Review Article

UDK: 611:001.4

RUFUS OF EPHESUS AND HIS CONTRIBUTION TO THE DEVELOPMENT OF ANATOMICAL NOMENCLATURE

RUFUZ IZ EFEZA I NJEGOV DOPRINOS RAZVOJU ANATOMSKOG NAZIVLJA

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SUMMARY

Rufus of Ephesus, a famous ancient physician, lived about the years 80 - 150 CE. His theories stressed the importance of anatomy and he preferred pragmatic approach to diagnosis and treatment. In his work "On the Names of the Parts of the Human Body", he put in pragmatic effort to make a lexicon of anatomy for his pupils. In the introduction, he described it as a manual for the students of medical art which relied on demonstration in teaching; visible (outer) parts of the body were shown on a demonstrator and invisible (inner) parts were shown on a dissected monkey. The brief explanation of the anatomical terms includes position, shape, and functions of organs, and this is what makes his work a pioneering effort to explain the anatomy clearly, systematically, and using consistent terminology. Rufus stressed the importance of exact nomenclature to prevent misunderstandings in medical practice.

This anatomy manual had a major influence on the development of anatomical terminology. It is an important contribution to the history of teaching. The other essential contribution of Rufus' lexicon (also known for its briefer title Onomastikon) is that the author recognised and critically reviewed the knowledge and views of his predecessors, physicians of the pre-Galenic period. No less important was his teaching to anatomists and physicians who followed, as they often cited or paraphrased Rufus in their own works (Galen, Oribasius). Many fragments of Rufus' work have been preserved by medieval Arabic medical writers, especially by Rhazes.

Keywords: history of medicine, anatomical nomenclature, antiquity, Rufus of Ephesus belongs

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Rufus of Ephesos Rufus iz Efeza

One of the basic requirements of anatomy is to clearly distinguish parts of the body. The first text on anatomical terminology started as early as dissections on animals. Rufus of Ephesus belongs to those authors who followed a pragmatic goal – to compose anatomical dictionary for their pupils.

Reports about the life of Rufus of Ephesus are few and incomplete. He came from Ephesus, Asia Minor, but the rest are only fragments of information about his life. He probably lived in the first half of the 2nd century CE, which means that he was probably born in the last quarter of the 1st century CE and died in the second quarter of the 2nd century (about the years 80-150 CE) (Sideras, 1995, p. 1085-1086). According to the largest preserved Byzantine lexicon of Suda, Rufus lived during the rule of the emperor Trajan (98-117 CE). At the time, Ephesus was an important trading centre and a well-known medical centre. Many references in his work show that he received medical training and practiced medicine in his native town.

There is no clear reference to other places of residence he might have had, but references in his books suggest that he lived in Egypt, probably in Alexandria, where he also practiced medicine. Chances are that he also practiced in the capital of the Roman Empire. Rome was then a great medical centre that attracted famous physicians such as Soranus and Galen. Suda lexicon mentions that: "Rufus lived during the reign of Trajan with Criton" (Suda, IV 301, 32 - 302, 2 Adler). Criton was the personal physician of the emperor Trajan in Rome.

Rufus of Ephesus wrote about 100 medical texts, most of which have been lost. His work was well received in the East and some has been preserved in Arabic only. Only four complete pieces have been preserved in Greek: Questions of the Physician (to the Patients) On Diseases of the Kidneys and Bladder On the Names of the Parts of the Human Body On Satyriasis and Gonorrhoea.

According Scarborough (1993, p. 45) and Littman (1996, p. 2703), the surviving works of Rufus also include *On Gout* (in Latin), *On Jaundice* (in Latin and Arabic) and *On Nabidh and Case Histories* (in Arabic). References to or extractions from his works have also been preserved in Galen, Oribasius, Aetius of Amida, Paul of Aegina, Alexander of Tralles, Rhazes, and Ibn al-Baitar (Daremberg, 1879, Préface, p. 9-10). He stressed the importance of anatomy and promoted pragmatic approach to diagnosis and treatment (Leven, 2005, p. 759; Nutton, 2004, p. 209-210).

