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BEHIND THE EPONYM

An Unwritten Anatomy Lesson:

The Influence of Roman Clothing on Neuroanatomical Terminology:

In memoriam Albert L. Rhoton, Jr. (1932–2016)

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Throughout the centuries, anatomists attempting to denominate the new structures they discovered have found inspiration in the civilization of ancient Rome and the clothing worn by its citizens. This aricle presents the origins of seven neuroanatomical terms, *fimbria, velum, funiculus, lemniscus, corona, splenium*, and *cingulum*, inspired by the clothing and jewellery of Roman women and the military attire of Roman soldiers. Thus, through their apparel, the Romans influenced the *Terminologia Anatomica* and "clothed" the structures of the brain and spinal cord, making them immortal. Clin. Anat. 29:685–690, 2016.

Key words: neuroanatomical terminology; Roman clothing; Latin language

INTRODUCTION

Roman clothing was characterized by simplicity. It was designed to reveal the social status of the people wearing it and, consequently, differed among kings, senators, soldiers, common Roman citizens, slaves, and gladiators. The influence of Roman clothing can be found in various neuroanatomical denominations, which paved the way for modern anatomical terminology (Turmezei, 2012). Nowadays, knowledge of the origins of anatomical terms is helpful and fascinating for scientists because it helps them to understand anatomical structures better (Paluzzi et al., 2012).

The aim of this study is briefly to review the influence of Roman clothing on neuroanatomical terminology.

FIMBRIA

Married Roman women (*matrons*) wore an adornment around the neck called *segmentum*—a sort of ribbon like a necklace, which could be embroidered with fringing called *fimbriae (fringes)* (Latin sg. *fimbria*, pl. *fimbriae*) (Adam et al., 1842). Other pieces of clothing for women with edges made from the bare warp threads of the loom were also called *fimbriae*.

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Such clothing could also be worn by men, but rarely, because it was considered characteristic of women's clothing (Smith, 1853). Effeminate men and homosexuals often used *fimbriae* in their attire. Even Julius Caesar, who was allegedly involved with men as well as women, sometimes wore fringed clothing (Hyrtl, 1880; Suetonius, 1913; Richlin, 1993).

The anatomists took inspiration from this accessory mainly worn by Roman women and used it to denominate the fringe of tissue from the uterine tubes, to which it bears a certain similarity. The fimbriated extremity of the uterine tubes was first briefly described by Herophilus of Alexandria, Eudemus, and Rufus of Ephesus (Buck and Stedman, 1914). They were followed by the Italian anatomist Gabrielle Fallopius (1523–1562), who in his work *Observationes Anatomicae* (1561) offered a wonderfully eloquent and correct description of the fimbriated extremity of the uterine tube, which came to be known as the Fallopian tube (Macchi et al., 2014). Fallopius was the first to introduce the term *fimbriae* to anatomical terminology (Herrlinger and Feine, 1964).

Fimbriae hippocampi, the prominent band of fringed white matter along the medial edge of the hippocampus (Hayman et al., 1998), was described much later because its positioning within the organ (brain) made it sensitive to putrefaction, and the anatomists lacked knowledge of how to approach and preserve it. Andreas Vesalius (1514–1564), a professor of anatomy at the University of Padova, was among the first anatomists to describe and illustrate the fimbria of the hippocampus, yet he did not name it. He observed it at the level of the inferior horn of the lateral ventricle, further to his dissections of human brains, and wrongly assumed that the fimbriae of the fornix originated from the posterior part of lateral ventricles (Finger, 2001; Swanson, 2014; Catani and Sandrone, 2015). The discovery and understanding of the anatomy of the *fimbriae hippocampi* escalated at once with the method of dissection introduced by the Italian anatomist Constanzo Varolio (1543–1575), who no longer examined the brain from top to bottom but removed it from the skull and turned it over, allowing for better dissection and visualization of the entire hippocampal region (French, 1999; Martensen, 2004).

