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Should Terminologia Anatomica be revised and extended? A critical literature review

Running title: Terminologia Anatomica

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ABSTRACT

The first edition of the Terminologia Anatomica was published in 1998 by the Federative Committee on Anatomical Terminology, whereas the second edition was issued in 2011 by the Federative International Programme on Anatomical Terminologies. Since then many attempts have been made to revise and extend the official terminology as several inconsistencies have been noted. Moreover, numerous crucial terms were either omitted or deliberately excluded from the official terminology, like *sulcus popliteus* and *diaphragma urogenitale*, respectively. Furthermore, several synonyms are to be discarded.

Notwithstanding the criticism, the use of the current version of terminology is strongly recommended. Although the Terminologia Anatomica is open to future expansion and revision, every change should be made after a thorough discussion of the historical context and scientific legitimacy of a given term. The anatomical nomenclature must be as simple as possible but also precise and coherent. It is generally accepted that hasty innovation ought not to be endorsed. Therefore, there is a need to take a closer look at these new proposals as they have been presented in numerous dispersed papers. This article provides an overview of these issues and concentrates on selected revisions and extensions that are didactically and clinically useful, thereby summarising the salient aspects of these new and compelling proposals.

Key words: anatomy, teaching, anatomical nomenclature, anatomical terminology, clinical anatomy, gross anatomy, Terminologia Anatomica

INTRODUCTION

The first edition of the Terminologia Anatomica was published more than two decades ago by the Federative Committee on Anatomical Terminology (FCAT) [3], whereas the second edition was issued in 2011 by the Federative International Programme on Anatomical Terminologies (FIPAT) [4]. Thus, the Nomina Anatomica Parisiensia (NAP) was replaced by the Terminologia Anatomica [20], which is an extended and modern version of the anatomical terminology, and its use is strongly recommended. Nevertheless, it should be stressed that many important terms have been omitted or excluded from it, so several segments of this publication are particularly neglected and they should be extended to cover also those terms whose importance is beyond dispute [1, 8-14]. Therefore, many attempts have been made to revise and extend the last edition of the anatomical terminology [8-14, 16-19]. There are hopes that some of these proposals will be incorporated into the next version of the Terminologia Anatomica. This will be also an opportunity to correct several minor mistakes, inaccuracies and inconsistencies that have been noted by different authors [11, 12, 17, 19]. Although the Terminologia Anatomica is open to future expansion and revision [6, 7], every such change to the official terminology should be made after a thorough discussion of the historical context and scientific legitimacy of a given term. It is generally accepted that the anatomical nomenclature must be as simple as possible. Moreover, several other rules should be followed when naming anatomical structures. Therefore, precipitous innovation ought not to be endorsed. Since these new proposals have been presented in numerous dispersed articles that concentrated on different aspects of anatomy [5, 8-15, 18, 19], there is a need to take a closer look at them. Furthermore, a more thorough discussion is needed as such new changes are potentially controversial or even contentious. The present article concentrates on selected new proposals [8-15, 18, 19], i.e. revisions and extensions, which are so important and compelling that they could be incorporated into the next version of the Terminologia Anatomica before other proposals are deemed judicious. These selected anatomical terms that are clinically and didactically very useful are discussed in more detail.

TOWARDS A PRECISE AND COHERENT TERMINOLOGY

A clear, precise, coherent, comprehensive and worldwide accepted language or system of terminology is essential to any scientific field as it prevents confusion, misinterpretation and errors during communication both within and outside the field [11, 12, 17, 19]. Anatomy is one of the oldest biological and medical disciplines, so its terminology is very old, often dating back to ancient times and providing a basis for any terminology that is used in

theoretical biology, medicine and clinical practice. Although it is sometimes claimed that in the real world many clinicians and some anatomy teachers ignore or are unaware of the official terminology and nothing really happens if these invalid, obsolete or colloquial terms that they continue to use are intelligible to the populace, like in the case of the ‘facet joints’ [7], this is misleading [cf. 17]. It should be remembered that the use of obsolete and invalid anatomical names in clinical practice or teaching enhances the risk of miscommunication, which may increase the risk of poor or even fatal outcomes. The list of such examples was given in our recent article [17] and it can be easily extended. Moreover, most authors concur that the need of a clear, precise and worldwide accepted anatomical terminology is beyond dispute. Furthermore, there are hopes that the Terminologia Anatomica will become a useful and powerful tool in communication without ambiguity not only between anatomists but also between anatomists and other specialists [11, 12].

Currently, there are two official versions of anatomical terminology, i.e. the Latin terms and their English equivalents. Some authors believe that both versions are of equal status and importance and that ‘English is the official language of anatomical terminology’. Therefore, several leading textbooks, for example the new Polish edition of Gray’s Anatomy for Students and other anatomical texts, use them concurrently. Interestingly, this belief might be misguided since in the Preface [3] the FCAT clearly states that: ‘Only the Latin list of terms should be used as the basis for creating lists of equivalents in other languages’ and ‘[The English version of terminology] is not the basis for terminology in other languages’. Even though the Latin version of terminology is preferred, at least for this particular purpose, it still contains inaccuracies, inconsistencies and mistakes.

For example, the term *vena magna cerebri* does not match the term *arteria cerebri anterior/media/posterior*, and therefore it should be changed into *vena cerebri magna*. Traditionally, the singular form of *ligg. alaria* (alar ligaments) was *lig. alare*, but some authors use *lig. alarium* now. The short, traditional and convenient term *sulcus chiasmatis* was replaced by a more logical but longer and rarely used name *sulcus prechiasmaticus* (prechiasmatic sulcus, although in the 7th edition of Netter’s Atlas of Human Anatomy and several other sources the term ‘prechiasmatic groove’ is used), and many authors continue to use other names for this structure, including *sulcus prechiasmatis*. Recently, it has been proposed that this structure should be termed *sulcus chiasmaticus* or *sulcus chiasmatis* (chiasmatic sulcus; chiasmatic groove).