Preserved writings and fragments of Rufus' work are collected in a complete edition in Greek with a parallel French translation made by Ch. Daremberg and Ch. É. Ruelle (*Oeuvres de Rufus d'Éphèse*, Paris 1879), available in an electronic format as well. Selected texts have also been translated into German by G. Kowalski, J. Kollesch, and D. Nickel.



Ch. Daremberg and Ch. É. Ruelle: Oeuvres de Rufus d'Éphèse (Works of Rufus of Ephesos), Paris 1879.

Ch. Daremberg and Ch. É. Ruelle: Oeuvres de Rufus d'Éphèse (Djela Rufusa iz Efeza), Paris 1879.

A BRIEF ANALYSIS OF ONOMASTIKON (On the Names of the Parts of the Human Body)

The fact that Rufus considered anatomy important is shown in his work for novice physicians $\Pi \varepsilon \rho i$ $\acute{o}vo\mu\alpha\sigma i\alpha\zeta \tau \widetilde{o}v \tau o \widetilde{v} \acute{a}v\theta\rho\acute{o}\pi o \nu \mu o \rho i\omega v$ (On the Names of the Parts of the Human Body), or briefly Onomastikon. This piece contains precious historical insight into anatomy of the pre-Galenic times. It is, however, outlined rather generally, because it was a prototype of anatomical dictionary in which the author provides his pupils-beginners with anatomical nomenclature.

In the introduction, Rufus compares medical studies to other occupations, specifically to learning how to play a four-string lyre or grammar. This comparison is justified. Rufus says that those who wish to learn this musical instrument first have to touch and name its four strings. Similarly, to get familiar with grammar one has to learn the names of its elements letters. As grammar describes systems of rules in each language, so does anatomy describe the basics about the human body. Even in less noble arts (occupations) such as metalworking, pupils first have to learn to name the materials and instruments used in the craft. This is why Rufus makes a rhetorical question: if less noble occupations do this, why should not noble ones do the same? Therefore, training in medicine should start by naming the parts of the body, first those visible from the outside and then proceed to the invisible ones, which can only be revealed by dissection of an animal that most resembles a man. In conclusion, Rufus notes that in even more ancient times dissections had been performed on men (Rufus, 1 - 10: p. 133, 1 - 134, 14 DA; Kollesch – Ni-ckel, 2007, p. 105 - 106). According to L. Edelstein, dissections on the human bodies were performed by Herophilus and Erasistratus in Alexandria (Edelstein, 1967, p. 281).

In the introduction ($\pi\rho ooi\mu ov$), Rufus invites the reader into "fictitious situation of demonstration teaching" (Nickel, 2009, p.64). Rufus' method has been confirmed by present knowledge that children learn better what they perceive by more senses at the same time. The first part of his writing deals with the visible (outer) parts of the human body ($\tau \dot{\alpha}$ $\epsilon \pi \iota \varphi \alpha v \tilde{\eta}$) and the second one with the invisible (inner) parts ($\tau \dot{\alpha} \ \epsilon v \delta ov$) (Rufus, 9: p.134, 10 DA). In the first part he uses a slave ($\pi \alpha \tilde{\alpha} \varsigma$) as a demonstration object and in the second a dissected animal ($\xi \ \varphi ov$) "which most resembles man", that is, a monkey. The monkey can also be found further in the text (Rufus, 127: p. 149, 12 - 150, 3 DA). This short introduction is followed by a chapter focused on describing single parts of the human body and naming them according to the traditional scheme *a capite ad calcem* ("from head to heel"). In the first section, Rufus names main components of the human body: head, neck, trunk, upper and lower extremities. Then he continues by describing each of these parts in detail. The description of single bones and regions of the head is followed by a description of the most important organs of the head: the eyes, nose, lips and ears (Rufus, 11 - 44: p. 135, 1 – 139, 1 DA). Rufus then moves on to the other parts of the face, paying particular attention to the mouth, teeth, gums, tongue, palate and pharynx (Rufus, 45 - 65: p. 139, 1 – 141,1 DA).

