an excess, in the humors, of the corrosive principle, either acid or alkaline; he referred to acid excesses as *acrimonia acida*, and to alkali excesses as *acrimonia lixiviosa*.<sup>6,9</sup>

Sylvius's chemical theories guided not only his scientific experiments but also his method of prescribing medication, which involved alkaloid- or acid-containing drugs designed to restore the

patient's homeostasis.<sup>8</sup> However, Sylvius's therapeutic approach based on applied chemistry came under severe critics by some 18<sup>th</sup> century physicians, including Boerhaave himself who dealt harshly with the iatrochemists, including Sylvius.<sup>9</sup> Admittedly, Sylvius's doctrines were based on rather few direct observations and, as was the case for most 17<sup>th</sup> century pre-Newtonian scientists, his credulity was often far greater than his critical acumen. Yet, Sylvius succeeded in making medicine appealing to his contemporaries by adapting it to new scientific developments. Furthermore, his devotion to chemistry and the way he embodied chemical doctrines in his theoretical explanations helped the empirically based chemical therapeutics to progressively replace the humoral Galenic approach.<sup>17</sup>

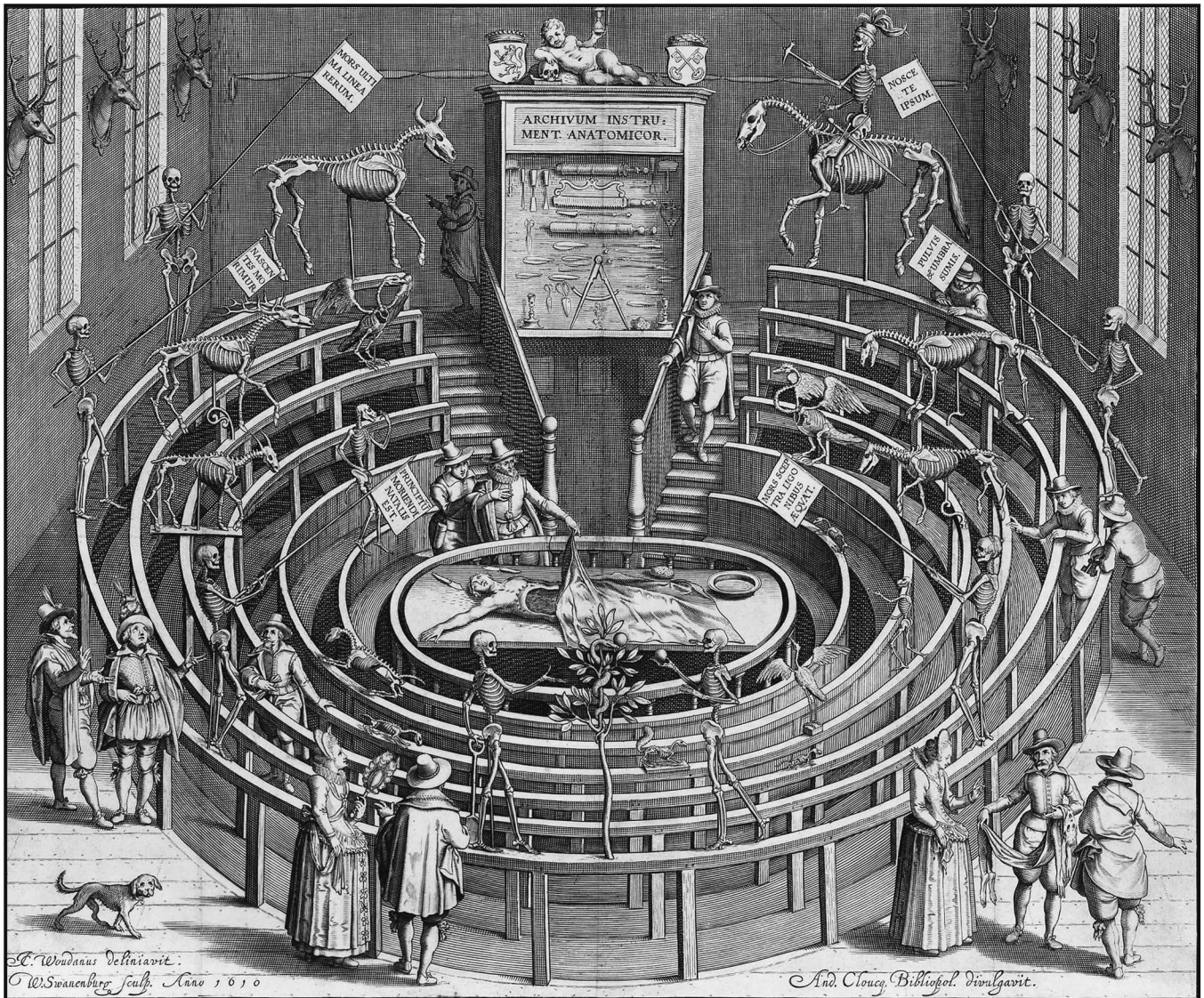
## THE FABRIC OF THE HUMAN BRAIN

### a) The lateral fissure

Sylvius is said to have dissected more than 300 human cadavers during the years he spent in Leiden.<sup>11</sup> He considered anatomy as the only basis upon which a proper understanding of the human body (the microcosm) could be elaborated. Most of Sylvius's academic demonstrations occurred at the *Collegium Medico Practicum*, but the more official and public dissections were given at Leiden's *Theatrum anatomicum*, one of the first European permanent anatomical amphitheatres (Figure 2). During the course of these immensely popular anatomical sessions, Sylvius paid a particular attention to the organization of the human brain, examining the organ through a novel dissection approach. Following the Renaissance, anatomists had minimized distortion problems due to unfixed brain simply by keeping the organ in place in the cranium and dissecting it along the horizontal plane in a top down manner, as exemplified in the celebrated treatise of Andreas Vesalius (1514-1564).<sup>18</sup>