These problems of the current version of terminology are often categorised as follows:
1) grammar mistakes (e.g. *fascia iliopsoas* should be called *fascia iliopsoatica*, *facies*

articularis calcanea anterior/media/posterior should be termed *facies articularis calcanearis anterior/media/posterior*, *systema conducente cordis* should be called *systema conducens cordis*, etc.), 2) semantic mistakes (e.g. *symphysis mandibulae* should be termed *syndesmosis mandibulae* since the symphyseal chondriole is present only in the week 22 but not later, and generally a syndesmosis between the two halves of the mandible can be observed; some authors, including Keith Moore, assert that the name *lig. carpale transversum* (transverse carpal ligament) is a better term than *retinaculum musculorum flexorum* (flexor retinaculum) since the latter does not correspond to the extensor retinaculum, while the unrecognised structure *lig. carpale palmare* (palmar carpal ligament) does, etc.), 3) various discrepancies and inconsistencies (e.g. the use of the terms *collum* and *cervix*, *trigonum femorale* and *trigonum femoris*, *cavitas nasi* and *cavitas nasalis*, *pudendus/pudendalis*, etc.), 4) too long and inconvenient terms (e.g. *musculus sternocleidomastoideus*, although there is no alternative name for this muscle and the current one is very popular, so it should not be changed, *sulcus prechiasmaticus*, etc.), 5) too many synonyms, 6) missing terms but especially those which are clinically and didactically very useful, cf. [11].

New modifications and changes have recently been proposed in order to solve these problems. However, it appears that not every new and tentatively approved change is a step in the right direction. For example, multiple synonyms have been proposed, including very awkward terms such as ‘*os atlanticum*’ for the atlas, ‘*os axiale*’ for the axis, ‘*os vertebrale prominens*’ for the vertebra prominens, ‘*os scapulare*’ for the scapula, ‘*os claviculare*’ for the clavicle, ‘*os humeri*’ for the humerus, etc. In our view, these new changes are not indispensable and some of them might be viewed as erroneous from a historical perspective (e.g. *ossa humeri* included the scapula, clavicle and humerus in ancient Rome). Furthermore, very old, traditional and commonly used terms, such as *cavitas glenoidalis*, *linea intermedia*, *femur*, *talus*, *diaphragma* (all were listed in the Basle edition of the Nominal Anatomica, BNA), etc. will be replaced by these names – such as ‘*os tali*’, ‘*diaphragma respiratoria*’ seu ‘*diaphragma thoracis*’ seu ‘*diaphragma thoracoabdominale*’ etc., although some of them (e.g. *femur*, *talus*) will remain in the English version of terminology, which might cause new problems. Moreover, *os femoris/os tali* etc. will be inconsistent with the names for their parts (*caput/collum/corpus*... but not + *ossis*...). Moreover, the names *fibula*, *tibia*, *patella*, *calcaneus* etc. should also be modified to match these new changes, and therefore new synonyms for them have been proposed, such as *os fibulare*, *os calcaneum* (why not use older variants such as *os calcaris* or *os calcis*?). In our opinion, their use might cause new problems

such as new discrepancies between anatomical texts and further departures from the official terminology as many of the abandoned terms (e.g. hip bone, diaphragm) are commonly used.

At the same time, it is claimed that the terms *metacarpus* (A01.1.00.027) and *palma* (A01.1.00.028) have the same meaning ('How does metacarpus differ from the palm?'), suggesting that one of them should be removed from the list, but this is misleading. Both terms refer to the central part of the hand, which is located between the wrist and the fingers. Unlike *metacarpus*, the term *palma* cannot be used for the posterior aspect of this region as it is confined to the anterior aspect of the hand, excluding the fingers. Unlike *palma*, *metacarpus* refers to the bony part of the hand, and usually not to the superficial view. The term *dorsum manus* refers to the dorsal side of the hand, excluding the dorsal aspect of the fingers. The fact that the fingers are excluded from the palm and the dorsum of the hand is a matter of convention. Thus, precise and worldwide accepted definitions of anatomical terms are arguably more important than new versions of terminology, cf. [7].

It is now accepted that Arabic numerals should be used for vertebrae instead of Roman numerals to avoid potential confusion with the cranial nerves. Nevertheless, this means that the same symbols will be used for the vertebrae and the spinal nerves (e.g. C1 can be used to denote both the atlas and the first pair of cervical nerves). 'CN I' and 'C1' do differ, while 'C1' and 'C1' do not. Moreover, if vertebrae can be given as C7 and T1 (the abbreviation 'Th' is outdated), then Arabic numerals should be (and will be) used for bones (e.g. *ossa metacarpi seu ossa metacarpalia* 1-5), fingers (1-5), toes (1-5) and muscles (e.g. *musculi lumbricales* 1-4, *musculi interossei palmares* 1-3, *musculi interossei dorsales* 1-4), which breaks with the long tradition.

The old and widely used Latin term *linea intermedia*, BNA (intermediate zone, TA [3,4]) was replaced by the term *zona intermedia*, which is a shorter and more convenient term. If this was an anatomically motivated decision, the reasons behind it remain a matter of speculation. If this was a terminologically motivated decision, as the term *zona intermedia* matches its English equivalent, then the same should have happened to the term *crista sacralis medialis* (intermediate sacral crest), which should be changed into *crista sacralis intermedia*, although some authors use 'medial sacral crest' to match the Latin term) to match the English equivalent. There are also other examples of similar inconsistencies (e.g. the use of the terms sulcus/groove for the Latin term *sulcus*, the use of the terms crest/ridge for the Latin term *crista*, etc.).

POPULARISING THE CURRENT VERSION OF TERMINOLOGY

Whilst in science it is relatively easy to enforce the use of the official terminology, for example by rejecting any manuscript that does not meet the formal requirements, clinicians and anatomy teachers can ignore the Terminologia Anatomica in practice [7]. The language of Polish anatomists and clinicians, for example, is heavily influenced by the previous versions of terminology, i.e. the BNA and especially the NAP that was produced in 1955. Thus, some of them continue to use older anatomical names, not only in speech but also in writing (Table 1).

In practice, the vast majority of students and clinicians adhere to the terminology used by their teachers and instructors, and they can ignore the official terminology to the detriment of its credibility [7, 16, 17]. Although the majority of anatomical textbooks and atlases respect the changes that have been endorsed by the official committees, some leading and otherwise excellent publications do not follow all these modifications, even when published as new editions, which is surprising. Thus, they are likely to use such obsolete terms as *foramen processus transversi*, *canalis hypoglossi* or *canalis hypoglossalis*, *cavum laryngis*, *cavum nasi*, *cavum tympani*, *ligg. sacroiliaca ventralia et dorsalia*, *lig. collaterale laterale et mediale*, *lig. collaterale laterale et mediale carpi*, *lig. transversum carpi* (should be *lig. carpale transversum*), *lig. laterale et deltoideum*, *musculus pectoralis maior*, *musculus rhomboideus maior*, *musculus psoas maior* (should be 'major' in all cases), *arteria et vena peronea*, *musculus peroneus longus, brevis et tertius*, *nervus peroneus communis, profundus et superficialis* (should be 'fibularis' in all cases), *arteria et vena lienalis*, *ventriculus* (should be *gaster*) and so forth. These outdated and invalid names are especially irritating when they are used in official anatomical texts and documents.

