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Research article

Toledo School of Translators and their influence on anatomical terminology

Luis-Alfonso Arráez-Aybar[a,*], José-L. Bueno-López[b,1], Nicolas Raio[c,d]

[a] Department of Human Anatomy and Embryology, Faculty of Medicine, Complutense University of Madrid, Madrid, Spain
[b] Department of Neurosciences, School of Medicine and Dentistry, The University of the Basque Country (UPV/EHU), Leioa, Biscay, Spain
[c] Island Wide Medical Associates Pc, Garden City, NY, USA
[d] Winthrop University Hospital, Mineola, NY, USA

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ABSTRACT

Translation facilitates transmission of knowledge between cultures. The fundamental transfer of anatomic terminology from the Ancient Greek and Islamic Golden Age cultures, to medieval Latin Christendom took place in the so-called *Toledo School of Translators* in the 12th–13th centuries. Translations made in Toledo circulated widely across Europe. They were the foundation of scientific thinking that was born in the boards of first universities. In Toledo, Gerard of Cremona translated Avicenna's *Canon of Medicine*, the key work of Islamic Golden Age of medicine. Albertus Magnus, Mondino de Luzzi and Guy de Chauliac, the leading authors of anatomical Latin words in the Middle Ages, founded their books on Gerard's translations. The anatomical terms of the *Canon* retain *auctoritas* up to the Renaissance. Thus, terms coined by Gerard such as *diaphragm*, *orbit*, *pupil* or *sagittal* remain relevant in the current official anatomical terminology. The aim of the present paper is to bring new attention to the highly significant influence that the *Toledo School of Translators* had in anatomical terminology. For this, we shall review here the onomastic origins of a number of anatomical terms (*additamentum; coracoid process; coxal; false ribs; femur; panniculus; spondylus; squamous sutures; thorax; xiphoid process, etc.*) which are still used today.

> Historical knowledge must be the preamble and the foundation of systematic knowledge which begins with that of the names given during the passage of time to the very same object of knowledge.' (Barcia Goyanes, 1978)

1. Introduction

The fertile imagination and thinking of ancient anatomists/physicians produced much of the vocabulary we employ today (Mosenthal, 2001). Anatomists have always had an ability to discriminate between structures with seemingly very similar characteristics. In order to point out these small differences, anatomists have named body components with distinct terms. A close examination of anatomical terms can reveal many structural characteristics (Rosse, 2001; Arráez-Aybar et al., 2003). It may not be forgotten that anatomical terminology is the basis of medical terminology and that the latter is used as a basic tool for scientific communication and recording. Perhaps this is the reason why research regarding the origin and developmental peculiarities of anatomical terms (onomatology) is a useful and fascinating exercise (Mosenthal, 2001; Paluzzi et al., 2012). This can contribute to the understanding of current anatomical terminology and meet the need for periodical updates (Marečková et al., 2001).

In the history of anatomical onomatology, five phases can be distinguished, the first one being the so-called prevesalian. In this first phase, the major authorities of anatomical onomatology were Aulus Cornelius Celsus (henceforth, Celsus) (c. 25 BC–50 AD), Rufus of Ephesus (late 1st century) and Julius Pollux (2nd century) during the Greco-Roman period (Sakai, 2007). Rufus of Ephesus authored a book called *On the Naming of the Parts of the Body*, which is considered to be the earliest treatise on anatomical terminology (Bujalkova, 2011). Julius Pollux compiled a lengthy thesaurus of Ionic/Attic/Koiné Greek (henceforth, Ancient Greek) words entitled *Onomasticon*. This thesaurus remained unknown to Muslims and Christians for 1300 years (Dirckx, 2004). It was rediscovered by Christian scholars at the end of the 15th century. From

* Corresponding author. Tel.: +34 91 394 71 87; fax: +34 91 394 71 87.
E-mail address: arraezla@med.ucm.es (L.-A. Arráez-Aybar).
[1] Member of the Trans-European Pedagogical Anatomical Research Group (TEPARG, affiliated to the European Federation of Experimental Morphology).