Sylvius was among the first anatomists who took pains to dissect the brain out of the cranium and section it along various planes but he did not provide specific illustration of his dissection procedures. Such knowledge was brought to us through the work of his students, principally Stensen and Bartholinus. In his *Discours sur l'anatomie du cerveau* given in Paris in 1665, Stensen speaks abundantly of Sylvius's ingenuous methods to unravel the complexities of the human brain, which appeared to have been a combination of the traditional Vesalian approach and the procedure advocated by Constanzo Varolio (1543-1575), who dissected the brain from base to top.<sup>19</sup> Stensen specifically mentioned the use by Sylvius of midsagittal sections that he himself exploited to provide the first faithful description of the various neuronal structures that are visible along that plane.<sup>15,19</sup>

Thomas Bartholinus noted carefully all of Sylvius's comments about the influential anatomical textbook published by his father Caspar Bartholinus (1585-1629) in 1611 that Sylvius used routinely during his 1640-1641 lectures.<sup>20</sup> He later included these comments in his revised version of his father's treatise that first appeared in 1641 under the title *Intitutiones anatomicæ*.<sup>21</sup> Later, a detailed listing of the very same notes (*dictata*) – a total of 234, of which 34 concern the head, including the brain – were published in a separate section of Sylvius's *Opera medica*.<sup>22</sup> Bartholinus' debt to Sylvius regarding brain anatomy is clearly acknowledged in the preface of his *Intitutiones anatomicæ*: “we can not pass over in silence the very accurate anatomist D. Franciscus Sylvius