GENERAL RULES OF TERMINOLOGY: KEEP IT SIMPLE

One of the commonly accepted rules in anatomy is that shorter and simpler terms should be preferred over longer and more complicated ones. For example, the name *epistropheus* (BNA) was replaced with the name *axis* when the first edition of the NAP was issued in 1955. Originally, the former was confined to the atlas, hence the term *epistropheus* was also erroneous from a historical point of view.

Although the current version of terminology follows this general rule as well as several other rules, some authors argue convincingly that further simplification is needed [11, 12, 19]. For example, the Terminologia Anatomica rarely uses the possessive genitive case, but one such grammatical structure does cause confusion, especially among students.

Namely, the traditional term *sustentaculum tali*, which should be replaced with the term *sustentaculum talare*. The latter was previously used by some authors, for example by Werner Spalteholz, and it cannot be understood as referring to a part of the talus, unlike the current name of this structure [11]. It is noteworthy that terms like *caput humeri* and *tuber calcanei* clearly refer to different parts of the humerus and the calcaneus, respectively, and the terms *incisura radialis* and *incisura ulnaris* clearly refer to different parts of the ulna and the radius, respectively. Therefore, the terms *facies articularis acromialis* and *facies articularis acromii* are not confusing since only the latter refers to the articular surface of the acromion, i.e. the surface for the acromioclavicular joint. The term *sustentaculum tali* is inconsistent with this general rule. Therefore, such minor changes are didactically motivated and they should be endorsed.

Similarly, the Latin term *fovea dentis* (facet for dens) uses a genitive form of the noun ‘dens’, implying that this structure belongs to the dens of the axis, while it is a part of the anterior arch of the atlas. In old anatomy textbooks, this structure is referred to as *fovea dentalis*. Curiously, the English equivalent is more logical and adequate than the Latin name. The Polish anatomical nomenclature also used a sound term (noun + adjective) to describe this structure (i.e. ‘dołek zębowy’), but a calque of the Latin term (i.e. ‘dołek zęba’) is currently used. Nevertheless, this situation is slightly different from the situation of the incorrect term *sustentaculum tali*, although both terms are anatomically inadequate and didactically treacherous, the former is short, convenient and confined to the Latin list, while the latter is used in both version of anatomical terminology.

Furthermore, these authors also propose that the term *vena portae hepatis* (hepatic portal vein) should be truncated to *vena portae* (portal vein), which is already used worldwide. Such modifications are natural and relatively safe. Nevertheless, the former has the didactic advantage of suggesting that there are also other portal veins somewhere in the body. For example, there are the portal veins of hypophysis (*venae portales hypophysiales*) which connect capillaries in the hypothalamus with capillaries in the anterior pituitary. The longer veins extend from the vessels of the tuber cinereum and the upper part of the infundibulum, and the shorter veins extend from the vessels of the lower part of the infundibulum. These vessels convey blood to the cavernous and intercavernous sinuses. Also, within the abdominal veins there are numerous small vessels which enter the liver independently from the portal venous trunk. These vessels are described as ‘accessory portal veins’. For example, Sappey’s veins connect peripheral portal branches of the left lobe with the lower part of the falciform ligament. Even though the risk of miscommunication is low,

the didactic virtues of the contemporary version of the official terminology should be appreciated.

GENERAL RULES OF TERMINOLOGY: AVOID SYNONYMS

Another rule of terminology that is widely accepted is that synonyms should be discarded. It is worth remembering that the BNA was published in 1895 when there were roughly 50000 names for approximately 5000 anatomical structures, and the process of scientific communication was hampered by a state of permanent confusion. Thus, the purposes of the BNA was to discard roughly 45000 synonyms as well as to establish the general rules such as confining the anatomical nomenclature to short, simple and logical terms that deal with the structures which can be observed by an unaided human eye with the general rule ‘one name for one structure’, hence the use of synonyms is not recommended. It is worth recalling that the pineal gland (pineal body) was known under many different names, including the pineal organ, epiphysis cerebri, penis cerebri, conarium, pinus, pineal eye, median eye, third eye, parietal eye, parietal organ, parietal gland, parietal body, etc. Such a status of terminology is very harmful to teaching. It is also extremely inconvenient and so stifling to research that we should be grateful to all these astute anatomists, including Marie Philibert Constant Sappey (1810-1896), Karl Gegenbaur (1825-1903), Wilhelm Krause (1833-1910) and Leo Testut (1849-1925), who tried to mitigate this situation by discarding multiple synonyms. Nowadays synonyms are abundant in some parts of the Terminologia Anatomica, and this situation should be dealt with. This is especially necessary if a given synonym is outdated and so rarely used that it is no longer useful or its use may even cause confusion. The hip bone (*os coxae*), for instance, has two synonyms, i.e. the coxal bone and the pelvic bone, but none of them is as frequent as the first term. Nonetheless, the rarely used term ‘coxal bone’ will be the official name for this bone. The adjective **peroneal** (*peroneus* or *peronea* in Latin), which was earlier criticised [12], should be replaced by the adjective **fibular** (*fibularis* in Latin) in all cases (muscles, vessels and nerves) because the former is rarely used in practice and there is a risk of confusion since this term sounds the same or almost the same as the adjective **perineal** in English. Therefore, the trend towards discarding the currently synonymous term ‘peroneal’ that was initiated in 1955 by the NAP, when all official names for muscles, vessels and nerves that had this adjective as part of their names were modified, should be endorsed. On balance, the use of the term ‘peroneal’ should not be endorsed. This mainly results from the fact that the use of homophones in any type of formal language is not advised.

GENERAL RULES OF TERMINOLOGY: DO NOT USE EPONYMS

Similarly, anatomical eponyms, e.g. the fascia of Camper or Camper's fascia, the fascia of Scarpa or Scapra's fascia, etc. should be abandoned [22] despite the fact that they are rooted in tradition and they can be interpreted as more sophisticated names which enliven the study of anatomy [2, 17], unlike other medical eponyms which happen to be very practical [21] such as tetralogy of Fallot or Fallot's tetralogy, Horner's syndrome or Horner syndrome, etc. In anatomy, eponyms do not lend any insight into the location or definition of a given structure, which makes this entire system of terminology inconvenient and obscure [17]. These names often commemorate not the real discoverer of a given structure but a later observer. Moreover, in different nations different names are used for the same structure. Another problem is that medical eponyms can be often used in two possessive forms and one non-possessive form, as the aforementioned disorders, respectively, which can be an obstacle when attempting to search scientific databases. Therefore, many attempts have been made to discard multiple synonyms and eponyms from the current version of the official anatomical terminology.