Follows the description of the neck and its parts (Rufus, 66 - 69: p. 142, 1 - 7 DA). The description of the trunk is preceded by a drawing of the upper extremities and their parts (arm, forearm, hand, fingers, and nails) (Rufus, 70 - 88: p. 142, 8 – 144, 13 DA). Rufus then names the trunk and its parts (breastbone, back, hips, breasts, ribs, cartilages, pubis, and genitals) (Rufus, 89 - 100: p. 145, 1 - 146, 7 DA). Sex organs are described separately, first male then female (Rufus, 101 – 112: p. 146, 7 – 147, 11 DA). Follows a part describing the groin, buttocks, thighs, knees, feet, heels, and toes back and front (Rufus, 113 – 126: p. 147, 11 – 149, 11 DA). Details about the structure of bones are mostly found in the first section of the work and are always described with parts of the body they belong to (Rufus, 127: p. 149, 12f DA).

The second section of Rufus' Onomastikon begins with a dissection of a monkey to more vividly describe the invisible (inner) parts of the human body. The monkey was chosen because it resembled man in many respects (Rufus, 127: p. 149, 12 – 150, 3 DA). It starts with a description of the cranial parts: the pericranium, cranial bones and sutures (Rufus, 129 - 140: p. 150, 7 – 152, 2 DA). Follow descriptions of muscles and apertures (Rufus, 141 – 146: p. 152, 2 – 153, 3 DA). Rufus then depicts the brain and its parts, the nerves, the eye, and its parts (Rufus, 147 – 153: p. 153, 3 – 154, 13 DA). He then describes the cervical vertebrae, the pharynx, and the heart, which is viewed as the source of body temperature, pulse, and life in general. He ends this section with a short description of glands in the area (Rufus, 154 – 168: p. 154, 13 – 156, 14 DA).

Follows a description of the stomach, liver, pancreas, kidneys, ureters, urinary bladder, and the sperm ducts (Rufus, 169 - 187: p. 156, 14 - 159, 10 DA). Rufus then describes various muscles, the uterus in women and sperm ducts in men (Rufus, 188 - 197: p. 159, 11 - 161, 3 DA). The sec-

ond section ends with structures and substances extending throughout the body, such as the vessels, nerves, ligaments, tendons, cartilages, membranes/coatings of various type, fat, flesh, marrow, basic body fluids, liquids, and excretions specific for particular organs, including blood, mucus, bile, saliva, urine, menstruation blood, winds, nose secretion, ear wax, milk (in women), and semen (Rufus, 198 - 228: p. 161,4 - 166,11 DA). The writing concludes with several embryological notes, a description of the surroundings of the foetus (chorion, navel, placenta, amniotic fluid) (Rufus, 229 - 232: p. 166,12 - 167,9 DA) and with Rufus' remark that these names cover most human body parts, even though some have been omitted (Rufus, 233: p. 167,10 - 13 DA).

When describing internal organs, in addition to describing their form, Rufus gives a macroscopic histological description of tissue characteristics (Thomssen – Probst, 1995, p. 1256). He understands the concept of a $\nu\epsilon\bar{\nu}\rho\nu$ (neuron) as simultaneously related to nerves, ligaments and tendons. In comparison with it (i.e. neuron), a cartilage ($\chi \acute{o}\nu \delta\rho\rho\varsigma$) attached to bone ($\acute{o}\sigma\tau\acute{e}o\nu$) is of harder composition. Rufus makes a difference between thin and thick coatings/membranes ($\dot{\nu}\mu\acute{e}\nu\epsilon\varsigma - \chi\iota\epsilon\bar{\omega}\nu\epsilon\varsigma$), fat ($\pi\iota\mu\epsilon\lambda\dot{\eta}$), flesh ($\sigma\dot{\alpha}\rho\ddot{\zeta}$), and marrow ($\mu\nu\epsilon\lambda\dot{o}\varsigma$). Flesh was divided into muscle flesh ($\dot{\eta}$ $\tau\omega\nu$ $\mu\nu\omega\nu)$ which is fibrous and hard, tissues filling the space between bowels, flesh solidified in injuries, and flesh in the cavities of bones (Rufus, 211- 217: p.163f DA). By analogy, Rufus noted various organs as muscular – rich in muscles ($\mu\nu\omega\delta\eta\varsigma$), fleshy ($\sigma\alpha\rho\kappa\omega\delta\eta\varsigma$), glandlike ($\dot{\alpha}\delta\epsilon\nu\rho\epsilon\epsilon\dot{o}\eta\varsigma$), fatlike ($\delta\iota\alpha\pii\mu\epsilon\lambda\rho\varsigma$, $\dot{\nu}\pi\sigma\pii\mu\epsilon\lambda\rho\varsigma$), and soft/smooth ($\psi\alpha\theta\nu\rho\dot{o}\varsigma$) (Rufus, 57, 64, 111, 167, 175: p. 140 f., 147, 156 f. f. DA).