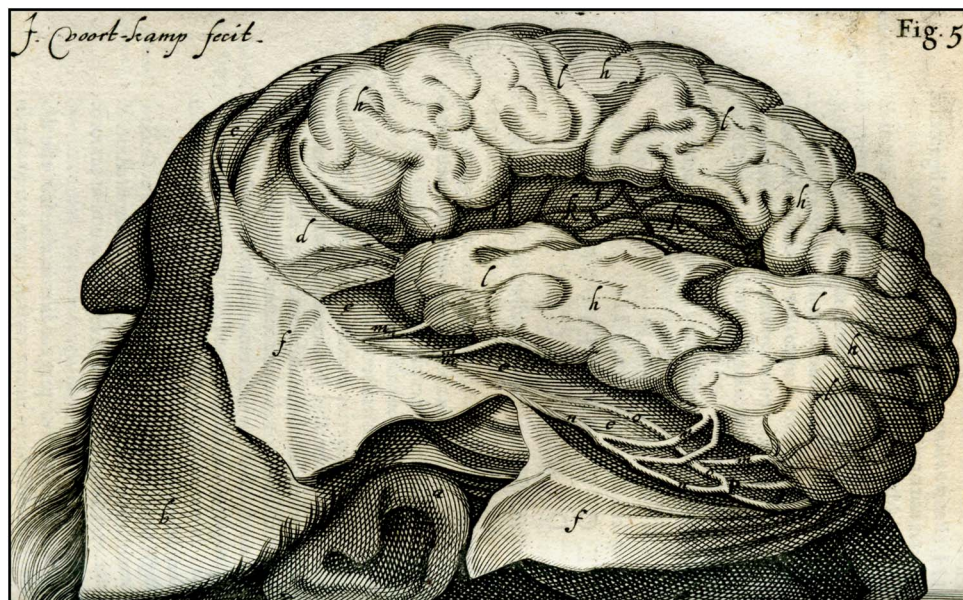


**Figure 2:** The Theatrum Anatomicum of Leiden University in 1610: engraving by Willem van Swanenburg (1580-1612), based on a drawing by Jan Cornelisz van't Woudt (Johannes Woudanus, ca. 1570-1615). Note the allegorical arrangement of animal and human skeletons, some displaying banners upon which are inscribed various emblematic sentences, such as the famous Delphic aphorism *Nosce te ipsum* (know thyself). These sentences (*Vanitas*), as well as the two skeletons at the front, which represent Adam and Eve, the latter holding the forbidden fruit of the tree of knowledge, underlie the fragility of human existence. Also note the three visitors on the left side, who are inspecting a “prepared” adult human skin. The Leiden anatomical theater later became famous throughout Europe as a cabinet of curiosities and rarities. (Boerhaave Museum, Leiden, Netherlands.)

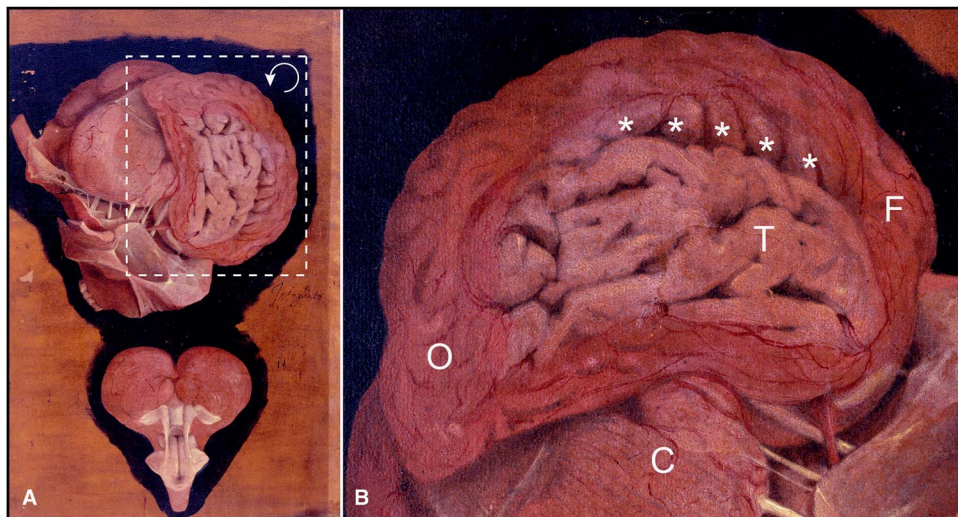
[since] we borrow from his noble brain and ingenuity the admirable new structure of the brain.”<sup>21</sup>

