The Spread of Rhythm in Life Science and Medicine (1st – 2nd century AD) – part 1

Thursday 14 December 2017, by Pascal Michon

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During the first two centuries of the current era, the Roman Empire was under the rule of the Principate. The tremendous civil violence that marred the end of the Republic disappeared. The whole Mediterranean was unified and the exchange between the Greek Eastern and the Latin Western worlds flourished. The Roman aristocracy was entirely "domesticated" but benefited from this period of peace, growth and intercultural exchange to develop new behaviors and interests. Concurrently with its particular attention to rhetoric as educational means, in which rhythm had a considerable share, it was also very much interested in Greek medicine where rhythm had also become essential.

Our knowledge of the medical pulse theory during the first two centuries of the Roman Empire is based on a fair number of specific treatises. Galen himself wrote in Greek at least six of them that are usually referred to by their Latin name: *De pulsibus ad tirones – On Pulses to Beginners*; *De pulsuum differentia – On Differentiae of Pulses; De dignoscendis pulsibus – On Distinguishing Pulses* (all three in vol. 8 in Kühn's edition, 1824); *De causis pulsuum – On Causes in Pulses; De praesagitione ex pulsibus – On Prognosis of Pulses*; *Synopsis librorum suorum de pulsibus – Synopsis on Pulses* (all three in vol. 9 in Kühn's edition, 1825). These texts have not been translated into English but they exist in a Latin translation made during the Renaissance. The most modern edition was published by Karl Gottlob Kühn between 1821 and 1833. There is also an English summary of the treatises made by John Redman Coxe in 1846.

In addition to those texts, there are five other treatises of the same period dedicated to the pulse. Three of them are attributed to Galen and published in Kühn's edition (vol. 5 and 19) but are probably not from his pen: *De pulsuum usu – On the Use of Pulses*; *De pulsibus ad Antonium disciplinae studiosum et philosophum – On Pulses to Antonius philosopher and eager student*; *Definitiones medicae – Medical Definitions*. Three more treatises were written under the same title *On pulses* by Pseudo-Rufus of Ephesus, Pseudo-Soranus and Marcellinus.

Strikingly, most of theses treatises have been written over a period of a little less than a hundred and fifty years. Marcellinus lived between the late 1st and early 2nd century AD; Pseudo-Soranus and Pseudo-Rufus of Ephesus probably in the 2nd century AD; and Galen from ca. 129 to 216 AD. This number of extant works developing the Herophilean pulse lore, often quoting and discussing each other, shows that there was, during this period, a surge of interest in this subject among Greek-Roman physicians—and their clients—and that the pulse was considered both an important theoretical and clinical subject, a phenomenon difficult to perceive and on which physicians often disagreed, and also quite certainly an ostentatious sign of the physician's special knowledge that was meant to impress his patients.

This does not mean, naturally, that the Herophilean pulse lore had been forgotten during the previous centuries. On the contrary, there is enough evidence that shows a continuous and vivid debate about pulse and rhythm. But as for the founder himself, nothing remains from the works of previous Greek physicians interested in this matter. We only know about them through the 2nd century AD treatises which often quote them quite accurately but necessarily in a very limited extent.

Contestation *vs* Refinement of the Herophilean Pulse Rhythm Theory – The Pneumatic School (1st cent. AD)

A few testimonies seem to indicate that the Herophilean pulse lore was contested after the 3rd century BC by non-Herophilean physicians, who found it too abstract to correctly account for the empirical phenomena they had to deal with and also too complicated to implement.

In his *Naturalis Historia – Natural History*, Pliny the Elder (23-79 AD) reports that, by his time, the Herophilean classification of pulse according to age and rhythm—which he seems strangely to partly confuse with speed—had been abandoned "on account of its excessive subtlety," while the observation of pulse frequency and pulse strength still served as "a pilot in life."