Rufus not only described anatomical structures, but he also explained their function and place within respective systems of organs. For example (Thomssen – Probst, 1995, p. 1256 – 1257) the cardiovascular system:

The heart, as an origin of warmth, life and pulsation, consists of the head ($\kappa \epsilon \varphi \alpha \lambda \dot{\eta}$), the bottom ($\pi v \theta \mu \dot{\eta} v$) and the heart cavities ($\kappa o \iota \lambda i \alpha \iota$). The thicker left chamber is arterial ($\dot{\alpha} \rho \tau \eta \rho \iota \dot{\alpha} \delta \eta \varsigma$), the thinner right chamber, which is wider than the left one, is venous ($\varphi \lambda \epsilon \beta \dot{\omega} \delta \eta \varsigma$). Along both sides of the heart-head there are wing-shaped free cavities which move in pulsation of the heart – they are so called heart ears ($\dot{\omega} \tau \alpha \kappa \alpha \rho \delta i \alpha \varsigma$). Coating around the heart is pericardium ($\pi \epsilon \rho \iota \kappa \dot{\alpha} \rho \delta \iota \sigma \varsigma$). Veins are vessels which have thin walls and transport the blood, but the bigger ones are hollow veins ($\kappa o \iota \lambda i \alpha \iota$). Veins differ from arteries in that they transport the blood, while specific function of arteries is pulsation. Arteries are in gen-

eral stronger vessels, only in the lungs it is the opposite (Rufus, 160 – 163, 179, 198 – 203: p. 155f, 158, 161 ff. DA).

RUFUS' CONTRIBUTION TO MEDICINE

As H. Thomssen and Ch. Probst (1995, p. 1255) wrote in their study *Die Medizin des Rufus von Ephesos*, Rufus obtained his anatomical knowledge from dissections he made himself, but also from the heritage of his predecessors that he cites in the work on anatomy in seventeen cases. He did not take over their knowledge uncritically, but he studied it and sometimes even corrected it. Rufus offers his reader some general references to his predecessors, e.g.:

"The ancients called the arteries of the neck "carotids" ($\kappa \alpha \rho \omega \tau i \delta \epsilon \zeta$), because they believed that when they were pressed hard, the animal became sleepy (from *karoun* – to stupefy) and lost its voice; but in our age it has been discovered that this accident does not proceed from pressing upon these arteries, but upon the nerves contiguous to them. Therefore nothing wrong would be done if this name was changed." (Rufus, 210 – 211: p.163, 9 – 12 DA).

Rufus most often quotes Hippocrates, even though the Hippocratic Corpus does not contain any *Onomastikon*. It does however refer to individual body parts. Looking at how Rufus emphasizes the anatomical explanations by Hippocrates in his polemics about terminological ambiguities, it is obvious that he had a deep knowledge of the Corpus. For example, Rufus refers to Hippocrates criticising his colleagues who "confuse the lower part of humerus with the upper part of ulna" (Rufus, 77: p. 143, 5 – 8 DA). Uterus is yet another example; Rufus uses the designations $\mu \eta \tau \rho \alpha$ and $\dot{v}\sigma \tau \dot{\epsilon} \rho \alpha$, but reminds us that Hippocrates also uses the names $\delta \epsilon \lambda \varphi \dot{v} \zeta$ and $\gamma ov \eta$ (Rufus, 193: p. 160, 6 f. DA).