GENERAL RULES OF TERMINOLOGY: AVOID LINGUISTIC MISTAKES

Whilst it has long been accepted that grammatical and linguistic correctness is important, the application of this general rule is not always possible. This is because some erroneous terms have been used for such a long time that they are now generally accepted by the scientific community. Some authors argue that it would be better to use the term 'lymphatic' (*lymphaticus* and *lymphatica* in Latin) as the current names *nodus lymphoideus* and *nodi lymphoidei* (plural) are derived from the word 'lymphoid', and in Greek 'eidos' means 'form', suggesting that these are not true lymphatic structures but they are only similar to such structures. Nevertheless, the term '*lymphaticus*' (e.g. *vasa lymphatica*, *ductus lymphaticus dexter*, *nodus lymphaticus*, etc.) is a synonym of '*furens*' and '*mente captus*', and it literally means 'mentally ill, insane, frenzied structures' in Latin. Therefore, it never should have been included in the official anatomical terminology. Instead, the Latin version of the word 'lymphatic' should be '*lymphacea*' and '*lymphaceus*', and only the term *vasa lymphacea* are linguistically correct. Nonetheless, these two erroneous forms are much more popular, making it unlikely that the correct form will be recognised as valid.

GENERAL RULES OF TERMINOLOGY: BE CONSISTENT

Currently, the terms *collum* and *cervix* are used inconsistently, and often interchangeably. Whilst the only valid names are, for instance, *collum pancreatis*, *collum vesicae biliaris seu collum vesicae felleae* and *collum glandis*, the neck of other organs, except bones, are usually termed *cervix*, for example *cervix uteri* and *cervix vesicae*, but the synonymous term *collum vesicae* is endorsed. The deep cervical vein (*vena cervicalis profunda*), which begins in the suboccipital plexus of veins and passes downwards between the splenius capitis muscle and the splenius cervicis muscle, is often termed *vena colli profunda*. Similarly, the cervical branch of the parotid plexus (*plexus intraparotideus*) that emerges from the inferior border of the parotid gland to supply the platysma is termed *ramus colli* or *ramus cervicalis* in Latin. Therefore, some authors claim that it would be better to confine the use of the term *collum* to bones only [11]. Although it seems judicious, the use of the name *collum* (for the part of the body) and for some other structures, including *ramus colli*, is extremely widespread. Therefore, this feature of terminology will probably persist. Moreover, if the official terminology adopts only logical names and discards the traditional ones, and especially those which are very popular, then it can be accused of not respecting tradition and being out of touch with reality [cf. 7]. Nevertheless, the names of several muscles should be changed because of terminological inconsistency. The problem of the use of the adjective *peroneus* (*peronaeus* in BNA) has been already discussed. However, the current name *musculus sphincter pyloricus* should be modified as follows *musculus sphincter pylori*.

In the section dealing with the regions of the human body (page 5), the Terminologia Anatomica [4] mentions the gluteal region (*regio glutealis*), while on page 2 the relevant parts of the body are termed *nates seu clunes* (buttocks in English). Since the cutaneous branches that innervate the buttocks are termed *nervi clunium superiores, medii et inferiores*, the term *clunes* should be preferred over the term *nates*, just as the intergluteal cleft is preferred over the term natal cleft. The English equivalent of the term *sulcus glutealis* is gluteal fold, while it should be termed gluteal sulcus, or alternatively the entity ‘*sulcus glutealis*’ should be revised as follows: *sulcus glutealis*; *plica glutealis* (in English: gluteal sulcus; gluteal fold).

It is not clear why some terms are written according to the modern rules of spelling, such as *peroneus* (instead of the traditional form ‘*peronaeus*’), *sulcus prechiasmaticus* (instead of ‘*sulcus praechiasmaticus*’), *musculus anconeus* (instead of ‘*musculus anconaeus*’), while other names are written according to the traditional rules (e.g. *foramen caecum*, *taeniae coli*, *taenia libera*, *taenia choroidea*, *taenia thalami*, etc.), which seems inconsistent. Consequently, some authors use both systems, whereas others choose the traditional (thereby

using ‘sulcus praechiasmaticus’ which is formally invalid and erroneous) or the modern convention (thereby using ‘foramen cecum’ which is also invalid and erroneous).

GENERAL RULES OF TERMINOLOGY: BE PRECISE

Apart from the problem of terminological inconsistencies and coexistence of synonyms, there is also a problem of inadequate terms that have been espoused by the official committees for the anatomical terminology, both the FCAT and the FIPAT. For example, the term nasolacrimal duct (*ductus nasolacrimalis*) is inadequate as it suggests that this structure begins within the nasal cavity and terminates in the lacrimal sac (*saccus lacrimalis*), but it is the other way round. Therefore, this structure should be termed the lacrimonasal duct (*ductus lacrimonasalis*), implying that it runs from the lacrimal sac to the anterior part of the inferior nasal meatus within the nasal cavity [15]. Nonetheless, it seems that the use of the inadequate name nasolacrimal duct is so prevalent among anatomists and clinicians that it is here to stay. Furthermore, the name nasolacrimal canal (*canalis nasolacrimalis*) would require similar modification and this is even less probable because anatomical terms that are rooted in a long tradition as well as those which have their equivalents in other anatomical names are unlikely to be changed.

WHAT DO WE DO WITH OMITTED AND EXCLUDED TERMS?

It should be noted that many traditional and essential terms have been omitted in the Terminologia Anatomica to the detriment of its comprehensiveness. Whilst the incorporation of terms like *eminentia retropublica*, *crista phallica*, *sulcus popliteus*, *incisura poplitea extensoria*, *incisura poplitea flexoria*, *crista supracondylaris lateralis et medialis*, *calcar femorale*, *crista bifurcata*, *caput tibiae*, *margo infraglenoidalis*, *monticuli (manus)*, *plica interdigitalis seu plica internatatoria*, but especially the newly coined terms like *crinis radii*, *incisura antegonialis*, or other clinical terms like *ligamentum ilioinguinale*, which is synonymous to the valid anatomical name *arcus iliopectineus*, can be considered optional, the incorporation or reintroduction of those terms that are very useful in teaching and clinical practice should be only a matter of time (Tables 2 and 3). It is an incontestable fact that terms like *cupula diaphragmatis* (diaphragmatic dome) and names for all these grooves, fissures, furrows and impressions on the surface of the lungs, the liver, the spleen, etc. have been used for decades or even centuries. These are didactically valuable terms, but their usefulness is not confined to teaching since they are often used in clinical practice.