Another technique leading to the advancement of knowledge of hippocampal anatomy was that of the French anatomist Raymond Vieussens (1635–1715), who reintroduced nerve fiber dissection, which had initially been used in the 17th century by the English anatomist Thomas Willis (1621–1675) and the Danish anatomist and bishop Nicholaus Stensen (1638–1686) (Vieussens, 1685; Marshall and Magoun, 1998). This technique helped Vieussens identify the multiple neuroanatomical structures for the first time, which he published in 1685 in a brain atlas called *Neurographia Universalis* (Vieussens, 1685; Türe, 2000). Vieussens also described the fimbria of the hippocampus, which he called *fimbriae fornicis*, inspired by its likeness to Roman fringed clothing*: fornicis fimbriae nuncupari solent* (fornix skirts usually called) (Vieussens, 1685).

In 1735, the Danish-born French anatomist Jacob Benignus Winslow (1669–1760), author of *Exposition anatomique de la structure du corps humain*, considered to be the first purely anatomical treatise (Bellary et al., 2012), adapted the term *fimbriae fornicis*, coined by Vieussens, into *corpus fimbriatum* (Meyer, 1971).

Among those who paid close attention to the hippocampal region was the French anatomist Félix Vicq d'Azyr (1748–1794). He distinguished between the major and minor hippocampus and published his study in 1786, in *Traité d'anatomie et de physiologie* (Vicq d'Azyr, 1786). He introduced a new term to describe this structure at the level of the hippocampus, namely *bandelette de l'hippocampe*, which he also called *taenia hippocampi* (in the French original, *corps frangé*, *corps bordé*).

The German anatomist Karl Friedrich Burdach (1776–1847) claimed (Burdach, 1822) it was the German ophthalmologist Justus Gottfried Günz (1714–1754) who had introduced the term *fimbria* in neuroanatomy, in 1750, replacing the previous name *corpus fimbriatum* given by Jacob B. Winslow (Hyrt, 1880; Swanson, 2014).

In 1890, the Swiss Jacob Honegger made the first topographical description of the hippocampus, dividing it into two segments, anterior (temporal), and posterior (septal), also proposing its first comissural connections with neighboring structures, including fibers passing out through the fimbria (Honegger, 1890; Buck, 1913; Swanson, 2014). Honegger had the opportunity to work in the laboratory of the famous German–Austrian neuropathologist and anatomist Theodor Hermann Meynert (1833–1892) in 1879 in Zürich. During this time, he achieved a remarkable collection of serial sections of the mammalian brain, from the finest carmine and gold series, in which the fimbria of the hippocampus could also be observed clearly (Herrick, 1893).

VELUM

The veil worn by Roman women was called *velum*, which also denoted the curtain that covered the doors of Roman homes or the deities in the temple (Smith, 1853; Cleland et al., 2007). In *Terminologia Anatomica* (TA) (FCAT, 1998), *velum interpositum* designates the triangular space between the two layers of the *tela choroidea* from the third ventricle ceiling (Rhoton, 2002), which covered it like a veil.

The first to introduce the term *velum interpositum* in neuroanatomical terminology was the Swiss anatomist and physiologist Albrecht von Haller (1708–1777), in 1754. He was also the first to distinguish it from the choroid plexus of third ventricle, which most anatomists had previously confused with it (Swanson, 2014). The initial denomination proposed by Haller was *veli sive plexus choroideis interpositi (interposed veil of choroid plexus)* (Swanson, 2014). He claimed that *velum interpositum* closes any potential communication between the third and lateral ventricles (Herndon and Brumback, 2012). Later, in his *The Anatomy of the Brain, Explained in a Series of Engravings*, the Scottish neurophysiologist and anatomist

