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Areview of analogies between some neuroanatomical terms and roman household objects

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A R T I C L E   I N F O

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A B S T R A C T

Wishing to contribute to an easier remembrance of the name, shape, location and function of some neuroanatomical structures, this paper aims to identify the origin of eight Latin terms (*pulvinar*, *capsula*, *infundibulum*, *operculum*, *flocculus*, *forceps*, *falx*, *habenula*).

Therefore, we analyzed the etymology of these Latin neuroanatomical terms in brief, and searched the possible correlations between the shape of different household objects used in Roman Antiquity and the shape of neuroanatomical structures bearing those names. We also perused the literature to identify the first anatomist who made such an analogy when searching to give a name to the anatomical structure he had discovered at dissection, as well as the time context of his discovery.

We found knowledge of few neuroanatomical structures tracing their origin to Antiquity, but most of the nervous structures we have studied were discovered in the 19th century, when the German school of anatomy played a distinctive part. However, the multitude of Latin words designating neuroanatomical structures by analogy is an undeniable proof of neuroanatomists' amazing imagination.

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1. Introduction

Gross anatomy has a great relevance in daily professional activity and in the undergraduate training of health professionals, in surgical and in other specialties (Arráez-Aybara et al., 2010). Human anatomy is one of the basic sciences of medicine without which the art of patient care could not be performed. Although there is less time to teach anatomy (Pabst, 2009), we must not forget that "nulla medicina sine anatomia" (Di Dio, 1999).

However, anatomy and mostly neuroanatomy are considered by any student to be disciplines which are difficult to learn, because these two have a specific vocabulary with many equivalent Latin names, which seems to be hard to memorize and must be mastered almost like a foreign language. Wishing to contribute to an easier remembrance of the name, shape, location and function of some of the neuroanatomical structures, this paper aims to identify the origin of eight Latin neuroanatomical terms (*pulvinar*, *capsula*, *infundibulum*, *operculum*, *flocculus*, *forceps*, *falx*, *habenula*) the etymological meanings of which are correlated to ancient objects and tools found in Roman houses in order to identify the possible analogies between these elements. We also investigated the literature to identify the first anatomist making such an analogy to obtain a name for those neuroanatomical structures he discovered at dissection, as well as the time context of his discovery.

2. Analogies between neuroanatomical structures and Roman furniture

2.1. Pulvinar

Entering into a *villa* in ancient Rome everyone would see the ***pulvinar*,** an armchair lined with numerous pillows known as *pulvini*, taking the form of a "empty throne" or a cushioned couch where the Romans placed statues of their deities, especially on the occasion of *Lectisternium* – a reconciliation ceremony with their gods (Smith, 1859).

Also, in the Roman Antiquity, at the Circus or the arena, the *pulvinar* was a special "royal enclosure", where the Emperor, seating on a huge imperial throne, could watch the spectacle. Moreover, from *pulvinar*, the Emperor showed himself to his subjects like a godlike creature (Pearson, 2013).

Due to its gross resemblance with this ancient furniture, the caudal nucleus of the thalamus that looked like an armchair was denominated with the word *pulvinar* (Federative Committee on Anatomical Terminology (FCAT), 1998) (Fig. 1). Between its arms there is no Roman deity, but the pineal gland. However, in the 17th century, the French philosopher René Descartes (1596–1650) asserted for pineal gland the role of a deity because he assigned it as the seat of intellect and soul.

The name *pulvinar thalami* for this neuroanatomical structure was used for the first time by the famous German Professor of Anatomy Karl Friedrich Burdach (1776–1847), who benefited from two major events of his time. First, another remarkable German anatomist, Johann Christian Reil (1759–1813), used for dissection the fixation technique with alcohol in order to obtain a harder organ suitable for cutting and searching new nervous structures. On the other hand, Burdach, like all the German anatomists from the end of 18th century to the beginning of 19th century, was under the influence of German Romantic intellectual movement, especially *die Naturphilosophie* (*philosophy of nature*) that reviewed the theory of knowledge based on the sensory evaluation (Poggi and Bossi, 1994; Meyer, 1970). Moreover, Romanticism had an important positive contribution to human anatomy. Combining scientific data with philosophical insights, the German anatomists of that time began to appeal to analogy and metaphor as means of useful knowledge transmission. Therefore, analysis and interpretation of the imagines evoked by different neuroanatomic structures has become a rich source of ideas and concepts (Cunningham and Jardine, 1990), which led to the advancement of medical science.