Here we propose that the following anatomical terms should be incorporated into the next version of the Terminologia Anatomica because they are very useful and important:

Cavitas axillaris (axillary cavity; axillary space) lies superior to the axillary fossa and has four walls: the anterior wall is formed by the pectoralis major and minor, the posterior wall is formed by the subscapularis, the teres major and the latissimus dorsi, the lateral wall is formed by the head and the surgical neck of the humerus, the coracobrachialis and the short head of the biceps brachii and the medial wall is formed by the serratus anterior. This space contains the axillary vessels, the infraclavicular part of the brachial plexus, lymphatic vessels and nodes and fatty tissue.

Foramen axillare laterale seu foramen quadrangulare seu foramen quadrilaterum (quadrangular space) is defined laterally by the surgical neck of the humerus, medially by the long head of the triceps brachii, proximally by the teres minor and distally by the teres major. It is a quadrangular space in the medial wall of the axillary cavity which connects the anterior and posterior regions of the axilla. It transmits the axillary nerve, the posterior circumflex femoral artery, the anterior and posterior circumflex femoral veins and lymphatic vessels.

Foramen axillare mediale seu foramen triangulare seu foramen trilaterum (upper triangular space; triangular space) is defined laterally by the long head of the triceps brachii, proximally by the teres minor (and the subscapularis, when viewed anteriorly) and distally by the teres major. The structures that pass through this space include the circumflex scapular artery and vein and lymphatic vessels.

Hiatus tricipitalis (lower triangular space; triangular interval) is defined laterally by the shaft of the humerus, medially by the long head of the triceps brachii and superiorly by the inferior margin of the teres major. It is important to remember that the radial nerve along with the profunda brachii artery pass out of the axillary cavity travelling through this space to reach the posterior compartment of the arm.

Lamina cribrosa axillaris (axillary cribriform plate) is the deepest part of the superficial axillary fascia that is pierced by vessels and nerves. Unnamed lymph nodes can be embedded in this layer of the fascia which covers an elliptical aperture that is bounded by two arches: the brachial arch and the axillary arch. The former is convex towards the upper arm, while the latter is more elevated from the chest wall by the neurovascular bundle. The anterior ends of both arches interconnect at the posterior margin of the pectoralis major, blending with the lateral margin of the clavipectoral fascia.

Ligamentum coracoscapulare anterius (anterior coracoscapular ligament) extends from the medial side of the suprascapular notch to the medial aspect of the coracoid process.

The suprascapular nerve passes inferior, whilst the suprascapular artery passes superior to this ligament. This ligament, which is present in roughly half of the population, is thought to be a risk factor of the suprascapular nerve entrapment.

Calcar femorale (femoral spur), which is sometimes described as ‘the true neck’ of the femur, is a vertical plate of condensed bone that is situated lateral to the medial cortex and superior to the lesser trochanter, extending from the posterior cortex of the neck towards the gluteal tubercle, thereby separating the lesser trochanter from the femoral shaft. This septum splits into laminae penetrating the cancellous bone distally beyond the lesser trochanter. Thus, it is thought to play an important role in transmitting load from the cantilevered neck to the shaft.

Crista intercondylaris lateralis (lateral intercondylar ridge) is a bony ridge that runs proximodistally on the medial wall of the lateral femoral condyle, and the anterior cruciate ligament (ACL) attaches posteriorly to this ridge. The attachment site where the two fascicles of this ligament, i.e. the ventromedial and dorsomedial fascicle of the ACL, insert at the lateral aspect of the intercondylar fossa, is sometimes referred to as ***crista bifurcata lateralis*** (lateral bifurcated crest).

Eminentia retropubica (retropubic eminence) is a bulge-like projection from the posterior aspect of the pubic disc into the pelvic cavity. The size of this bulge affects the length of the true (or obstetric) conjugate (*conjugata vera seu obstetrica*), which is the distance between the promontory of the sacrum and the most posterior point of the pubic symphysis. This projection can be observed in multiparous females. This feature is much less prominent in other adults, and it is always absent in young individuals.

Margo infraglenoidalis (infraglenoid margin) is located on the proximal end of the tibia, just below the level of the superior articular surface or plateau holding a pair of slightly concave condylar articular areas for articulation with menisci and the lateral and medial condyles of the femur.

Nervus perforans ligamenti sacrotuberosi (perforating nerve of sacrotuberous ligament) is a branch of the pudendal nerve that originates in the vicinity of the ischial spine. It passes through the lower margin of the sacrotuberous ligament and then loops around the lower margin of the gluteus maximus to innervate the skin of the inferomedial part of the buttock.

Sulcus popliteus (popliteal groove; popliteal sulcus) is a groove for the tendon of the popliteus on the lateral surface of the lateral condyle of the femur, which is located inferior to the lateral epicondyle, reaching proximally **the incisura poplitea flexoria** and distally abutting **the incisura poplitea extensoria**.

Spatium subgluteale (subgluteal space) is the cellular and fatty tissue located between the middle and deep gluteal aponeurosis layers which are not easily visible as they are closely linked to the fascia. The anterior wall of this space is formed by the piriformis, superior gemellus, obturator internus, inferior gemellus and quadratus femoris, and the posterior wall is formed by the gluteus maximus. The linea aspera and the lateral fusion of the middle and deep gluteal aponeurosis layers extending up to the tensor fasciae latae demarcate the lateral margin of this space. It communicates medially with the pelvic cavity through the greater sciatic foramen, which is largely filled by the piriformis, and the lesser sciatic foramen, which is partially occupied by the tendon of the obturator internus. The neurovascular structures that run within the subgluteal space include the sciatic nerve, the posterior cutaneous nerve of the thigh, the inferior gluteal nerve and artery and the muscular branches to both heads of the biceps femoris. The subgluteal space, which is an echolucent area, is clinically important.