The section of Bartholinus’s textbook that deals with brain anatomy contains 13 notes, all in brackets and starting with the initials F.S. The fifth one concerns the lateral fissure and refers to figure 5 of the book, which provides a clear depiction of this remarkable scissure and the gyri that lie in its depth (Figure 3). It reads as follows: “[F.S. If you examine the indentations which are represented in Figure 5 quite attentively, you will notice that they are very deep and that the brain is divided from one side to the other by the “*anfractuosa fissura*,” which starts in the front of the ocular roots, and from there moves backwards above the base of the spinal cord, following the temporal bones,

and it divides the upper part of the brain from the lower].”<sup>21</sup> That this sentence belongs to Sylvius is in little doubt since a very similar passage occurs in his *Disputationes Medicarum*, first published in 1663.<sup>23</sup> Sylvius’s fourth *Disputationes*, which derives from a thesis defended by his student Gabriel Ypelaer (1636 - ?) in 1660, contains the following sentence: “All the surface of the cerebrum is very deeply marked by gyri similar to convolutions of the small intestine and especially by a distinct fissure or hiatus that begins near the orbits. It runs posteriorly above the temples as far as the level where the brain stem has its origin. It divides the cerebrum into an upper, larger part and a lower, smaller part. Gyri occur along the whole length and depth of the fissure.”<sup>23</sup>



**Figure 3:** A lateral view of the brain with the lateral fissure clearly outlined. Drawn by Sylvius himself and engraved by J. Voort-Kamp (dates unknown), this illustration appeared for the first time in the 1641 edition of Caspar Bartholinus *Institutiones Anatomicae* published by his son Thomas.<sup>20</sup> The lateral fissure is shown as a deep sulcus that separates the cerebral hemisphere into a ventral and a dorsal part. Besides the usual shapeless gyri, the drawing provides the first depiction of the insula, the letter *kk* indicating its location within the depth of the lateral fossa. (From Bartholinus T. *Institutiones anatomicae*. Leiden: F. Hackius; 1641.)



**Figure 4:** A: Reproduction of one of the *Tabulae Pictae* of Fabricius Ab Aquapendente (*Tabula 112.10*) depicting a lateral view of the human brain slightly lifted from the cranial base, at the top, and a posterior view of the brainstem and cerebellum, at the bottom. B: This enlarged view of the upper figure of *Tabula 112.10*, which has been rotated at 90 degrees from its original position (see rectangle in A), reveals the temporal lobe uncovered by the meningeal envelopes. The lateral fissure is clearly delineated (asterisks added), as well as some of the temporal lobe gyri and sulci. We added some labeling on the original figure to locate the cerebellum (C) and the occipital (O), temporal (T) and frontal (F) lobes. Like all *Tabulae Pictae*, this plate is devoid of legend and has never appeared in print. (Biblioteca Nazionale Marciana, San Marco, Venice, Italy.)

Sylvius's fifth note in Bartholinus's treatise and the more detailed description he provided some twenty years later appear to be the first mentions in the literature of the fissure and artery that today bear the name of Sylvius.<sup>12</sup> Yet, this major morphological

trait of the human brain is likely to have been noticed by other anatomists before Sylvius, as exemplified by the illustrations provided by the celebrated Paduan anatomist and surgeon Hieronymus Frabricius Ab Aquapendente (1533-1619) at the very



**Figure 5:** A: The façade of Sylvius's beautiful twin-house at 31 Rapenburg Canal built according to Sylvius's plans, with three rooms designed as chemical laboratories. B: The gable on the left side of the house displays the coat of arms of the Dele Boë-Crevecœur family (just above the window), as well as the house's foundation year 1664 (inscribed in the hemicycle above). In 1730, Herman Boerhaave bought Sylvius's luxurious house and died there eight years later. Philippe Parent took these two photographs in 2007. C: A painting by Frans van Mieris the Elder (1635-1681) dating from 1672 and often referred to as "The Music Lesson." It depicts Sylvius and his second wife, Magdalena Lucretia Schletzer, who plays the lute, a symbol of concord in matrimony and family that frequently appears in Dutch paintings of that period. (Dresden, Gemäldegalerie, Germany.)

