In what respect are they similar?: A practical guide to adjectives with -ideus in anatomical terminology

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Abstrakt: V učebniciach medicínskej latinčiny sa často stretávame so zjednodušujúcou kategorizáciou niektorých sufixov. Adjektíva so suffixoidom -ideus/-idalis, by mali označovať podobnosť s materiálnymi objektami, no táto motivácia je prítomná iba u malej časti pomenovaných anatomických štruktúr. Práca poskytuje prehľad a kategorizáciu týchto adjektív tak, aby s ňou mohol efektívne pracovať aj študent, ktorý sa s anatómiou iba zoznamuje.

Introduction

Medical anatomical terminology comprises a fairly systematic corpus of terms of ancient origin, which is built on common and productive word-forming components as well as on functioning word-formation principles and rules. Standardized adjectival suffixes are counted among distinctive, and both semantically and morphologically well classifiable derivational elements of the medical vocabulary. Adjectives with Latin suffixoids[1] *-ideus* and *-idalis* are traditionally believed to denote a resemblance to the object designated in the stem, and are often praised for their semantic clarity, their potential to introduce ancient realia to a student, and their ability to facilitate the learning and prolong the retention of such knowledge. Nevertheless, even if the aforementioned suffixoids are treated frequently in the scientific literature[2] and the semantic relationship between the *objects* and *names* appears self-evident, when examined closer, the relationship is rather complex and the point of similarity between anatomical structures and material objects is less straightforward. The case is, for the most part, demonstrated on material taken from the works of the most prominent medical writer, Vesalius, who sums up the previous medical knowledge in Latin.

Historical overview

Latin suffixoids *-ideus* and *-idalis* originate from the Greek adjective suffix -ειδής, -ές (after Greek εἶδος – shape, form) and are classified as a subdivision of the productive group of Greek adjectives in -ης and -ες. Buck & Petersen[3] suggest that the semantics of adjectives with the Greek suffix -ειδής, -ές is built not only on the original etymology denoting alikeness, but also on the group of etymologically unrelated adjectives with the suffix -ώδης (after Greek ὀσμή/ὀδμή smell, odour) which, due to the attenuation of the meaning, gradually shifted into denoting any kind of similarity or

[1] The use of term *suffixoid* after Šimon & Marečková (2012:206)

[2] Hyrtl (1880), Ahrens (1977), Buck & Petersen (1945), Marečková (1999), Poláčková & Džuganová (2000), Šimon & Marečková (2012).

[3] Buck & Petersen (1945:697–698)

possession. The fusion of the meanings, they suppose, was possible owning to the figurative use of the term smell (e.g. ἐργώδης difficult, toilsome, one that smells of work or troubles), as well as the orthographic similarity of the two suffixes. The high frequency of adjectives with suffixes -ειδής/-ώδης in the ancient Greek proves that the similarity of objects in general ranks among the most productive morphosemantic rules[4], hence it is not surprising that it was successfully employed in medical, and especially in anatomical, terminology.

The process of incorporating and adapting Greek adjectives ending in -ειδής into Latin medical terminology was not described in detail as the phonological and orthographic qualities of the ancient manuscripts vary frequently[5]; with the Renaissance, however, these adjectives typically appear within Latin medical texts in Greek, side by side with explanations to their meaning, as Greek was no longer widely understood[6]:

> Inferior huius processus [TA processus coracoideus] pars exacte laevis est, ac instar antiquae Graecorum literae C cavus, ob idemque etiam σιγμοειδής appelatus. Alii vero a quadam imagine, quam obtinet cum altera anchorae parte, quae terrae infigitur, ἀγκυροειδή hunc processum vocarunt. Nonnulli rursus, quod corniculae rostri modo inclinatur, κωρακοειδή appellavere.