Similarly, reintroduction of very useful terms that have been recently excluded from the official terminology is necessary. For example, the removal of the didactically and clinically useful term *diaphragma urogenitale* (urogenital diaphragm) was motivated by the fact that the deep transverse perineal muscle (*musculus transversus perinei profundus*) is absent or scant in females, and the external urethral sphincter (*musculus sphincter urethrae externus*) is not a flat structure. Thus, it was concluded that the terms *diaphragma urogenitale* and *fascia diaphragmatis urogenitalis inferior* should be considered misnomers. After the reorganisation of this section of terminology three separate terms have been endorsed, i.e. the perineal membrane, the transverse perineal ligament and the deep transverse perineal muscle. The penultimate term and the last one are reserved for males since in females there is no transverse perineal ligament, and the occurrence of the deep transverse perineal muscle is uncertain. It remains unclear, however, why the term urogenital diaphragm was discarded completely as it could have been confined to the anatomy of the male pelvic floor since there is no doubt that the deep transverse perineal muscle is present in males. Alternatively, it could have been marked as a general descriptive term, irrespective of the presence of the muscular components of the deep perineal pouch in both sexes. In general, those terms which are clinically and didactically very useful should be incorporated into the next version of the official terminology. Today, medical students are still taught about the urogenital diaphragm and its components in both sexes, even though this structure is no longer officially recognised, which causes additional confusion.

CONCLUSIONS

The use of older versions of terminology or multiple synonyms can hinder the communication and can lead to a state of confusion, which was observed before the introduction of the first official version of anatomical terminology. The modern version of terminology espouses the use of many synonyms, which is detrimental to teaching process and research. Some of these synonyms, like in the case of the adjective ‘peroneal’ that is likely to be confused with ‘perineal’, are to be discarded. Numerous useful names have been omitted or excluded from the official terminology, and some of the valid names are confusing or illogical, which should be revised. Furthermore, there are several inconsistencies and mistakes that should be corrected such as the odd use of the term *collum* and *cervix* in many different anatomical names, the odd preference for those terms that should be synonymous or excluded from the official terminology such as *nates*, *sustentaculum tali* and so forth. It is not clear why some terms are used in two variant forms, such as *trigonum femoris* and *trigonum femorale*, *cavitas abdominis* and *cavitas abdominalis*, *cavitas thoracis* and *cavitas thoracica* etc., which should be amended. On balance, the Terminologia Anatomica is to be revised as it should be precise and coherent. In the future, it can become a powerful tool in communication between specialists all around the world. Nevertheless, the long anatomical tradition must be respected. Furthermore, other vexed issues of terminology, such as the frequency of use of individual terms and their didactic and clinical usefulness, should be taken into consideration when making a final decision.

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Table 1. Comparison of selected previous terms (based largely on BNA and NAP) and their current equivalents, showing the most characteristic features of the modern terminology, including greater precision and coexistence of synonyms.

Previous terminologies	Terminologia Anatomica
General terms	
<i>Cavum abdominis</i>	<i>Cavitas abdominis; Cavitas abdominalis</i>
<i>Cavum nasi</i>	<i>Cavitas nasalis ossea; Cavitas nasi</i>
<i>Cavum peritoneaei</i>	<i>Cavitas peritonealis</i>
<i>Cavum thoracis</i>	<i>Cavitas thoracis; Cavitas thoracica</i>
<i>Collum</i>	<i>Collum¹; Cervix</i>
<i>Crena ani</i>	<i>Crena analis; Crena ani; Crena interglutealis</i>
<i>Extremitas superior et inferior</i>	<i>Membrum superius et inferius</i>
<i>Nates; Clunes</i>	<i>Nates; Clunes</i>
<i>Trigonum femorale</i>	<i>Trigonum femoris²; Trigonum femorale</i>
Skeletal system	
<i>Ala magna ossis sphenoidalis</i>	<i>Ala major ossis sphenoidalis</i>
<i>Ala parva ossis sphenoidalis</i>	<i>Ala minor ossis sphenoidalis</i>
<i>Canalis basipharyngeus</i>	<i>Canalis palatovaginalis</i>
<i>Canalis pharyngeus</i>	<i>Canalis vomerovaginalis</i>
<i>Capitulum mandibulae</i>	<i>Caput mandibulae; Condylus mandibulae</i>
<i>Crista infrazygomatica</i>	<i>Crista zygomatcoalveolaris</i>
<i>Epistropheus</i>	<i>Axis</i>
<i>Fissura pterygoidea</i>	<i>Incisura pterygoidea</i>
<i>Fissura pterygopalatina</i>	<i>Fissura pterygomaxillaris</i>
<i>Foramen occipitale magnum</i>	<i>Foramen magnum</i>
<i>Foramen opticum</i>	<i>Canalis opticus</i>
<i>Fossa hypophyseos</i>	<i>Fossa hypophysialis</i>
<i>Lamina palatina ossis palatini</i>	<i>Lamina horizontalis ossis palatini</i>
<i>Lamina papyracea ossis ethmoidalis</i>	<i>Lamina orbitalis ossis ethmoidalis</i>
<i>Os multangulum majus</i>	<i>Os trapezium</i>
<i>Os multangulum minus</i>	<i>Os trapezoideum</i>
<i>Os naviculare manus</i>	<i>Os scaphoideum</i>
<i>Processus mamillaris</i>	<i>Processus mamillaris</i>
<i>(Processus supracondyloideus)</i>	<i>(Processus supracondylaris)</i>
<i>Sulcus chiasmatis</i>	<i>Sulcus prechiasmaticus</i>
<i>Sustentaculum tali</i>	<i>Sustentaculum tali³</i>
<i>Tuberositas coracoidea</i>	<i>Tuberculum conoideum et linea trapezoidea</i>
<i>Tuberositas costalis</i>	<i>Impressio ligamenti costoclavicularis</i>
Muscular system	
<i>Musculus anconaeus</i>	<i>Musculus anconeus</i>
<i>Musculus corrugator</i>	<i>Musculus corrugator supercillii</i>
<i>Musculus extensor digitorum communis</i>	<i>Musculus extensor digitorum</i>
<i>Musculus extensor indicis proprius</i>	<i>Musculus extensor indicis</i>
<i>Musculus flexor digiti quinti brevis;</i>	<i>Musculus flexor digiti minimi</i>