He draws attention to exact nomenclature used in clinical practice to prevent misunderstanding in medical communication, e.g.: "The opening through which sperm and urine are excreted is called urethra $(o\dot{v}\rho\dot{\eta}\theta\rho\alpha, \pi \dot{o}\rho o\varsigma \ o\dot{v}\rho\eta\tau\iota\kappa \dot{o}\varsigma)$; it must not be called ureter $(o\dot{v}\rho\dot{\eta}\tau\eta\rho)$, because ureters are other hollow spaces through which urine flows from the kidneys to the bladder" (Rufus, 103: p. 146, 12 – 15 DA).

Rufus of Ephesus was acknowledged by his successors as a competent, independent, and prolific author and physician. His work is often mentioned by Galen and the Byzantine compilers Oribasius and Aetius and translated into Latin. Translations into Arabic and quotations by Arabic authors confirm his influence in the Arabic world.

Referring to anatomical works by Galen, T. Sakai says the following: "The anatomical descriptions by Galen utilised only a limited number of anatomical terms, which were essentially colloquial Greek words of this period" (2007, p. 65). Moreover, according to Charles Singer: "Galen was an ardent anatomist, but had very seldom (some think never) dissected a human body. His detailed anatomical descriptions are mostly of apes" (1959, p. 1). These two accounts alone seem to point back to Rufus.

Galen (several decades younger than Rufus) does not mention Rufus too often, but when he does, his reference is always positive and appreciative: "Rufus is an outstanding physician very familiar with [medical] art" (Galen, De antid. II 2: XIV 119, 1 f. Kühn) or: "...among more recent physicians, melancholy has best been described by Rufus of Ephesus" (Galen, De atra bile 1: V 105, 3 – 6 Kühn; see also the study by V. Nutton 2008, p. 139 - 158). Galen recommends Rufus' writings on therapies (Galen, De simpl. med. temp. ac fac. 7: XI 796, 2 - 6 Kühn) and quotes eight verses from a Rufus' book on pharmacology (De comp. med. sec. loc. I.1: XII 425 – 13 Kühn; see also Daremberg, Fragments de Rufus, p. 291 – 296). These are, however, exceptional cases, but on the whole, Rufus' heritage is interspersed in Galen's writings without attribution. According to A. Sideras (1995, p. 1235), Galen, unlike later compilers, tends to utilise his sources without quotes and references. Daremberg shares this opinion. In a prologue to Rufus' work he says: "Galen does not literally quote from Rufus, but we believe that he must have reproduced certain parts of his works, or at least he must have mentioned the physician of Ephesus" (Daremberg, 1879, Préface, p. 9 – 10). This mostly applies to the anatomical writings and would require an extended comparative study of Rufus' work with the works by Galen to verify the claim. Still, Deichgräber (1972, p. 59) seems to confirm this general feeling: "Galen frequently used the texts written by Rufus, with or without quotation".

A Byzantine compiler Oribasios (4th century, CE) also highly appreciated the work of Rufus and denoted him as "the Great" (Oribasius, Libri ad Eun. (Praef.) 6: CMG VI 3, p. 318,4 f. RAE). In his collected works *Collectiones medicae* we find reference to Rufus' *Onomastikon* (Orib. Coll. Med. XXV 1: CMG VI 2, 1, p. 48, 1 – 51, 10 RAE). According to A. Sideras, with exception of the prologue, there are literal parallels to Rufus' original and the text also contains the same pseudo-Rufian digressions as in his original works/abstracts (epitomai). We can, however, find parts where Rufus' original and the pseudo-Rufian selection differ. We can assume that both are based on the same compilation (1995, p. 1133).