> Between the nerves lie hidden the arteries, i.e. the ducts for pneuma. The veins, i.e. the channels for blood, float among them. The pulsation of the arteries is most apparent in the extremity of the limbs. In general, it is an indicator of diseases, and it was divided by Herophilus, an oracle of medicine, into definite measures and metrical laws according to age *[in modulos certos legesque metricas per aetates]*: regular, or in rapid motion, or slow *[stabilis, aut citatus aut tardus]*. But this [nowadays] is abandoned on account of its excessive subtlety; nevertheless, through our observation of the frequent or feeble beat *[crebri aut languidi ictus]* it [still] regulates the steering of one's life. (Pliny, *Natural History*, 11.89.219, trans. Heinrich von Staden)

In another passage Pliny says that Herophilus' rhythmic theory of pulse associating "ages" with certain types of "musical feet" was "abandoned in succeeding years" because "it necessitated a strong acquaintance with the belles lettres."

> These several schools of medicine, long at variance among themselves, were all of them condemned by Herophilus, who regulated the arterial pulsation according to [musical feet], correspondingly with the age of the patient *[in musicos pedes venarum pulsu discripto per aetatum gradus]*. In succeeding years [however], the theories of this sect were abandoned, it being found that to belong to it necessitated a [strong] acquaintance with [the belles lettres] *[deserta deinde et haec secta est, quoniam necesse erat in ea litteras scire].* (Pliny, *Natural History*, 29.5, trans. John Bostock & H.T. Riley, my mod.).

A century later, Galen notices again that while there were still a certain number of physicians, as himself, advocating and using Herophilus' pulse rhythm theory, many others considered it too speculative and unefficient.

> Some, however, proceed to a plausible account [sc. of quickness and slowness in pulse], writing systematic accounts of the Herophilean kind about the rhythms in pulses, while others both disparage such speculation as idle verbosity and distance themselves from it completely. (Galen, *De praesagitione ex pulsibus*, 2.1, 9.275, trans. Heinrich von Staden)

However, this contention against the Herophilean use of metric rhythm was neither complete nor definitive. Berrey provides a list of 19 Herophilean physicians from Herophilus himself (330/320-260/250 BC) to Demosthenes Philalethes (*fl*. 7 BC-50 AD), who most probably practiced medicine according to Herophilus' pulse lore (2011, p. 266-269). Moreover, von Staden suspects Pliny to be ignorant of the latest works of the "Pneumatic school of medicine" in which rhythm was indeed considered an important *differentia* and subject of much debate.

> The statement that the strength and frequency of the pulse were still being used as diagnostic criteria, but that its speed had been abandoned—about rhythm and size, Herophilus' two other criteria, Pliny says nothing [unlike von Staden, I think that rhythm is clearly targeted by Pliny – PM]—can only mean that Pliny was not well informed about the efflorescence of pulse-lore in the Pneumatic school of medicine. (von Staden, 1989, p. 285, n. 158)

Indeed, the development of the pulse rhythm theory seems to have been already thriving in the Pneumatic school since its foundation in Rome by Athenaeus of Cilicia in the 1st century AD. Some texts from the 2nd century provides a few hints about this efflorescence which, according to Wilamowitz and Wellmann, was already well advanced in the work of Pliny's contemporary Agathinus (1st century AD), although the pulse lore of Agathinus' pupil, Archigenes (33/34 or 53/54-116/117 AD), is much better documented (von Staden, 1989, p. 285, n. 158).

Pseudo-Rufus of Ephesus, who according to Scarano (1990) was "a follower of the Herophilean sect flourishing in Rome at the time of Galen" reports a list of categories that was used by Archigenes and probably other members of the Pneumatic school before and after him. As in Herophilus' fragment that was commented above, rhythm is listed last, which may indicate that it was still considered to be of special interest.

> The ten species of pulse, according to Archigenes, are determined: 1. by the quantity of the dilation; 2. by the quality of the movement; 3. by the intensity of the strength; 4. by the amount of the beat; 5. by the duration of the rest; 6. by the consistency [of the artery]; 7. by equality and inequality; 8. by regularity and irregularity; 9. by fullness and emptiness; 10. by the rhythm. (Pseudo-Rufus, *Synopsis on Pulses*, ed. Daremberg, p. 231-232, my trans)

A fair number of pieces of evidence shows that rhythm began to be an object of fierce conceptualization. First, its various definitions were discussed with great care.