<i>Musculus flexor digiti minimi brevis</i>	<i>Musculus iliocostalis thoracis</i>
<i>Musculus iliocostalis dorsi</i>	<i>Musculus longissimus thoracis</i>
<i>Musculus longissimus dorsi</i>	<i>Musculus opponens digiti minimi</i>
<i>Musculus opponens digiti quinti</i>	<i>Musculus fibularis brevis; M. peroneus brevis⁴</i>
<i>Musculus peronaeus brevis</i>	<i>Musculus fibularis longus; M. peroneus longus⁴</i>
<i>Musculus peronaeus longus</i>	<i>Musculus fibularis tertius; M. peroneus tertius⁴</i>
<i>Musculus peronaeus tertius</i>	<i>Musculus pterygoideus lateralis</i>
<i>Musculus pterygoideus externus</i>	<i>Musculus pterygoideus medialis</i>
<i>Musculus pterygoideus internus</i>	<i>Musculus depressor labii inferioris</i>
<i>Musculus quadratus labii inferioris</i>	<i>Musculus levator labii superioris</i>
<i>Musculus quadratus labii superioris</i>	<i>Musculus depressor anguli oris</i>
<i>Musculus triangularis</i>	<i>Musculus zygomaticus major et minor</i>
<i>Musculus zygomaticus</i>	
Nervous system	
<i>Nervus peronaeus communis</i>	<i>Nervus fibularis (seu peroneus) communis⁴</i>
<i>Nervus peronaeus profundus</i>	<i>Nervus fibularis (seu peroneus) profundus⁴</i>
<i>Nervus peronaeus superficialis</i>	<i>Nervus fibularis (seu peroneus) superficialis⁴</i>

¹The term *collum* should be confined to bones only to solve several terminological inconsistencies.

²The term *trigonum femoris* should be discarded as the only valid term should be *trigonum femorale*.

³The name *sustentaculum tali* is confusing, unlike the term *sustentaculum talare*, a synonym that should be endorsed.

⁴The adjective *peroneus* should be excluded from the official terminology.

Table 2. Abridged list of Latin terms and their English equivalents that might be considered for incorporation into the sections concerning the upper limb in the next version of the Terminologia Anatomica, based largely on [13]; new proposals are given in bold type (see text for details).

Latin term	English term
<i>Ansa pectoralis</i>	Ansa pectoralis
<i>Arcus tendineus musculi supinatorii</i>	Tendinous arch of supinator muscle
<i>Canalis cubitalis</i>	Cubital canal
<i>Canalis pronatorius</i>	Pronator canal
<i>Canalis radialis</i>	Radial canal
<i>Canalis supinatorius</i>	Supinator canal
<i>Cavitas axillaris</i>	Axillary cavity
<i>Caput ossis capitati</i>	Head of capitata
<i>Cavitas glenoidalis; Fossa glenoidalis</i>	Glenoid cavity; Glenoid fossa
<i>Collum ossis capitati</i>	Neck of capitata
<i>Collum ulnae</i>	Neck of ulna
<i>Corpus claviculae</i>	Body of clavicle; Shaft of clavicle
<i>Corpus ossis capitati</i>	Body of capitata
<i>Crinis radii</i>	Crinis of radius
<i>Crista articularis radii</i>	Articular crest of radius

<i>(Crista pronatoria)</i>	(Pronator crest)
<i>Crista supinatoria; Crista musculi supinatoris</i>	Supinator crest
<i>Crista supracondylaris lateralis</i>	Lateral supracondylar ridge
<i>Crista supracondylaris medialis</i>	Medial supracondylar ridge
<i>Eminentia carpi radialis</i>	Radial carpal eminence
<i>Eminentia carpi ulnaris</i>	Ulnar carpal eminence
<i>Facies articularis sternalis</i>	Sternal articular surface; Sternal facet
<i>Fascia dorsalis manus superficialis</i>	Superficial dorsal fascia of hand
<i>Fascia hypothenaris</i>	Hypothenar fascia
<i>Fascia palmaris profunda</i>	Deep palmar fascia
<i>Fascia thenaris</i>	Thenar fascia
Foramen axillare laterale;	Quadrangular space
Foramen quadrangulare; Foramen	
quadrilaterum	
Foramen axillare mediale;	Upper triangular space
Foramen triangulare; Foramen trilaterum	
<i>Fossa lunata</i>	Lunate fossa
<i>Foveola radialis</i>	Anatomical snuffbox
<i>Hiatus basilicus</i>	Basilic hiatus
<i>Hiatus tricipitalis</i>	Lower triangular space; Tricipital hiatus
<i>Incisura scapulae inferior</i>	Inferior scapular notch; Spinoglenoid notch
<i>Incisura scapulae superior</i>	Superior scapular notch
<i>Isthmus ossis scaphoidei</i>	Waist of scaphoid
Lamina cribrosa axillaris	Axillary cribriform plate
<i>Ligamentum carpale palmare</i>	Palmar carpal ligament
Ligamentum coracoscapulare anterius	Anterior coracoscapular ligament
<i>Ligamentum glenohumerale inferius</i>	Inferior glenohumeral ligament
<i>Ligamentum glenohumerale medius</i>	Middle glenohumeral ligament
<i>Ligamentum glenohumerale posterius</i>	Posterior glenohumeral ligament
<i>Omus</i>	Shoulder
<i>(Os centrale dorsale)</i>	(Episcaphoid)
<i>(Os centrale palmare)</i>	(Prescaphoid)
<i>(Os epilunatum)¹</i>	(Epilunate)
<i>(Os epitrapezium)²</i>	(Epitrapezium)
<i>(Os epitriquetrum)³</i>	(Epitriquetrum)
<i>(Os hypolunatum)⁴</i>	(Hypolunate)
<i>(Os hypotriquetrum)</i>	(Hypotriquetrum)
<i>(Os metapisiforme)⁵</i>	(Metapisoid)
<i>(Os metascaphoideum)⁶</i>	(Metascaphoid)
<i>(Os metastyloideum)</i>	(Metastyloid)
<i>(Os parastyloideum)</i>	(Parastyloid)
<i>(Os paratrapezium)</i>	(Paratrapezium)
<i>(Os precapitatum)</i>	(Precapitate)
<i>(Os pretrapezium)</i>	(Pretrapezium)
<i>(Os radiale externum)</i>	(Parascaphoid)
<i>(Os radiostyloideum)⁷</i>	(Radiostyloid)
<i>(Os subcapitatum)</i>	(Subcapitate)
<i>(Os triangulare)⁸</i>	(Triangular)
<i>(Os triquetrum ulnare)</i>	(Metapyramid)
<i>(Os ulnare externum)⁹</i>	(Parapyramid)
<i>(Os ulnostyloideum)¹⁰</i>	(Ulnostyloid)
<i>Os sesamoideum pollicis laterale</i>	Lateral sesamoid bone of thumb
<i>Os sesamoideum pollicis mediale</i>	Medial sesamoid bone of thumb
<i>Plexus lymphaticus palmaris</i>	Palmar lymphatic plexus
<i>Processus glenoidalis</i>	Glenoid process