Apart from Byzantine medicine, Rufus also had a considerable influence on Arabic medicine and its authors. He had an opportunity to make himself familiar with current medical knowledge of the Arabic world during his studies in Alexandria. Later Arabic authors translated almost all of his works into the Arabic language. Manfred Ullmann, who studied the Arabic translations of Rufus'works in detail, writes:

[...] Arabic writers, especially Muḥammad ibn Zakarīyā ar-Rāzī, also known as Rhazes (c. 865 – c. 923/932 CE), quoted at least a dozen of his works. In addition, in 987 CE, Muḥammad ibn Isḥāq an-Nadīm, a merchant from Baghdad, compiled an extensive bibliography - *Kitāb al-Fihrist*, where he referenced 42 titles under the name of Rufus. Three centuries later, ibn abī Uṣaibi' enlarged this list with another 16 titles. (Ullmann, 1995, p.1297)

The most influential of these authors, Rhazes, in his most celebrated work, a Greek-Arabic compendium of medical and surgical knowledge entitled *Kitab al-Hawi* (The Comprehensive Book on Medicine) quotes Rufus to quite a large extent. This source was translated into Latin as *Liber continens* in 1279. For each disease Rhazes listed medical theories from Greek, Syrian, Indian, Persian, and Arabic medicine. The book contains about 400 fragments of Rufus' writ-ings that are however hard to identify (Ulllmann, 1995, p. 1293 - 1349). According to Ullmann, the Latin medieval translation contains so many imperfections that "the fragments of Rufus' writings in *Liber continens* can only be utilised together with the texts of the Arabic source" (1995, p. 1299 – 1300).

CONCLUSION

Rufus wrote his work *On the Names of the Parts of the Human Body* as an introduction to the study of medicine for future generations, in which anatomical nomenclature is its cornerstone and therefore is an important contribution to the history of teaching. Brief explanation of anatomical terms also includes data about the position, shape and function of organs. His work relies on the medical tradition and work of his predecessors. For Rufus of Ephesus anatomy was a means to achieve a particular goal of linking theory with demonstration teaching. His work was important for future clinical practice, as he stressed the importance of exact nomenclature to prevent misunderstanding in medical communication. Onomastikon reveals Rufus of Ephesus as a universal man "who was, in addition to medicine, strongly interested in history and culture" (Ullmann, 1995, p. 1349). This claim is also supported by his studies and critical assessments of his predecessors, mainly Hippocrates. Undoubtedly, Rufus has made an important contribution to future studies of medicine. In the writings of his successors, Rufus appears to be frequently mentioned, cited or paraphrased. This is particularly true for medieval Arabic literature, which has preserved most of his writings.

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Sažetak

Rufuz iz Efeza, slavni antički liječnik, živio je otprilike između 80. i 150. pr. Kr. U svojim je teorijama isticao važnost anatomije i prednost davao pragmatičkom pristupu dijagnozi i liječenju. U djelu O imenima dijelova ljudskog tijela učinio je pragmatički napor kako bi izradio anatomski leksikon za svoje učenike. Djelo u uvodu opisuje kao priručnik za studente medicinskog umijeća, koji se oslanja na demonstraciju u podučavanju vidljivih (vanjskih) dijelova tijela prikazanih na demonstratoru i nevidljivih (unutarnjih) dijelova na seciranome majmunu. Kratko objašnjenje anatomskog nazivlja uključuje precizan položaj, oblik i funkcije organa, što je pionirski napor u zornijem objašnjavanju anatomije, uza sustavnu uporabu konzistentne terminologije. Uz to je zagovarao korištenje egzaktnog nazivlja kako bi se spriječili nesporazumi u medicinskoj praksi.

Ovaj priručnik ne samo da je imao velik utjecaj na razvoj anatomske terminologije, već je uvelike pridonio povijesti podučavanja. Važnost je Rufuzova leksikona (poznat po svome kraćem naslovu Onomastikon) i u tome što je autor prepoznao i kritički preispitao znanje i poglede svojih prethodnika, liječnika predgalenskoga razdoblja. Ništa manje važno nije podučavanje anatoma i liječnika koji su ga slijedili i često citirali ili parafrazirali u svojim djelima (Galen i Oribazije npr.). Mnogi fragmenti Rufuzova djela sačuvani su preko srednjovjekovnih arapskih pisaca, posebice Razesa.

Ključne riječi: povijest medicine, antika, anatomsko nazivlje, Rufuz iz Efeza