Karl Friedrich Burdach was "doctor in philosophy, medicine and surgery", as it is shown on the frontispiece of his book, *Vom Baue und Leben des Gehirns* (Burdach, 1822). He introduced a new discipline within medical sciences, *the morphology*, meaning the study of the form and structure of organisms, without consideration to function. He hoped that this new science would lead to some progress in the development of anatomy, which meant, until then, "more to cut organic structures than philosophizing about them" (Nyhart, 1995). Burdach wrote an essay entitled *Über die Aufgabe der Morphologie* (*On the task of Morphology*), in which he described the term *Morphologie* granting it three values: "Zweig der Heilkunde", "Zweig der Naturwissenschaft", and "Zweig der Naturkunde" (Burdach, 1817). This work is considered a milestone in understanding the role of the animal form in an attempt to create a new science of life. He highlighted the fact that all visible structures should be subject to observation, description and comparison.

Faithful to this mode of information acquisition in scientific activity, when he saw on brain dissection that the posterior rounded prominence of the human thalamus was like a cushion, he made a description and named it *das Polster* (*pulvinar*) thinking of the Latin word *pulvinus* which means pillow or cushion: "*Das Polster (pulvinar)*, eine Anschwellung am hintern Ende des inner Randes der obern Vierhügel wie ein Kissen herüber legt" (Burdach, 1822). [The cushion (*pulvinar)*, a swelling at the posterior end of the inner edge of the upper quadrigemina like a pillow over seats (*our translation*)]. Burdach made very little comment about the possible functions of the thalamus. Moreover, full recognition of its functional significance is not well understood even today, but some anatomists see it as an integration nucleus. However, the human *pulvinar* is the largest thalamic area in terms of size and cortical connectivity (Barron et al., 2015). It is not only integrated into the optic and acoustic systems but is also connected with the cortical areas important for language and symbolic thinking (Kahle and Frotscher, 2003). Also, there is overwhelming evidence that the *pulvinar* has a role in visual salience (Grieve et al., 2000).

2.2. Capsula

Returning to Antiquity, in a Roman *villa*, there always have been a *capsa***,** used as a chest, a repository, a box, or a *capsula*, meaning "small box or enclosure" (Diab, 1999). *Capsa* was the box for holding books and were usually made of beech-wood and were of a cylindrical form. *Capsa* or *capsula* were often placed by the side of statues dressed in the togs (Smith, 1859). In neuroanatomy (Federative Committee on Anatomical Terminology (FCAT, 1998)), this name was applied to a structure which has come to designate a wrapper around another. Thus, there is *capsula interna* (internal capsule), *capsula externa* (external capsule), and *capsula extrema* (extreme