Since the end of the 16th century, the process of adaptation has accelerated. The Greek adjectives with -ειδής were gradually replaced by their Latin counterparts, either preserving original Greek orthography (*-ides*), or incorporating them to the Latin system of declension as *-ideus*. Bauhin[7], presumably consciously, distinguishes between the two endings; the Greek suffix *-ides* is used when he denotes *similarity* between a material object and anatomical structure, but when he aims to denote *reference* or*relation* toa structure; he employs the ending *-ideus*. Nevertheless, this tendency seems to have been lost quickly, as the two endings are used unsystematically by later authors (Spigelius, Bartholinus), with the Latin one, *-ideus*, finally gaining prominence. Soon, the suffixoid *-ideus* was used in both the names of anatomical structures where similarity or resemblance is denoted and the names of structures referring only to spatial, functional or other relation. Adjectives with *-idalis* (e.g.

[4] Horecký (1982:199)

[5] Langslow (2000:78 ff.)

[6] Vesalius, Fabrica 1, 27: The lower part of this process is quite smooth and concave like the ancient letter C, so that it is called *sigmoid*. Nevertheless others, based on the appearance that an anchor gains when it has one part fixed in the ground, have called this process *ancyroid*. Yet others have called it *coracoid*, because it bends like a beak of a crow.

[7] Bauhin (1605:997) Latin 'Musculi *cricoarytenoidei* laterales a *cricoide* cartilagine exoriuntur' translates: Lateral cricoaryten*oidei* (in Latin word ends in form of the ending -ideus, muscles are related spatially to the cartilage) muscles are muscles that arise from a cric*oeid* (in Latin word ends in form of ending -ides, because the cartilage has the shape of ring) cartilage.

ethmoidalis, *glenoidalis*) can be explained as secondary imports from French (*[os] ethmoïde: ethmoïdal*). TA[8] re-introduced one such adjective, helicoidalis[9].

With the first internationally accepted Anatomical nomenclature, BNA, thirty-four such adjectives became official terms and together with their derivatives gave names to almost three hundred anatomical structures. Only minor changes occurred within that list thereafter. A few adjectives from the first edition were later neglected due to different interpretation of anatomical structures (*adenoideus*[10]*, bulboideus*[11]) or superseded by terms that were considered to be more appropriate (*haemorrhoidalis* BNA → *analis* INA → *rectalis* PNA+TA; *condyloideus* BNA → *condylicus* INA → *condylaris* PNA+TA).

The most significant changes were introduced by the INA, but these were only of interim character. The INA replaced several adjectives of Greek origin with Latin terms > ([*processus*] *clinoideus* > [*processus*] *alae parvae/dorsi sellae*; *xiphoideus* > *ensiformis*; *intercondyloideus* > *intercondylicus*; *haemorrhoidalis* > *analis*; *subarachnoidalis* > *leptomeningicus*) and omitted all adjectives with suffix *-idalis.* Instead, a strict and purposive distinction between adjectives expressing the similarity (Greek suffix *-ides*), and those expressing spatial, functional or other relation or reference to another objects was introduced (Latin suffix *-ideus*), e.g.:

colon sigmoides: portion of the large intestine being similar by its shape to the letter C (so called sigma lunatum)

arteriae sigmoideae: two arteries that pass obliquely downward to the sigmoid colon

os sphenoides: bone being similar to the wedge

lingula sphenoidea: pointed process on the sphenoid bone

musculus deltoides: triangular muscle shaped like Greek letter Δ (delta)

ramus deltoideus: branch of thoracoacromial artery that supplies the deltoid and pectoralis major muscles

This distinction enabled a user of anatomical terminology, especially an uninformed one or beginner, to identify the structures where similarity with a material object is to be considered promptly; however, with the following nomenclatorial modifications,

[8] The following abbreviations stand for different editions of the International anatomical nomenclature within the text. BNA stands for *Basiliensia nomina anatomica*, INA stands for *Ienaiensia nomina anatomica*, PNA stands for *Parisiensia nomina anatomica*, NA stands for later editions of PNA, particular edition is marked separately by the year when it was published, TA stands for *Terminologia anatomica*.