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Onomasticon, the anatomists of the 16th century often used Latin words to replace Islamic Golden Age terms. These Latin words are still used in anatomical nomenclature today.

As a matter of fact, up to the 10th century, Ancient Greek was the primary medical language. From the 11th century onward, the Ancient Greek language is overtaken by the medieval Latin language, especially in medicine, and with it anatomy, which is not yet even considered as a separate discipline (Hyrtl, 1880). The authors of the time were struck with the inadequacies of the Latin language with regard to anatomical terminology. Albertus Magnus (Albert the Great; 1193/1206–1280; born in Lauingen, Bavaria, presently Germany), Mondino de Luzzi (c. 1270–1326; Florence, presently Italy) and Guy de Chauliac (c. 1300–1368; Chaulac, presently France), with Isidore of Seville (560–636; Cartagena, presently Spain) as predecessor, were the authorities that provided the largest number of anatomical terms in Latin during the Middle Ages (Barcia Goyanes, 1978 I, 139). Terms that have been compiled by Jacopo Berengario da Carpi (1460/66–1530; Carpi, presently Italy) in his brief *Isagogae breves* (1530) (Kachlik et al., 2008).

However these Latin terms do not come directly from Ancient Greek writings but through Islamic Golden Age translations that, in general, are poor in anatomical names, which is unfortunate not only from the technical standpoint but also the literary. However; Arabic is the vector of the Ancient Greek culture into Latin medieval medicine and science, and therefore into anatomy. Thus Christian scholars who write on philosophy, medicine and science from the Year 1000 to the Renaissance were called Arabists, a term coined by Albrecht von Haller (1708–1777; Bern, Switzerland) in his *Bibliotheca anatomica* (1774).

These Arabists usually performed translations into Latin by means of transliteration instead of phonetic transcription. Moreover, Arabists created new terms while often being unaware of either the most elementary anatomy or the names that the designated terms have in Ancient Greek and even Latin. It must be taken into consideration that there were no technical or anatomical terms, in Latin that is, because medicine was written in Greek during the Roman era (Barcia Goyanes, 1978, I, 13).

During the 12th and 13th centuries, the essential transfer of terminology from Ancient-Greek/Islamic-Golden-Age languages to medieval Latin took place in the so-called *Toledo School of Translators*. The contributions of this School far surpass the feeble influences of Ancient Greco-Roman knowledge which were characteristic of the High Middle Ages. Regrettably, the *Toledo School of Translators* contribution has been scantily recorded in the anatomical literature thus far. The present study is intended to remark on the significant influence that the *Toledo School of Translator*s has had in the development of anatomical nomenclature, so that some terms conceived by *Toledo Schools of Translator* still persist in the most recent *Terminologia Anatomica*, as composed by the Federative Committee of *Terminologia Anatomica* of the International Federation of Associations of Anatomists (FCAT, 1998).

2. Historical context

In the Year 489, the Nestorians (Christian heretics exiled by the Byzantine Emperor Zeno) founded a school known as the *Academy of Gundishapur* (Persia, presently Iran) (Vatle, 1991). There, the Presbyter and Archiater Sergio of Shaina (Year 536) translated a number of Greek manuscripts into the Syriac language, including the twelve books of Hippocrates of Cos (henceforth, Hippocrates; c. 460 BC–370 BC; born in Kos, presently Greece) and thirty-seven of Aelius Galenus (Clagett, 1955). Aelius, or Claudius, Galenus, also known as Galen of Pergamon or simply Galen ('the Calm'), who was born in Bergama, presently Turkey, and lived from 129 to c. 199.