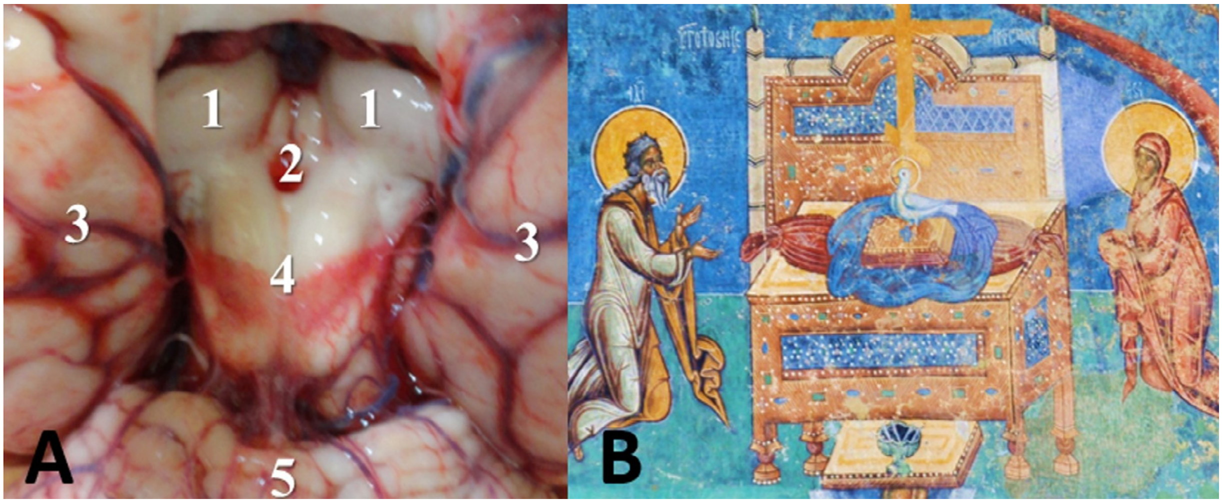

Fig. 1. (A) Posterior view of the pineal region with: (1) *pulvinar nuclei*, (2) *pineal gland*, (3) *medial view of occipital lobes*, (4) *tectal plate*, (5) *cerebellum* (personal collection). (B) *Hetoimasia* (Greek ἑτοιμασία = *preparation*), equivalent of the Roman empty throne (pulvinar) (or Throne of the Second Coming of Christ), used in Byzantine iconography on exterior picture of the western wall of Voronet Monastery, Romania, 1535 (detail).

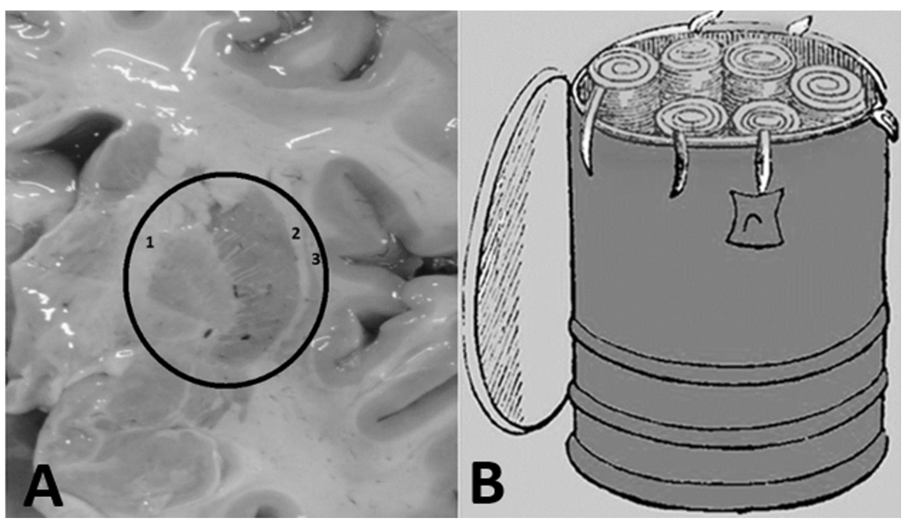

Fig. 2. (A) Coronal section of brain to show (1) *internal capsule*, (2) *external capsule* and (3) *extreme capsule*. (personal collection). (B) An open *capsa* with six rolls of books in it-from a painting at Pompeii (adapted from Smith, W., 1859. *A Dictionary of Greek and Roman Antiquities*. Little Brown and Company, Boston).

capsule), which are white matter structures enclosing deep brain nuclei which appear to be seated in a box (capsule) (Fig. 2).