[9] First time employed by Carey (1921:189 ff.) *stratum helicoidale gradus longi/brevis,* to describe the disposition of fibres in the muscular layers of the small intestine wall that have form of a spiral with a long and short pitch, orig. *stratum circulare.*

[10] Nowadays the term is used only in the clinical terminology, e.g. *diathesis adenoidea.*

[11] Originally, *corpuscula nervorum terminalia bulboidea* syn. *corpuscula bulboidea (Krausii*), the structures have been later removed from the category of the sense-organs (Fitzgerald 1962:189 ff.).

the distinction was neglected. All adjectives with suffix *-ides* were reverted back into Latinized suffix *-ideus*; several adjectives with suffix *-idalis* (e.g. *ethmoidalis, rhomboidalis, sphenoidalis, subarachnoidalis*) have been reintroduced by the PNA. Further changes have been confined to orthographical adjustments that appeared in NA 1989[12], such as monophthongization of diphthongs within the stem (aryt*ae*noideus > aryt*e*noideus, sph*ae*roideus > sph*e*roideus) or reduction of vocalic groups on the morphemic border[13] (thyr*eoi*deus > thyr*oi*deus, chor*ioi*deus > chor*oi*deus). This reduction did not apply to the adjective *hyoideus.*

Semantics, translatability and comprehensibility

The survey of the extensive list of Greek adjectives with suffix -ειδής, -ές by Buck & Petersen shows that ancient medical writers reach for adjectives with these endings when they refer to some general meaning (e.g. ά(ν)ειδής formless, indistinct; διαειδής transparent; εὐειδής well or properly shaped, beautiful; δυσειδής not properly shaped, ugly, asymmetrical; ὁμοειδής of the same species or kind, uniform, homologous), or when they intend to describe different shapes and qualities. As the source of motivation they use a wide variety of material objects, such as:

- *Consistency or composition*, e.g. σπογγοειδής spongy (of the bone structure); ἐλαιοειδής oily (of the bodily fluids and discharge)
- *Geometric figures and shapes*, e.g. (τρι)γωνοειδής (tri)angular (of sutures); κυβοειδής cubical (of the bone shape)
- *Letters of the Greek alphabet*, e.g. πιοειδής shaped like the letter πῖ (of the emplacement of the large intestine); λα(μ)βδοειδής shaped like the letter λά(μ)βδα (of the suture)
- *Colour of objects*, e.g. μολυβδοειδής pale as lead (of the colour of lungs); φλογοειδής fiery-red, inflamed (of skin)
- *Household utensils,* e.g. κοτυλοειδής cup-shaped (of socket or cavity of a joint); ἠθμοειδής like a strainer, perforated (of one of nasal bones)
- *Military objects*, e.g. σαλπιγγοειδής trumpet-like (of oesophagus); θυρ(ε)οειδής shield like (of cartilage)

[12] cf. Marečková (1999:26–27)

[13] Longer forms, with an extra vocal -i- appeared in BNA based on the Kühn's edition of Galenic texts from 1821. It was argued that the adjective choroides without an extra -i- vocal is not derived from Greek chorion (membranous sac enclosing the embryo) but from the word choros (dance), or that the adjective thyroides comes from Greek thyra (door) instead of thyreos (shield). The longer forms were accepted by BNA, despite Hyrtl's (1880: 261 ff.) comments that both longer and shorter forms are well established and correct. After corrections by INA, longer forms were reintroduced by PNA and were valid until the 1989 edition of NA.

Motivation leads us to understand the semantic connection between a derived, special, and primary meaning of a given word. With an indirect motivation, which is based on a simile or metaphor, it can be difficult to specify the point of similarity between the primary object and anatomical structure to which the adjective applies in its derived meaning. The meaning of the rare adjective πυρηνοειδὴς , for example, is motivated by its similarity with the stone of the fruit; nevertheless, dictionaries suggest that a stone from a variety of fruits – olive, pomegranate, medlar, myrtle, elderberry, date and edible nuts – or even fish bones could be considered here. Indeterminateness of form not only hinders a term's comprehensibility (as it is difficult to establish the point of similarity), but it has also consequences for its translatability.