end of the 16<sup>th</sup> century. These beautiful hand-painted pictures (about 300 of them) representing in natural color both human and animal structures, were planned as an atlas for Fabricius's ambitious anatomical treatise (*Theatrum totius animalis fabricæ*), which was initiated in 1591, pursued until about 1601 but, unfortunately, never completed nor published.<sup>24,25</sup> These color illustrations – the so-called *Tabulae pictae* – were rediscovered by

the Cagliari neuroanatomist and medical historian Giuseppe Sterzi (1876-1919) in 1909 in the San Marco Marciana Library of Venice, where they had lain for almost 300 years.<sup>26</sup> The *Tabulae pictae* dealing with the nervous system contains one plate (*Plate Rari 112.10*) that provides a clear depiction of the lateral fissure (Figure 4). It shows, at the top, the lateral aspect of the brain *in situ* and, at the bottom, a posterior view of the brainstem and

cerebellum. Like all the other *Tabulae pictae*, this illustration has no legend and was never published and, as far as we know, Fabricius never alluded to the lateral fissure in his writings.<sup>25</sup>

Hence, although Fabricius appears to have been the first anatomist to provide a clear depiction of the lateral fissure, it is Sylvius who first called attention upon this structure, describing it accurately and placing it in proper perspective regarding the overall anatomical organization of the human brain. As such, he fully deserves to have his name associated with the lateral fissure, fossa and artery. Sylvius's pioneering description of the insula, however, remained largely ignored. It was rediscovered at the beginning of the 19<sup>th</sup> century by the German psychiatrist and polymath Johann Christian Reil (1759-1813) who provided a detailed description of the structure.<sup>27</sup> Although Reil gave full credit to Sylvius for its pioneering description, the insula became progressively known as "the island of Reil."

### b) The cerebral aqueduct

The association of Franciscus Sylvius's name with the cerebral aqueduct is more problematic. The cerebral aqueduct appears to have been known since the time of Galen, although, according to Galen's translator Charles Victor Daremberg (1817-1872), his description of the canal concerns the subarachnoid space extending from the third ventricle and not the cerebral aqueduct. However, several 14<sup>th</sup> and 15<sup>th</sup> century authors admitted the existence of a communication between the third and fourth ventricle and some 16<sup>th</sup> century anatomists, including Vesalius, accurately described the conduit.<sup>12,28,29</sup> Giulio Cesare Aranzio (1530-1589), a former student of Vesalius, is probably the first to have used the term *aqueduct* in reference to this passage.

Franciscus Sylvius correctly described and named the cerebral aqueduct in his fourth *Disputationes*. He used the term *Canalis vel aquae-ductus* to describe the conduit that runs through the midbrain substance "from the third into the fourth ventricles under the corpora quadrigemina, crowned by the testes and the nates."<sup>23</sup> However, it is the writings of Stensen and Bartholinus that led to the progressive attachment of Sylvius's name to the cerebral aqueduct. Stensen repeatedly referred to the aqueduct as "ce canal de Monsieur Sylvius" (this channel of Mister Sylvius) in his 1665 Parisian *Discours*,<sup>19</sup> whereas Bartholinus's description of the third ventricle and cerebral aqueduct is largely based on the neuroanatomical notes provided by Sylvius.<sup>21</sup> The famous Swiss-born physiologist Albrecht Von Haller (1708-1777), who graduated in medicine at Leiden University in 1727 under the tutorship of Boerhaave, gave Sylvius full credit for his description of the cerebral aqueduct in his highly influential treatise *Bibliotheca Anatomica*.<sup>30</sup>

This Danish connection has obviously played a major role in the progressive elaboration of the eponym *aqueductus sylvii*. However, far from being a historical mistake, as advocated by some,<sup>31</sup> the association of Sylvius's name to the cerebral aqueduct should be viewed as a well-deserved homage from young and enthusiastic students for the major contribution of their master to brain anatomy.<sup>28,29</sup>