As a neuroanatomical structure, internal capsule was first illustrated by the founder of modern human anatomy, Andreas Vesalius (1514–1564). In his *De humani corporis fabrica* (*On the Fabric of the Human Body*) (1543), the most influential books on human anatomy, the author mentioned in the key to Figure 7 of the Seventh Book that *letter E* meant “the shining white matter” (Vesalius et al., 1543/2009), denominating what we now call “internal capsule”. This nervous structure was called *corporis striati limbus posterior* (Willis, 1672) in 1672 by the English anatomist Thomas Willis (1621–1675), a pioneer in the research into the anatomy of the brain: then, the French anatomist Raymond Vieussens (1635–1715), in his work on neuroanatomy, *Neurographia universalis*, in which he made “*descriptio anatomica . . . integra et accurata*” of the entire human nervous system, named capsule as *geminum semicirculare centrum* (Vieussens, 1775) in 1684. After one hundred years it was graphically depicted in a brilliant way by the another famous French anatomist, Vicq d’Azyr, in his *Traité d’anatomie et de physiologie avec des planches coloriées représentant au naturel les divers organes de l’homme et des animaux* (Déjerine, 1895). But the first who coined the term *capsula* in neuroanatomy nomenclature was Johann Christian Reil, in 1809, who used the term “capsule” (*Kapsel*) for the structure which encircled basal nucleus as a container (Reil, 1809a). The German anatomist did not know so much about the function of these anatomical structures, but perhaps he decided to use this term due to the shape similarities between ancient papyri protecting *capsula* in Roman Antiquity and the macroscopic appearance of anatomical capsule covering the lenticular nucleus, which is indeed a valuable structure of the nervous system.

Later, Karl Friedrich Burdach, in his *Vom Baue und Leben des Gehirns*, made detailed description of anatomical capsules and defined them as “*capsula interior*” (*innere Capsel*), and *capsula externa* (*äussere Capsel*) (Burdach, 1822). He wrote that the internal capsule is made up of “white matter leaves” (*Markblättern*) because throughout this firm area made up of white substance, the nervous tissue was easily separated into “*leaves, laminae*”. He describes it as a crescent encircling the lenticular nucleus (*Linsenkern*). The imagination of this Romantic anatomist appealed to metaphors in order to describe this structure: "An diese ihren Rändern sind die Blätter schmäler, und es bleiben daher zwischen ihnen Lücken, in welche graue Substanz von den anliegenden Ganglien hereinragt, so dass dadurch ein gestreftes oder flammiges Ansehn entsteht. Die vordre untre Schicht der inner Capsel entspricht in ihrer Faserung dem Linsenkerne, indem sie von dessen Umkreise wie eine Glorie ausstrahlt" (Burdach, 1822). ["At their edges, the leaves are narrower, and therefore there remain gaps between them, in which the gray matter of the adjacent ganglia sticks out, thereby a flaming appearance arises. The front layer of the inner capsule corresponds to the fibers separating the lenticular nucleus and radiating from its perimeters like an aura" (*our translation*)].

Burdach also described *capsula externa* (Burdach, 1822), and then he presented the convergence of those two capsules: "So convergiren den beide Capseln, und treffen am ganzen obern, scharfen Rande des Linsenkerns in einem spitzen winkel zusammen, um von da in gemeinschaftliche Strahlung überzugehen" (Burdach, 1822). [So, the two capsules converge, and meet together on the upper sharp edge of the lens nucleus at an acute angle, to go from there in joint radiation" (*our translation*)].

At the end of 19th century, there was a considerable progress in medical sciences, mostly in neuroanatomy and neuropathology. Two of those who brought great achievement to neuroanatomy in that period of time were Professor Joseph Jules Déjerine (1849–1917) together with his wife, anatomist herself. They used horizontal nervous tissue sections corresponding to macroscopic brain tissue section obtained from dissections and stained them with Weigert's stain method for myelin in order to analyze them with the microscope. In 1895, they published detailed drawings of the internal and external capsules and presented them as being made up of nerve fiber bundles which connected different nervous structures, highlighting their relationships with surrounding structures, the putamen and globus pallidus (Déjerine, 1895).

3. Identification of some tool shapes in the morphology of neuroanatomical structures

3.1. Infundibulum

In their everyday life, Roman families utilized *infundibulum*, an object in the form of a funnel, wide at the top and narrow at the bottom, used to transfer the liquids from a vessel to another.