When the adjective πυρηνοειδής is used by Rufus[14] in the description of *dens axis* (process projecting from the upper surface of the body of the second cervical vertebra), it is obvious that further explanation is needed to translate the adjective successfully. The problem with establishing the point of similarity and understanding the adjective πυρηνοειδής is observed both in Vesalius[15], who tries to explain it by a group of similes to different pointy objects – a canine tooth, a pine cone, the top point of a pyramid and others – as well as centuries later in Gersh' translation of Onomasticon from 2014[16].

In what respect are they similar?

Nevertheless, different kinds of problems, even misunderstandings, can occur also when well-known and frequently used adjectives with the suffixoid -ideus are examined closer. For example, the three cartilages of larynx are known as thyroid (Fig. 1), cricoid (Fig. 2) and arytenoid (Fig. 3) and translated as shield-like, ring-like and laddle-like cartilage, respectively. However, when looking for the actual point of similarity between anatomical structures and material objects in anatomical atlases, only the shape of the cricoid cartilage is readily identifiable.

Principally, three difficulties need to be overcome when we look for the points of similarity between ancient objects and anatomical structures. (1) *The original term may result from the observation of a different object than that used nowadays.* We often forget that anatomical structures, especially those with a long history, were not given names upon the observation of a human body, but that of an animal. The difference between various species can be substantial, and in a human body the point of similarity can be absent. For example, the thyroid cartilage (gr. θυροειδής), together with other cartilages of the larynx was very difficult to observe on human bodies,

[14] Rufus, Onomasticon 156 (cf. Daremberg): Ἡ δὲ τοῦ δευτέρου σφονδύλου εἰς τὸ ἄνω καὶ ἔμπροσθεν ἀπόφυσις, πυρηνοειδὴς καλεῖται. (The upper and frontal projection of the second vertebra is called "stone-of-fruit-like".).

[15] Vesalius, Fabrica 1, 15

[16] Gersh (2012:62) and Garrison & Hast (2014:134)

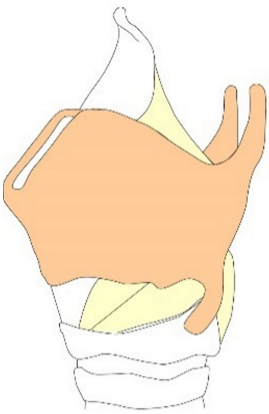

Fig. 1

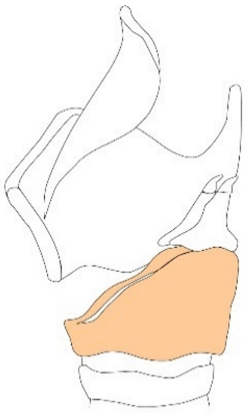

Fig. 2

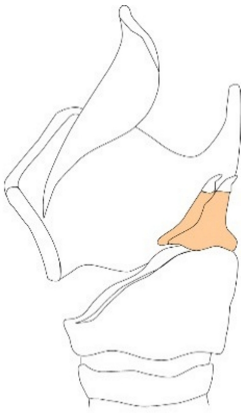

Fig. 3

(Cartilages of Larynx, Fig. 1 – cartilago thyroidea, Fig. 2 – cartilago cricoidea, Fig. 3 – cartilago arytenoidea, redrawn from various sources)

as majority of dissections in the 16th century were performed on bodies of convicts, who were often hanged and had their larynxes destroyed by the noose. This is the reason why Vesalius in his public demonstrations uses the larynx of an ox, a pig and other cattle[17]. If our cultural concept of the shield is based on typical rounded or elongated shield of the classical era, we will probably be able to connect it only to the thyroid cartilage of a pig (Fig. 4), which is oblong, rectangular and has no cut-outs on its superior margin. It also visually corresponds to the shape of a door (gr. θύρα) that was used as a prototype of the protecting arm. The fact that the identical term was preserved also in the human anatomy for the cartilage with a substantially different shape is based on the existence of a modified crescent-shaped light shield called *peltarion* or *pelta* (Fig. 6) that has cut-out somehow similar to the human thyroid cartilage (Fig. 5).