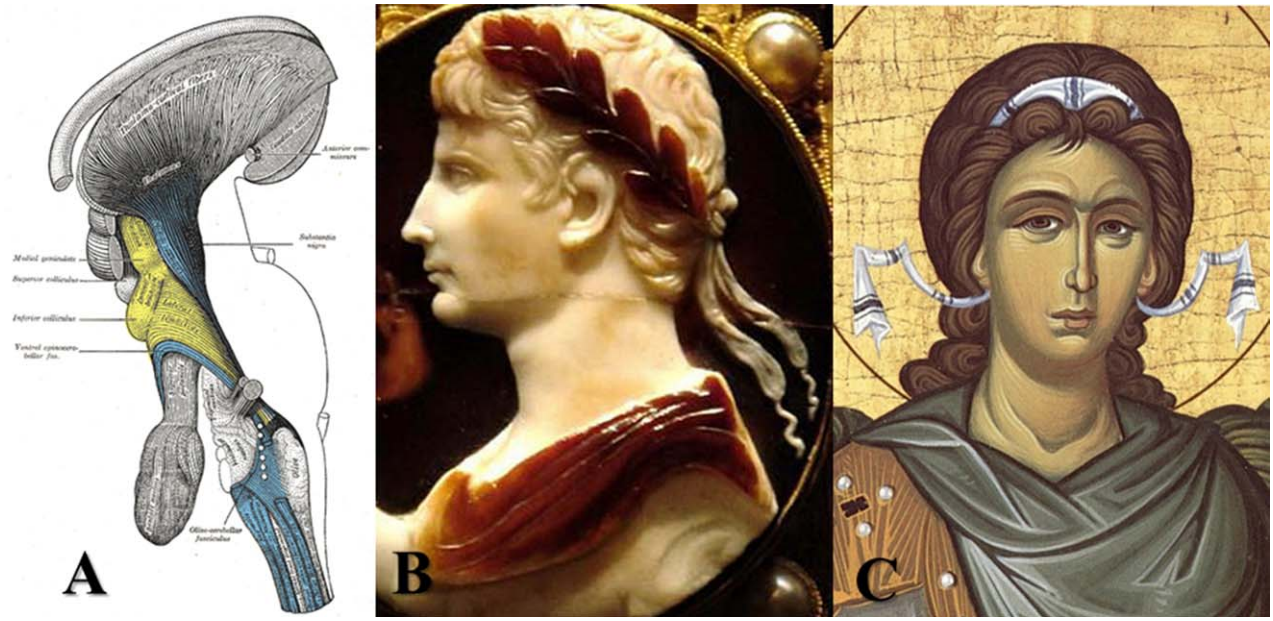

Fig. 1. (**A**) Deep dissection of brainstem (lateral view) with medial lemniscus (blue) and lateral lemniscus (yellow) (Henry Gray, Anatomy of the Human Body, 1918). (**B**) The Augustus Emperor cameo located in the centre of The Cross of Lothair revealing the lemniscus over the neck (Aachen Cathedral Treasury, early first century). (**C**) Romanian Byzantine iconography represented an angel with lemniscus around the head symbolising obedient listening to God's voice (public domain). [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]

Charles Bell (1774–1842) called it the *velum of Haller* in memory of its discoverer (Bell, 1802).

Inspired by Haller, subsequent anatomists adopted the name *velum* to designate other anatomical structures that seemed to have a role in covering something. Thus, the German anatomist Johann Christian Reil (1759–1813) named the *posterior medullary velum* (*das hintere Marksegel*), a medullary band or strip by which the cerebellum communicates with the medulla (Gordon, 1817; Dunglison 1842).

FUNICULUS

An accessory found in Roman attire was the *funiculus* (a diminutive of the Latin *funis*), representing a cord that was sometimes used to fasten pieces of clothing (Johnson, 1827; Smith and Anthon, 1843; White, 1975).

While the gray and white matter of the spinal cord were differentiated fairly quickly, in 1572, by the Dutch anatomist Volcher Coiter **(**1534–1576**)** (Schmahmann and Pandya, 2009), the cords of the spinal cord were illustrated as late as 1666 by an anatomist of the same origin, Gerard Leendertszoon Blasius (1627–1682), in his work *Anatome Medullae Spinalis Nervorum*. Blasius also had the great merit of identifying and illustrating the *dorsal funiculus* and *lateral funiculus* very clearly, though without naming them (Swanson, 2014). Remarkable progress was made after the microtome was devised by the German anatomist and surgeon Benedikt Stilling (1810–1879) in 1824. This allowed him to cut alcohol-hardened and frozen spinal cord into thin sections and to examine them under the microscope (Pearce, 2006). This technique formed the basis of subsequent research on the structure of the spinal cord, culminating in the German anatomist Karl Friedrich Burdach's demonstration of three medullary columns in the cord, which he called *funiculi* (singular *funiculus*) (Burdach, 1822; Swanson, 2014). Thus, it was the renowned German anatomist who introduced the term *funiculus* (pl. *funiculi*) for the first time in neuroanatomical terminology, in 1822, in order to describe the organization of white matter of the spinal cord in the form of three cords: *ventral funiculus, lateral funiculus*, and *dorsal funiculus* (Burdach, 1822). At the level of the posterior funiculus of the cervical portion of the spinal cord, Burdach noticed a slender fasciculus (later called Goll's fasciculus) and a thicker fasciculus, located laterally, which he called *fasciculus cuneatus* (Stricker, 1872), the only one that still bears his name today.