Due to its funnel-like shape, the neuroanatomical structure that unites the base of the brain with the hypophysis was denominated as *infundibulum* (Federative Committee on Anatomical Terminology (FCAT), 1998) by the renowned ancient physician, anatomist and lexicographer Rufus of Ephesus (80–150 AD) (Diab, 1999) and by the prominent Greek physician and philosopher of Roman Empire, Galen of Pergamon (129 to c. 200 AD), who performed a lot of dissection, especially on animals.

Ruphus considered anatomy an important discipline for the study of medicine and he wrote works on descriptive anatomy and anatomical nomenclature (*On the Names of the Parts of the Human Body*) (Prioreschi, 2001), which had a major impact on the advancement of medicine. He is considered to be the first to introduce the term *infundibulum* when he had described an anatomical structure having the shape of a funnel (Diab, 1999).

At almost the same time, Galen used the term *infundibulum* for the neuroanatomical structure that acted as a "funnel" for residues or waste products made up in ventricles on their way to the pituitary gland, which filtered them before passing through perforations of palate into mouth as *pituita*, mucus or phlegm. Galen regarded the *infundibulum* as a cavity extending to pituitary gland and surrounded by a wall formed by pia mater (Swanson, 2014).

Thus, the morphological features discovered at brain level in Antiquity excited ancient anatomists' imagination. In order to determine a name for all their amazing discoveries, anatomists used analogies with all kind of objects they had in their proximity, especially household tools employed in everyday life.

In the Renaissance, the period when Western people desired to revive the Golden Age of Antiquity, human dissection, more or less public, was allowed. This fact led to the development and deepening of the knowledge on the structure and functioning of the human body. Renaissance anatomists used the same analogies as the forerunners to designate the newly discovered neuroanatomical structures and also the same Latin language because this was the language of *accademia*.

Andreas Vesalius (1514–1564), based on original dissections and observations, was the anatomist who also described *infundibulum*, but called it *basin*or *pelvis*, "which is shaped like a funnel"... "that receives the cerebral pituita that flows down from the third ventricle" ... and ... "through which cerebral pituita drips into the gland through foramina next to the gland" (Vesalius et al., 1543/2009). To demonstrate the function of *infundibulum* as a funnel, Vesalius poured a dye into the third ventricle and then watched its flow (Cruveilhier, 1871).

For 300 years, the data about the structure and function of *infundibulum* were kept as in Vesalius's version. In the second half of the 19th century, using the tissue fixation techniques, the microscope and the new staining methods for nervous tissue, the French anatomist Jean Cruveilhier (1791–1874) carefully examined the brain and described *infundibulum*. He supported the idea that this structure is a funnel-shaped channel, wide above, where it communicated with the third ventricle, and narrow below, where it reached the pituitary body. He tried to answer to a dilemma of his contemporary anatomists: is *infundibulum* "a solid or a hollow stem"? and concluded that its shape is that of a funnel, but it did not work as a funnel because it did not allow a fluid to pass from the brain to the nose.

3.2. Operculum

Searching again the daily life of the Romans, we identify the o*perculum,* which represented a little lid that covered jars and pots for cooking (White, 1975). This term was also adopted in neuroanatomy, being found in the name of *operculum frontale, operculum parietale*, and *operculum temporal* (Federative Committee on Anatomical Terminology (FCAT), 1998). Their names correspond to the cerebral lobe they belong to.

In the history of anatomy, Johann Christian Reil was appointed as the first anatomist who, during brain dissections, found that the structure covering Sylvian fissure has the appearance of a roof. In 1809, he named it as "*das Dach der Sylvischen Grube*" (Reil, 1809b), (*roof of the Sylvian pit*) that corresponded with what would be later called the frontal and parietal *operculum*.

Later, Burdach, in his work, published in 1822, used the term "*der Klappdeckel*" (*flap cover*) equated with the Latin word *operculum* (Burdach, 1822) as he considered that it had the appearance of a cap covering a pot.