Between the years 632 and 732 Islam spread from the south of Hindustan up to Al-Andalus (which first encompassed, at its maximum extent, not only the Iberian Peninsula but also the French Septimania, presently Languedoc-Roussillon, France). Then, in distinct parts of this vast territory, a process began taking place, which also incorporated original contributions in the medical field, of appropriation and assimilation of the Ancient Greek legacy. During the 9th century, several caliphs of the Abbasid Dynasty – al-Mamun (813–833) and his immediate successors – were big promoters of an early intellectual awakening in Baghdad (presently Iraq). During this period many philosophical, scientific and medical texts – particularly, the Ancient Greek manuscripts were preserved in the Hippocratic Academy of Gundishapur – these manuscripts were translated into Arabic from diverse languages (Ancient Greek, Chinese, Sanskrit and Persian) (Vatle, 1991). Hunayn ibn Ishaq (henceforth, Hunayn; 809–873; born in Kufa, presently Iran), private physician of Caliph al-Mutawakkil, directed a team of scholars that translated, though not *ad litteram* but *ad sensum* (i.e., for approximation), the whole '*Galenic corpus*' (Habbi, 1994). Hunayn is recognized as a creator of technical and scientific Islamic Golden Age language. Also he is the probable editor, under the Latinized name of Ioannitius, or Johannitius, of an introduction to Galenic medicine, *Isagoge Ioannitii ad Tegni Galeni*, which was edited several times during the 15th and 16th centuries and was widely read in Christendom's universities.

In the first third of the 10th century, Al-Andalus was ruled by the Omeya Caliphate. Cordoba (presently Spain), which is Al-Andalus' capital, quickly rose to a level of cultural influence rivalling that of Baghdad, Damascus and Kairuán (presently Iraq, Syria and Tunisia, respectively). During the 9th–13th centuries the Islamic Golden Age of medicine reached its peak (Ricordel, 1998). Most great Islamic Golden Age medical authorities focused on anatomy as part of medicine and surgery. They subscribed to the classical teaching that anatomy is the propaedeutic for surgical intervention (Solassol, 1989). In it we find an accounting not only of the Alexandrine theories, but also of many documentary sources of ancient Persia (Shoja and Tubbs, 2007). A typical feature of these documents is that anatomy and surgery occupy a constantly enriching place in manuals (Schipperges, 1966). These specific authors should be noted:

- Muhammad ibn Zakariyā Rāzī also known by his Latin name Rhazes (854–932; born in Rey, presently Iran), is considered the first great Islamic Golden Age physician. His work *Liber medicinalis Almansoris* is a true encyclopedia of the medical knowledge of his age. The first one of his ten books is dedicated to anatomy, which is studied in 26 chapters (Tubbs et al., 2007).
- 'Ali ibn al-'Abbas al-Majusi, latinized as Haly Abbas (949–982; born in Arejan, Persia, presently Iran). During his time in Baghdad, Aly Abas wrote a large medical encyclopedia entitled *Kāmil al-Sināa al Tibbiya* (*The Perfect Book of the Art of Medicine*) or *al-Maliki (The Royal Book)*. This book strongly influenced the work of Avicenna (see below). The main part of this book was translated into Latin by Constantine the African (born in North Africa, c. 1020 and died at Monte Cassino, presently Italy, c. 1087) under the title of *Liber pantegni* (c. 1086) without any reference to Haly Abbas. This *Liber* becomes a founding text of the *Schola medica salernitana*. Stephen of Pisa translated the entire book in Antioch (under the name of *Liber regius or Liber regalis dispositionis*). The work is held in high esteem among Christendom's physicians. In the ninth book there are 110 chapters about anatomy and surgery, which are unified (Aciduman et al., 2010; Zargaran et al., 2013).
- Abu al-Qasim Khalaf ibn al-Abbas Al-Zahrawi (936–1013), in Latin also known as Albucasis or Abulqasim, was an Andalusian physician – born in El-Zahra, north of Cordoba – and is considered the greatest Islamic Golden Age teacher of surgery. He