CINGULUM

In Roman antiquity, the *cingulum* was a belt worn by churchmen (Lebby, 2013) or a cord made of wool that a bride wore over her frock. The wool was woven and represented the bond between wife and husband (Sebesta and Bonfante, 2001).

This piece of clothing was also worn by soldiers (*cingulum militare*) in the form of a leather belt

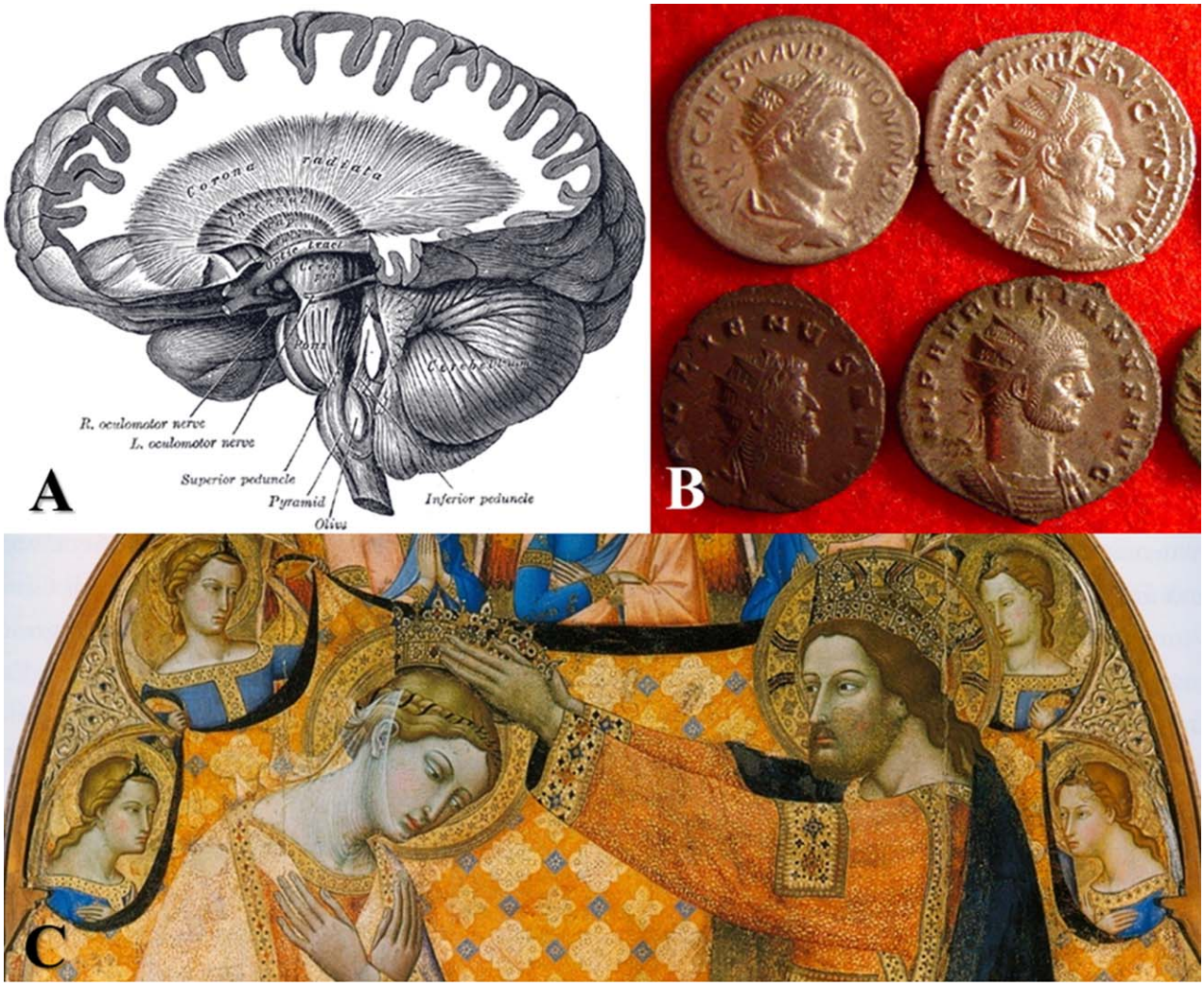

Fig. 2. (**A**) Corona radiata (Henry Gray, Anatomy of the Human Body, 1918). (**B**) Coins from Ancient Roman period, representing Roman Emperors with radiate crowns. (**C**) God crowning Virgin Mary as Queen of Heaven, placing on her head the radiate crown (Jacopo di Mino del Pellicciaio, Coronation of Virgin—detail, 1340–1350) (public domain). [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]

around the waist, decorated with metal ornaments, in which dagger or sword was kept. It had leather or metal extensions over the lower part of the body to protect the male genital organs (Friedman and Osberg, 1977). The *cingulum* was an important piece of clothing in military uniform, with a high moral value, because a mild military punishment involved the offending soldier standing in camp without his belt (Cleland et al., 2007).

In TA (FCAT, 1998), the denomination *cingulum* was given to a gyrus surrounding most of the corpus callosum like a belt. The *girus cinguli* was described for the first time in the history of anatomical terminology, together with other association tracts, by the German anatomist Johann Christian Reil in 1809, who named it *tenia tecta* (*bedeckten Bänder –covered bands*). In 1822, Karl Friedrich Burdach named it *cingulum* owing to its likeness to the Roman belt: *Die Zwingen (cingula) liegen zu beiden Seiten der