4. Crafts of ancient Rome and terminologia anatomica–systema nervosum

4.1. Flocculus

In Roman Antiquity, the Latin word *flocculus* was used to denominate a little tuft of wool (Venes, 2013) used by women to weave various clothing items. The image of a tuft of wool inspired the neuroanatomists to refer to one of the lobes of the cerebellum as *flocculus cerebelli* (Federative Committee on Anatomical Terminology (FCAT), 1998) as from a macroscopic point of view these two elements shared similarities. The *flocculus cerebelli* is a little irregular lobule, located in front of the biventral lobule, between it and the middle cerebellar peduncle. It seems like a tuft of wool as it is subdivided into a few small laminæ, and is connected to the inferior medullary velum by its central white core (Gray, 1918/2000).

The first who recognize this small cerebellar lobe was Michele Vincenzo Giacinto Malacarne (1744–1816) (Burdach, 1822), Italian anatomist and surgeon, founder of topographical anatomy. In the first detailed description of the cerebellum anatomy performed in his ***Nuova esposizione della struttura del cervelletto umano***, Malacarne used the term *flossi laminose* (*laminated flakes*) (Malacarne, 1776).

In the same period, Félix Vicq d'Azyr (1746–1794), a famous French physician and anatomist, founder of comparative anatomy and discoverer of homology theory in biology, called the fourth inferior lobe of the cerebellum as the pneumogastric nerve lobe or *flocculus* (Meckel, 1838) in his monumental work *Traité d'anatomie*.

It should be emphasized that Félix Vicq d'Azyr was a representative anatomist of the French Enlightenment, the intellectual movement expressing itself also in medicine of Western Europe. The anatomists emphasized reason, analysis, and empiricism, proposing the idea that theories should be based upon human observations and experience. As Enlightenment centered around the project of the *Encyclopedia*, in order to make knowledge widely available, brain dissections and denomination of the newly identified nervous structures were stimulated as anatomists felt the need of an anatomical glossary (Parent, 2007) that would contribute to the intensive study of the man who was sought like a wonderful machine.

In this context, Félix Vicq d'Azyr founded comparative anatomy and made significant efforts to develop a new anatomical nomenclature, purely descriptive (Parent, 2007; van Gijn, 2009). Thus, he identified the fourth inferior cerebellar lobe, also observing that its surface was divided into several laminae just like sequencing strands of wool into a ball. The French anatomist used the term *flocculus*, but he did not identify its function. The discovery of this small cerebellar lobe was possible because Félix Vicq d'Azyr used a brain fixation technique taken from the Dutch anatomist Frederik Ruysch (1638–1731). Made up of a combination between alcohol, hydrochloric acid and saltpeter, that fixation solution hardened and preserved brain, allowing elaborate dissection for a long time. This conservation technique became a standard in neuroanatomical research especially beginning with the careful research of brain structure made by the German anatomist Johann Christian Reil (Parent, 2007).

4.2. Forceps

Roman blacksmiths used *forceps* to remove the hot iron from the fire and then to shape it on the anvil. Also, there was a kind of *forceps* used to remove damaged teeth (Smith, 1859).

The term is found in Terminologia Anatomica (Systema Nervosum) as *forceps minor* and forceps *major* (Federative Committee on Anatomical Terminology (FCAT), 1998), denominating the white matter bundles that cross the *corpus callosum*; on cross section of the brain they look similar to the forceps arms. The first anatomist who made this observation was Johann Christian Reil. He saw that on either side of the *corpus callosum* the fibers radiated in the white matter, and so he compared them with the arms of a pincers and called this structure as "*die Zange*" (*forceps*) (Reil, 1809c). Recognizing the primacy of Reil and also the analogy this one introduced in neuroanatomical nomenclature, another German anatomist, Friedrich Arnold, observed that those fibers curving forward from the *genu* into the frontal lobe are smaller than those curving backward into the occipital lobe of the cerebrum. So, he denominated these two structures as *forceps anterior* or *minor*, and the *forceps posterior* or *major*, respectively (Arnold, 1838).