(2) *The association between shapes, functions and names is not a stable one and changes over time.* The second cartilage of larynx is called cricoid (gr. κρικοειδής, Fig. 8), ring-like, and its circular shape truly resembles the ring. Moreover, some anatomical atlases[18] specify its signet-like shape (Fig. 7). But besides *krikos* (κρίκος) there are at least four other terms for rings in the ancient Greek (δακτύληθρον, δακτύλιος, κιρκίον, σφραγίς), therefore one could ask why *krikos* was used, if all rings are circular, and whether the point of similarity really lies in the circular shape.

The answer could be easily found in medieval atlases. Archery was still quite common and a specific archer's ring, with a lowered and narrowed posterior part and an

[17] Garrison & Hast (2014:183)

[18] Dauber (2001:168)

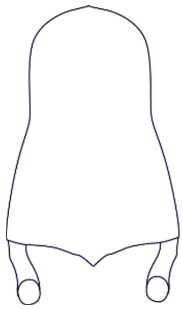

Fig. 4

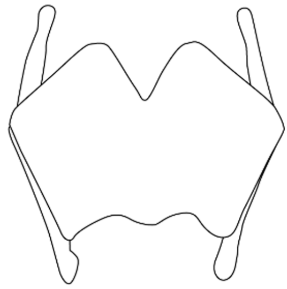

Fig. 5

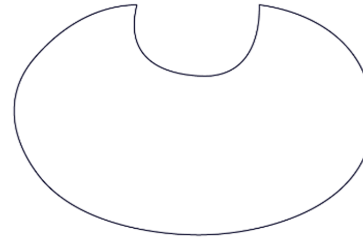

Fig. 6

(Cartilago thyroidea, frontal view, Fig. 4 – c. t. of Sus scrofa domestica, redrawn form Wysocki et al. (2010:340), Fig. 5 – human c. t., schematic, Fig 6. – peltarion, a shield, schematic)

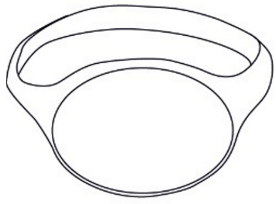

Fig. 7

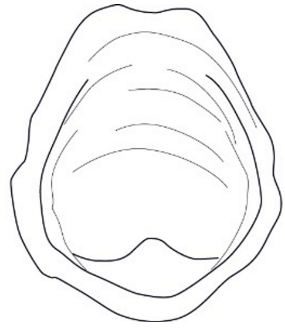

Fig. 8

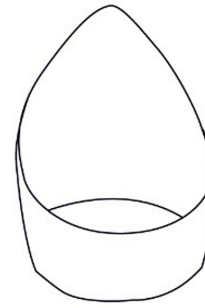

Fig. 9

(Fig. 7 – a signet, schematic, Fig. 8 – cartilago cricoidea, human, dorsal view, Fig. 9 – archers ring, schematic)

elevated and broadened anterior part, called *krikos*, was commonly used to protect the inner side of archer's thumb when drawing a bow (Fig. 9). The problem with finding the original motivation arises in this case from our cultural background, which interferes with connotations that are absent in the ancient material reality.

(3) *The semantic clarity of the term can be also blurred by its translation.* The last cartilage of the larynx, the laddle-like or arytaenoid (gr. ἀρυταινοειδής), is the smallest of the three. Today, when we are familiar with its structure, many atlases depict it as two triangular or pyramid-like objects (Fig. 12). In Vesalius' times, however, its anatomical structure was not clarified. Vesalius was the first to realize its twin nature, but a minute corniculate cartilage on the top of the arytenoid one was described much later. From Vesalius comments on the name of the cartilage, a certain ambiguity is perceivable:

> Tertiam laryngis cartilaginem Graeci vocarunt ἀρύταιναν et ἀρύταινοειδῆ, …, quod illi ollarum parti simillima sit, qua aquam manus lavaturis affundimus. Illi namque ollarum oris sedi aptius congruit, quam ligneis illis conchis, quibus nautas sentinam exhaurire, ac olitores irrigare hortos conspicimus. Siquidem et eiusmodi situlis seu vasculis Graeci hanc cartilaginem contulisse videntur, non quidem toti vasi, sed ipsius mucroni[19].