### c) The animal spirits

To explain the action of the nervous system, Sylvius – like most of his contemporaries – used the ancient Galenic notion of *spiritus animalis*, the purest and finest substance of the human

body generated by ultrafiltration of the blood. However, Sylvius believed that psychic spirits were produced in the brain substance itself and not in the cerebral cavities or the *rete mirabile*, as advocated by Galen. Already clearly exposed in his 1634 thesis,<sup>3,4</sup> Sylvius further expanded this view later in his fourth *Disputationes*, which bears the following revealing title: *De Spiritum Animalium in Cerebro, Cerebelloque Confectione, per Nervo Distributione, atque Usu Vario* (The animal spirits are produced in the brain and cerebellar substances and eventually distributed through the nerves for various usages).<sup>23</sup>

In Sylvius's scheme, the cerebral and cerebellar cortices acted jointly to separate and purify the animal spirits from the blood, with the remaining watery part of the blood forming the meningeal and ventricular fluids. The animal spirits then moved into the white matter and nerves and, if not entirely used up at these levels, a substantial part of them passed within the lymphatic vessels and returned to the blood. Thus, somewhat like the Harveyan blood circulation theory, Sylvius promoted the concept of an animal spirit circulation: from the blood to the brain, from the brain through the nerves, from the nerves to the lymphatics and back into the blood. Obviously influenced by Descartes, Sylvius considered the animal spirits sufficiently subtle to communicate the affections of the mind to the body and vice versa.<sup>23</sup> For him, the agitations of the human mind caused by the passions of the soul were the proper subject of medicine.<sup>17</sup>

Hence, while remaining largely within the framework of the Galenic tradition, Sylvius's solidism notion of animal spirit production, which was later greatly expanded by Thomas Willis,<sup>32</sup> finally led to the abandonment of the cellular or ventricular doctrine of brain functions that had dominated medical thinking for about 1500 years.

### SYLVIUS'S PRIVATE LIFE

Some time after he moved from Amsterdam to Leiden, Sylvius bought a house on Rapenburg Canal, the preferred residence site of city officials, wealthy merchants, and university professors.<sup>10</sup> He then commissioned Willem Wijmoth, a well-known Leiden entrepreneur, to rebuild the house so as to meet all of his professional and personal needs. The final product was remarkable (Figure 5A,B). Beside its beautiful façade and the habitual commodities, the house contained a large study room harboring Sylvius substantial library, a room for tutorials, and no fewer than three well-equipped laboratories. Sylvius progressively became one of the greatest Dutch painting collectors and promoters in Leiden. He commissioned portraits, including of himself, to some of the most famous painters in Amsterdam and Leiden, particularly Frans van Mieris the Elder (1635-1681) and Gerrit Dou (1613-1675).

Most of Sylvius's paintings emphasized the importance of self-knowledge and the effort to achieve moderation and control in all things, a theme largely derived from the Christian humanism of Erasmus (ca. 1467-1536) that pervaded Dutch society at that time. This is exemplified by the numerous *Natures Mortes* in Sylvius's collection, which alluded to the ephemeral essence of human existence and the vanity of the things of the world.<sup>10,16</sup> In his choice of paintings, Sylvius appeared to have followed closely the early Renaissance concept stipulating that artists should study nature in a truly scientific spirit.

Sylvius's views on the importance of self-knowledge and the effort to achieve moderation and control are already expressed in

his 1658 inaugural address as Chair of Practical Medicine. Such is also the case for marriage and family, which he considered the foundation of the society. This theme is beautifully illustrated in van Mieris's painting of Sylvius and his wife Magdalena Schletzer that hung in the master bedroom of the Rapenburg house (Figure 5C). Sylvius commissioned this painting in 1669 shortly after the plague took his beloved wife and daughter, leaving him deeply afflicted. Van Mieris's painting underlines the marked contrast between the sad widowerhood of Sylvius, wearing severe dark garments, and the joyful state of mind of his wife, who exhibit a colorful French-fashioned silk gown, with a fur stole and semitransparent veil, while playing the lute, a well-known symbol of marital harmony in 17<sup>th</sup> century Dutch painting.<sup>33</sup> Sylvius died six months after this work was completed and the inventory of his estate revealed, on one hand, a stunning collection of 185 beautiful paintings and, on the other hand, a humble cradle that Sylvius kept in his bedroom in memory of his beloved daughter.

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#### DISCLOSURES

Andre Parent has nothing to disclose.

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