Mittellinie, an der peripherischen Fläche des Balkens als ein Paar rundliche, aus Längenfasern bestehende und in die Länge sich erstreckende, seitlich aber in eigne Randwülste ausstrahlende Bündel, in welchen man zuweilen auch auf dem senkrechten Querdurschschnitte einen grauen Strang entdeckt* (Burdach, 1822).

LEMNISCUS

Another piece of clothing used by the Romans was the *lemniscus* (Latin *lemniscus*—band), a band that women used, together with brooches, to fasten their clothing (Calza and Lugli, 1941) or as a head ornament (Smith, 1875). These bands (Latin pl. *lemnisci*) were also attached to crowns or tiaras, hanging down from one's neck and back (Smith, 1875) (Fig. 1).

The band of white matter designated the *lemniscus* was observed for the first time by the Swiss anatomist Albrecht von Haller in 1765 (Rasmussen and Peyton, 1948). Later, in 1809, the German anatomist Johann Christian Reil was the first to follow the course of this band of white matter through the pons and midbrain and to introduce it to neuroanatomical terminology as *lemniscus*. The French anatomist Louis Pierre Gratiolet (1815–1865) later called it *le ruban de Reil* (Hyrtl, 1880) in honor of its discoverer.

Reil also succeeded in visualizing the *lemniscus* by using the technique of fixation with alcohol that he had patented, which allowed him to obtain a harder brain suitable for cutting so that new nerve structures could be sought (Turliuc et al., 2016). Subsequently, in 1867, the German–Austrian neuropathologist and anatomist Theodor Hermann Meynert suggested that *medial lemniscus* was a sensory tract (Boivie, 1971). He was the first to distinguish two parts of the lemniscus: superior (medial) and inferior (lateral) (Meyer, 1971) (Fig. 1).