Vesalius argues that if Greeks used the word for the vessel to name the cartilage, they did not mean the whole object, they had in their mind only its spout (figs. 10a, 10b, 11).

Fig. 10a

Fig. 10b

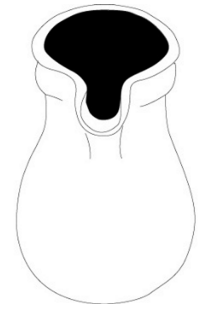

Fig. 11

Fig. 12

(Fig. 10 – cartilago arytenoidea redrawn from Vesalius, Fabrica (1543: 2, 21), lateral view (a), inferior view (b), Fig. 11 – a pitcher with a spout, schematic, Fig. 12 – cartilago arytenoidea, redrawn from Daubner (2007:169C))

Nevertheless, during the era of national medical languages, equivalents to the Greek adjective ἀρύταινοειδής reflected the original motivation, the name of the vessel, which in some languages (lat. *cartilago guttur(n)alis*, germ. *Gießbeckenknorpel,* hung. *a kannaporc*, pol. *chrząstka nalewkowata*, slov. *krhlovitá chrupka,* rus. черпаловидный хрящ) can easily became a source of confusion.

How to use adjectives with -ideus successfully

Building on the Anatomical nomenclature of Jena (INA), medical dictionaries[20] and historical sources, it is possible to conclude that in the majority of cases the adjectives ending in -ideus are used to name the structures where reference to the resemblance

[19] Vesalius, Fabrica 2, 21: The Greeks called the third cartilage of the larynx "arytaina" and "arytainoeide", …, as it would be very similar to that part of a pitcher with which we pour water to wash hands. As a matter of fact it more closely resembles that part of the mouth of jars, than those wooden shell-like vessels, with which we see sailors drain the bilge water, or gardeners water their plots. Anyhow, if the Greeks indeed seem to have compared this cartilage to vessels or small containers, they did not compare it to the whole vessel, but to its tip.

[20] Zieliński (2004), Marcovecchio (1993), Dvořák (1960), Hyrtl (1880)

of the object designated in the stem is not materialized and may even be misleading. Here we offer a basic instruction manual containing the majority of adjectives ending in -ideus used in the current version of anatomical nomenclature TA and not approached by other works[21]:

1. None of the adjectives ending in -ideus derived with extra prefixes denotes similarity. In fact, the prefix of such adjective is a reliable sign of the spatial relation to the object named by the original adjective with ending in -ideus but without the prefix, e.g.: *periamygdaloideus* denotes position around the corpus amygdaloideum, *interarytenoideus* denotes position between twin arytenoid cartilages.
2. None of the compound adjectives ending in -ideus denotes similarity. Such compound adjectives are terms designating muscles, ligaments, articulations or veins, arteries and nerves that supply or innervate the structure, a few terms designate sutures, lines and recesses, which form natural borderlines between anatomical structures. A compound adjective ending in -ideus then designates two anatomical structures that are connected or separated: *m. thyrohyoideus* arises from the oblique line of the thyroid cartilage and inserts on the greater horn of the hyoid bone, is accompanied by the thyrohyoid membrane and ligament, and innervated by thryrohyoid branch of the nerve loop C1-3. *Palatoethmoidal suture* is a borderline between the palatal and ethmoid bones.
3. Four adjectives with -ideus where the stem denotes some geometrical shape only adjective *conoideus*, *cuboideus*, *rhomboideus* and *trapezoideus* name structures with shapes denoted by the stems. The adjective *cylindroideus* was replaced by cylindricus; adjectives naming types of joints – *articulatio ellipsoidea, sphaeroidea* and *trochoidea*, were chosen inappropriately. The joint itself does not have the shape of an ellipse, sphere or wheel; it is the shape of the joint's head they refer to. Only a few anatomical structures really have geometrical shapes, these are: *os cuboideum* and *trapezoideum*, *ligamentum conoideum* and *trapezoideum, area trapezoidea* and *corpus trapezoideum* and finally *fossa rhomboidea* and *musculus rhomboideus*.
4. Also there are four adjectives with -ideus where the stem denotes a letter of the Greek alphabet – *deltoideus*, *hyoideus*, *lambdoideus* and *sigmoideus*. Those where the motivation corresponds to the shape of letter are: *os hyoideum, ligamentum deltoideum* and *musculus deltoideus, sutura lambdoidea*, *colon sigmoideum* and *sinus sigmoideus*. When it comes to the shape that should to be associated with letter sigma, it is not our S, or the Greek Σ, but so called sigma lunatum, which is our letter C[22].