4.3. Falx

If we look back to Antiquity, we can find the Roman peasants using the *falx* in agriculture and horticulture (Rich, 1860). It was a curved knife with one sharp edge. This instrument was used in many different occasions and received its name by adding an epithet, depending on the context and its shape. A *falx* could be used for cutting down corn and it was a sickle. The scythe, which was employed in mowing hay, was called *falx foenaria*. The pruning-knife and the bill, on account of their use in dressing vines, as well in cutting the branches of trees, were distinguished by the appellation of *falx vinitoria*, or *arboraria* (Smith, 1859). The *falx* was also used in mythological battles, but also by the Romans on the battlefields with other mortals. It is noted primarily as a weapon with which Jupiter was injured by Thyphon or as a weapon with which Hercules slew the Lernaean Hydra, or as the weapon with which Mercury cut off the head of Argus (Smith, 1859).

This name was also taken over by neuroanatomists as *falx cerebri* and *falx cerebella* (Federative Committee on Anatomical Terminology (FCAT), 1998) to denominate tough sickle-shaped processes of the dura mater that partially separates the two cerebral hemispheres and the two cerebellar hemispheres, respectively.

The first detailed presentation of *falx cerebri* was made by the famous Andreas Vesalius. In the chapter "*Processes of the Hard Membrane*", he made the analogy between the portion or process of the hard membrane that divides the right side of the brain from the left longitudinally in the head with the harvester's sickle (in Latin he used the word *falx*): "the base of the sickle is the part that is continuous with the portion of the hard membrane that covers the cerebellum, its tip is the part attached to the septum between the olfactory organ (for this process the hard membrane becomes gradually narrower like a sickle as it passes from the rear of the head forwards), and its back is part of this process that dissectors find to be continuous with the third sinus of the hard membrane . . . while the part of the process that faces the corpus callosum of the brain is curved inwards and so resembles the sharp edge of the blade" (Vesalius et al., 1543/2009). Also, in Figure 3 from *Book VII*, he presented the image of the hard membrane marking it with the letters D,D,D as he obtained at brain dissection and defined it as "the portion of the hard membrane that divides the right side of the brain from the left" (Vesalius et al., 1543/2009) and drawn attention to the shape of this structure, suggesting the reader to carefully examine the image.

Regarding the denomination of *falx cerebelli*, first reference to this structure belongs to the Italian anatomist Antonio Pacchioni (1665–1726), who devoted himself to elucidating the structure and function of dura mater (Brunori et al., 1993). In his treatise, *De durae meningis fabrica et usu disquisitio anatomica*, published in 1701, he made an extensive description of the dural structure, stating that there is a small crescent-shaped formation that separates the two cerebellar lobes (Pacchioni, 1701).

Later, the Danish-born French anatomist Jacques-Bénigne Winslow (1669–1760) wrote *Exposition anatomique de la structure du corps humain*, published in 1732, which is the first treatise of purely descriptive anatomy derived from common objects. When he described "*Folds and septa*" of the dura, he mentioned: "The dura mater sends off several processes; three of which form particular septa that divide the brain into certain parts. One of them is superior, representing a kind of *mediastinum* between the two great lobes of the brain; the second is in a middle situation like a *diaphragm*, between the cerebrum and the cerebellum; the third is inferior, between the lobes of the cerebellum. The superior septum is longitudinal in form of a scythe, and hence it is termed the falx of the dura mater; the middle septum is transverse; and might be called (. . .) *tentorium cerebelli*. The inferior septum is very small, and runs down between the lobes of the cerebellum; on which account it may be termed either simply *septum cerebelli*, or *septum occipital minus*" (Winslow, 1784).

Taking the ideas of these two anatomists, but quoting them in his famous treatise *Elementa Physiologiae corporis humani*, the illustrious anatomist and physiologist Albrecht von Haller (1708–1777) was the first who called the small dural process separating the two cerebellar lobes as *falx*: "In universum, duo similes & æquales cerebelli lobi sunt, quos *falx*, a dura membrana encephali nata, haud profunde bipartite" (von Haller, 1757–1766) [Generally speaking, the two cerebellar lobes are similar and equal, deeply divided by sickle (*falx*), a naturally hard membrane of the brain (*our translation*)].