<i>Promontorium radii</i>	Promontory of radius
<i>Recessus axillaris</i>	Axillary recess
<i>Septum hypothenaris</i>	Hypothenar septum
<i>Septum thenaris</i>	Thenar septum
<i>Sulcus musculi subclavii</i>	Groove for subclavius muscle
<i>Tuberculum dorsale radii</i>	Dorsal radial tubercle
<i>Tuberculum ossis scaphoidei</i>	Tubercle of scaphoid

¹*Os centrale II* (epimenoid), i.e. a bone that is located between the scaphoid and the lunate.

²A small bone that can be present at the dorsal aspect of the trapezium.

³*Os epipyramis*, i.e. a small bone that lies between the lunate, the hamate and the triquetrum.

⁴*Os centrale III* (hypomenoid).

⁵*Os pisiforme secundarium seu os ulnare antebrachii*.

⁶*Os naviculare ulnare manus*.

⁷The radiostyloid lies in the vicinity of the styloid process of the radius.

⁸*Os triquetrum secundarium seu os intermedium antebrachii*, which lies between the lunate, the triquetrum and the distal end of the ulna.

⁹The parapyramoid lies at the distal aspect of the triquetrum, on the ulnar side of the body of the hamate.

¹⁰The ulnostyloid is located in the vicinity of the styloid process of the ulna.

Table 3. Abridged list of Latin terms and their English equivalents that might be considered for incorporation into the sections concerning the lower limb in the next version of the Terminologia Anatomica, based largely on [14]; new proposals are given in bold type (see text for details).

Latin term	English term
<i>Arteria femoralis communis</i>	Common femoral artery
<i>Arteria sinus tarsi</i>	Artery of tarsal sinus
<i>Arteriae perforantes</i>	Perforating arteries
<i>Arteriae tarsales</i>	Tarsal arteries
<i>Arteriae retinaculi</i>	Retinacular arteries
<i>Calcar femorale</i>	Femoral spur
<i>Caput tibiae</i>	Head of tibia
<i>Crista intercondylaris lateralis</i>	Lateral intercondylar ridge
<i>Crista phallica</i>	Phallic crest
<i>Crista supracondylaris lateralis femoris</i>	Lateral supracondylar crest of femur
<i>Eminentia iliopubica</i>	Iliopubic eminence
<i>Eminentia retropubica</i>	Retropubic eminence
<i>Fascia saphena</i>	Saphenous fascia
<i>Fascia vastoadductoria</i>	Vastoadductor fascia

<i>Foramen infrapiriforme</i>	Infrapiriform foramen
<i>Foramen suprapiriforme</i>	Suprapiriform foramen
<i>Fossa iliopectinea</i>	Iliopectineal fossa
<i>Fossa piriformis</i>	Piriform fossa
<i>Incisura infrafaciecularis</i>	Infracetanal notch
<i>Incisura poplitea extensoria</i>	Popliteal notch for extensor muscles
<i>Incisura poplitea flexoria</i>	Popliteal notch for flexor muscles
<i>Incisura tali</i>	Talar notch
<i>Lamina vastoadductoria</i>	Vastoadductor membrane
<i>Ligamentum ilioinguinale</i>	Ilioinguinal ligament
<i>Margo infraglenoidalis</i>	Infraglenoid margin
<i>Musculus abductor digiti minimi pedis</i>	Abductor digiti minimi of foot
<i>Nervus perforans ligamenti sacrotuberosi</i>	Perforating nerve of sacrotuberal ligament
<i>Os coxae</i>	Hip bone; Coxal bone
<i>(Os cuboideum accessorium)</i> ¹	(Accessory cuboid)
<i>Os sesamoideum hallucis laterale</i>	Lateral sesamoid bone of great toe
<i>Os sesamoideum hallucis mediale</i>	Medial sesamoid bone of great toe
<i>(Os supranaviculare)</i> ²	(Posterior talonavicular)
<i>(Os talotibiale)</i> ³	(Talotibial)
<i>(Os tibiale externum)</i> ⁴	(Accessory navicular)
<i>(Os trigonum tarsi; Os intermedium cruris)</i> ⁵	(Accessory talus)
<i>Pes anserinus profundus</i>	Deep pes anserinus
<i>Pes anserinus superficialis</i>	Superficial pes anserinus
<i>Planum tibiae</i>	Plateau of tibia
<i>Pylon tibiae</i>	Tibial pilon
<i>Spatium subgluteale</i>	Subgluteal space
<i>Sulcus femoralis</i>	Femoral groove
<i>Sulcus infraacetabularis</i>	Infracetabular groove
<i>Sulcus intercollicularis</i>	Intercollicular groove
<i>Sulcus malleoli lateralis</i>	Lateral malleolar groove (of fibula)
<i>Sulcus malleoli medialis</i>	Medial malleolar groove (of tibia)
<i>Sulcus popliteus</i>	Popliteal groove
<i>Sulcus preauricularis</i>	Preauricular groove
<i>Tuberculum iliacum</i>	Iliac tubercle
<i>Vena circumflexa femoris anterior</i>	Anterior femoral circumflex vein
<i>Vena circumflexa femoris posterior</i>	Posterior femoral circumflex vein
<i>Vena femoralis communis</i>	Common femoral vein
<i>Vena saphena magna accessoria anterior</i>	Anterior accessory great saphenous vein
<i>Vena saphena magna accessoria posterior</i>	Posterior accessory great saphenous vein

¹*Os peroneum* is a small bone that is sometimes present within the tendon of the fibularis longus muscle, at the angle between the talus, the navicular, the calcaneus and the cuboid.

²This bone can be located within the space of the posterior part of the talonavicular joint.

³This small bone can be present at the anterior margin of the talocrural joint.

⁴The accessory navicular can be occasionally present (in roughly 10% of children and 2% of adults) at the medial aspect of the navicular, usually as a bilateral bone.

⁵The accessory talus is also known as the triangular bone; it lies at the posterior aspect of the talus, abutting the lateral tubercle of the posterior process of the talus, and this bone is present in approximately 10% of adults.