COROANA RADIATA

In ancient Rome, *coroana* (Latin *corona*—crown) was a circular ornament made of metal, flowers or leaves, placed on one's head or around the neck as a token of reward for talent, military success, conquest or war, civil merit or victory. *Corona Radiata* was the crown offered to deities and to deified heroes and was sometimes worn by kings as a sign of their divinity (Smith, 1853) (Fig. 2).

The term *Corona radiata* (*Stabkranz)* was introduced in neuroanatomy by the German Johann Christian Reil in order to describe the radiation of white matter tracts that reach deep into the brain (Schmahmann and Pandya, 2009) and in sagittal section resemble the *Corona Radiata* worn by Roman emperors (Fig. 2): *Die Radiation des Hirnschenkel-Systems, das mit der Radiation des äufseren Randes der Sehhügel zusammenschmilzt und den Stabkranz bildet* (the radiations of the cerebral peduncle system, which merge with the radiations of the outer edge of the thalamus, form the corona radiata) (Reil, 1812).

SPLENIUM

In ancient Rome, the *splenium* (Latin *splenium*—bandage) was a bandage used to hide certain facial flaws or unesthetic scars, which could take the form of a half-moon when it was used to cover half of one's face (Adam et al., 1842; Larson et al., 1974). Women also used this bandage as an ornament, or as a beauty mask, which they imbued with donkey milk and aromatic herbs, following a recipe invented by Poppaea Sabina, Nero's wife (Carr, 1836; Mingazzini, 1922/2013). In neuroanatomy, the posterior end of the corpus callosum is called *splenium*, a structure crossed by the visual fibers connecting the two cerebral hemispheres (Aboitiz et al., 1992).

After he started to apply his new technique for preserving the brain, Reil was able to elucidate the anatomy of nerve structures that had been incompletely or unclearly described until that time. Thus, he visualized the corpus callosum and described its anterior end, in which he identified an anterior curve and a beak, and a posterior end, which he simply called *glove* (Meckel et al., 1838). Reil also has the merit of describing agenesis of the corpus callosum for the first time in 1812, which he discovered incidentally during an autopsy on a 30-year-old woman (Reil, 1812b).

However, the term *splenium* was introduced in neuroanatomy in 1822 by the German anatomist Karl Friedrich Burdach. He described it in his monumental work *Vom Baue und Leben des Gehirns*, also calling it *die Wulst* (bulge) or *die Balkenwulst*; in full (Swanson, 2014): *Dieser umgeknickte Theil, oder die Wulst (splenium) liegt mit seiner obern Fläche nicht, wie das Knie, frey, sondern dicht an der untern Fläche des Balken-körpers an, und erstreckt sich unter demselben etwa 6 Linien von hinten nach vorne* (Burdach, 1822), meaning: *This folded-over part, or the bulge (splenium), lies with its upper surface, as a knee, free, but close to the lower surface of the joist (*i.e. *corpus callosum) body, and extends under the same about six lines from back to front* (our translation).

Later, in 1838, the German anatomist and anatomy professor at the University of Heidelberg, Friedrich Arnold (1803–1890), took over the term and completed its meaning, calling it *splenium commissurae maximae* (splenium of the great commissure) (Arnold, 1838; Swanson, 2014). Burdach did not call the newly identified structure *splenium* because he thought it would cover the pineal region like a bandage; he did so because it greatly resembled the dressing used by the Romans. They used several medicinal herbs in the splenium, making it rounded like a bulge. For this reason, before Burdach, it was called *bourrelet postérieur du corps calleux* by Vicq d'Azyr, in 1786, and *superimposed bulge* by Soemmerring, in 1788 (Swanson, 2014). Burdach was unfamiliar with the fascinating world of Ancient Rome, as proven by the fact that, in his attempt to denominate the neuroanatomical structures he discovered, he often resorted to Latin terms (Turliuc et al., 2016).

CONCLUSIONS

Since ancient times, anatomists have contributed to the understanding of brain and spinal cord function by finding new anatomical structures. Taking inspiration from Roman civilization and its clothing, they created an anatomical terminology that properly explained the structures it denoted. The Romans and their clothing could be said to have influenced European schools of anatomy and to have "clothed" the human body, making it immortal.

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