[21] esp. Šimon & Marečková (2012)

[22] Wright (1896), Šimon & Marečková (2012:209)

5. With adjectives that refer to seed and nut – *sesamoideus* and *amygdaloideus* – the point of similarity does not lie in their shape, but in their size. While the term *corpus amygdaloideum* is quite a new invention (introduced in PNA 1955 to replace *nucleus amygdalae*, it was chosen on the base of the similarity of the nucleus to a swollen almond), *os sesamoideum* is of Galenic origin, and the bone(s) it refers to, were by ancient authors thought to be the smallest and the hardest bones of the human body.
6. Household utensils and furniture were the motivation for three adjectives. The adjective *clinoideus* refers to three pairs of projections on the sphenoid bone, which are similar to legs of a table or litter. This adjective has no derived forms. It is used to refer to clinoid processes of the sphenoid bone exclusively. The Slovak equivalent *naklonený* inclined, probably comes from the Russian наклоненный. The adjectives arytenoid and ethmoid refer to household utensils. *Aryt(a)enoideus* (lit. spout-like) is used to name different parts of the twin cartilage (apex, basis), but in the rest of the terms it indicates only a relationship to the cartilage. The adjective ethmoidalis (gr. ήθμοειδής like a strainer) is of Galenic origin. The term was motivated by perforations on *lamina cribrosa* (lat. *cribrum* sieve), which is nowadays distinguished as a specific part of the ethmoid bone. However, the motivation is not reflected in Slovak or Czech equivalents, because it was reserved for the *lamina cribrosa.*
7. There are four adjectives motivated by the internal structure of objects. In ancient texts the adjective *arachnoideus* (gr. άράχνη spider and its web) is used to describe nerves, capillary veins or branches of an artery and retina based on their delicate character. The circular organization and reticulate shape of the cobweb were not semantically important for its usage in the medical terminology. Two structures – *arachnoidea mater cranialis* and *spinalis*, refer to these qualities. The adjective *chor(i)oideus* was originally used to specify quality membrane covering the ventricles of the brain, but also the meninx of the brain, and one of the membranes covering the eye. It is the vascular character (κατάφλεβος) of all of these membranes that associates it with the membrane enclosing the foetus in the womb chorion (gr. χόριον). Currently the vasculose character is present in the two structures – the vascular coat of the eye between the sclera and the retina (*choroidea*) and the vascularised villous plexus of the brain ventricles (*plexus choroideus).* Other terms imply only relatedness to it. The usage of the adjective *hyaloideus* is also interesting. Originally it was used for the membrane encompassing the vitreous humor (ὑαλοειδὲς ὑγρόν) and was referred to because of its transparency, which resembles glass. Nevertheless, the membrane for which the name was intended is nowadays called vitreous using the Latin equivalent *vitreus* instead of the Greek one *hyaloideus.* The three structures where the adjective is still used (arteria, canalis, fossa) are only parts of the corpus vitreum and membrana vitrea, so again only spatial relatedness is expressed by the adjective.

Acknowledgement

My thanks are due to RNDr. Michaela Račanská, PhD from the Department of Anatomy at Masaryk University in Brno, Czech Republic, who helped the quality of the article through various remarks and suggestions.

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Bionote

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