Sir Charles Bell (1774–1842) clearly stated that *falx cerebri* was a borrowed term due to the similarity between the shape of the anatomical structure and the shape of the cutting tool, the sickle (Bell, 1802). He also mentioned the presence of a ditch between the lobes of the cerebellum where a small falx, similar to an inverted *falx cerebri*, could be found. He called it *processus falciformis cerebelli* (Bell, 1802).

At the beginning of the 19th century, under the direct influence of *Naturphilosophie*, that relied on the idea that something general should unify all aspects of life so that a single form underlies all living phenomena (Stone, 2011), the famous German scientist Johann Friedrich Meckel the Younger (1781–1833) stressed the acquisition of empirical data from which certain useful conclusions could be derived. He did thorough descriptions of both cerebral and cerebellar dural processes and attached them names that were preserved in anatomical terminology: *falx cerebelli* (die Sichel des kleinen Gehirns), along with *falx cerebri* (die Sichel des großen Gehirns) (Meckel, 1817).

4.4. Habenula

Inside the brain there is an amazing structure called *habenula* (Federative Committee on Anatomical Terminology (FCAT), 1998). Its denomination rooted in the Latin word *habena*, which represented the reins the Romans used to restrain their horses (Smith, 1859).

The habenular region was observed for the first time by Theodor Hermann Meynert (1833–1892), a German–Austrian neuropathologist and anatomist, who is also known as one of the Founders of the Brain Psychiatry (da Mota Gomes and Engelhardt, 2012). In 1872 he described a small mass of grey matter in the posterior edge of *stria medullaris* of the human brain and called it "*das Ganglion der Habenula*". Moreover, he identified the efferent main bundle of that area which he called "*fasciculus retroflexus*", now called habenulointerpeduncular tract of Meynert (Jones, 1985).

The German anatomist was the first scientist to perceive that the study of the brain was an interdisciplinary research project bringing together anatomy and physiology. Using the term *habenula* to denominate a neuroanatomical structure, he also pointed its function as the synaptic site of the pineal gland, brainstem and olfactory centres (Kahle and Frotscher, 2003). There are two habenular nuclei and a habenular comissure, interconnecting the two nuclei. All these three elements frame the habenular triangle. The *habenular nucleus* receives afferent and efferent pathways forming a relay system. So, all of its afferent and efferent connections appear to be very similar to the reins with which a former quadriga rider restrained his horses. Referring to its function, it is important to mention the fact that *habenula* is responsible for integration of olfactory and visceral function hence it is part of the limbic system. Also, the *habenula* is olfacto-somatic correlation centre and this is apparent from the fact that there is a reflex movement of the neck and body towards or away from source of olfactory stimuli (Kulkarni, 2008).

This nervous structure has a role in motivation and reward as the neurons from *habenula nucleus* are "reward-negative", which means that they can be activated by the stimuli that are associated with lack of reward or unpleasant events. It has been proven by studies made on a monkey that when the expected reward is missing, then the habenular neurons have an increased activity and when an unexpected reward is granted then the habenular neurons have a decreased activity. In addition, it seems that *habenula* is a nervous structure involved in the behavioural response to pain (Fakhoury and López, 2014). All these function astonish us as they reveal, indeed, closely similarities with the function of the reins on the horses.

5. Conclusions

Neuroanatomical terminology finds its origins in the analogies between the shapes of certain cerebral anatomical structures revealed by autopsies and the conformation of some domestic objects used in any Roman household. The multitude of Latin words that designate some neuroanatomical structures by analogies is an undeniable proof of neuroanatomists' amazing imagination. However, the denominations we have presented here were chosen by anatomists over many historical periods, but they all had in common a passion for anatomy.

It is impressive that many of those Latin denominations have been preserved until today. With a little effort of imagination, and also based on numerous scientific data acquired to date, we can recognize that earlier anatomists were able to capture in one word a great deal of information about the structure and even functions of different neuroanatomical structures that we can see with undisguised astonishment during dissection.

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