> Rhythm, says Bacchius the Herophilean, is a motion which has a definite order in time *[κίνησις ἐν χρόνοις τάξιν ἔχουσα – kínêsis en khrónois táxin ékhousa]*. The Herophilean Zeno says: the

> rhythm is an order of time-lengths *[τάξις τῶν χρόνων – táxis tôn khrónôn]* or an order in the duration in which the dilation and the contraction of the arteries occur. However, it would be more accurately defined as follows: rhythm is the proportion of the pulse time-lengths that have a certain relationship to each other. Another has defined it in these terms: the rhythm is the configuration of times from the moment when the arteries dilate until they contract. (Pseudo-Galen, *Medical Definitions,* 220, 19.408-409, my trans.)

Pulse rhythm admitted new subcategories. In a fragment transmitted by Galen, Archigenes recollects Herophilus' list of four primary criteria—size, speed, vehemence, and rhythm—to which he adds four subsidiary criteria which all seem to be related to rhythm—order *[taxis]* and disorder *[ataxia];* evenness *[homalotes]* and unevenness *[anomalia]*.

> Although Herophilus expounded the other differences between pulses by genus as follows, namely by "size, speed, vehemence, and rhythm," he also mentioned [order] *[taxis]* and [disorder] *[ataxia]* and evenness *[homalotes]* and unevenness *[anomalia]* by species without combining them [sc. into genera]. (Archigenes quoted in Galen, *De diff. puls*., 2.6, 8.592-593, trans. van Staden, my mod.)

Finally, since the pulse rhythm constituted a sign of the patient's health or pathological state, a new series of semiological-rhythmical categories was elaborated on the basis that each age-group had its own typical rhythm. In his *Synopsis on Pulse*, Pseudo-Rufus suggested to differentiate between a "eurhythmic" pulse "which, in each age, preserves its natural progression" and a "pararhythmic" one which does not.

> It is necessary to know that, in all kinds of pulses, one distinguishes size, speed, fullness and rhythm. A *great* pulse is that of which one feels by the touch, in a marked way, the length, the breadth and the depth. A *full* pulse is the one that strikes the fingers with strength and is tense like a nerve. A pulse whose rhythm is regular is that which, in each age, preserves its natural progression; it is called *eurhythmic*; conversely, that which does not keep this regular progression is called *pararhythmic*. The *rapid* pulse is the one that quickly withdraws from the fingers; speed and frequency differ: speed can be recognized by a single beat; it takes several to assess frequency. (Pseudo-Rufus, *Synopsis on Pulse*, ed. Daremberg, p. 228-229, my trans.)

The Pseudo-Galenic *Medical definitions*, a treatise which was written during the same period, is even more precise. It differentiates between "arhythmic," "cacorhythmic," "pararhythmic," "heterorhythmic," and "ecrhythmic" pulses according to their varying deviations from the "eurhythmic pulse" in which the rhythm is normal considering "the age of the patient, the temper of the year and all other conditions."

> The *eurhythmic* pulse is one which has the rhythm appropriate to the age of the patient, his natural constitution, to the temper of the year and to all other conditions.
>
> The *arhythmic* pulse is one which has no rhythm and nothing appropriate.

> The *cacorhythmic* pulse is one which has the rhythm contrary to the *eurhythmic.*
>
> I call *pararythmic* the pulse which has in some measure the rhythm appropriate to the age of the patient but not always. I call *heterorhythmic* the pulse whose rhythm is that of another age. The *ecrhythmic* pulse is one whose rhythm does not correspond to that of any age, or any other condition. (*Definitiones medicae* in Galen, ed. Kühn, 221-222, 19.409-410, my trans.)

In all these new elaborations, rhythm was still defined in Herophilean terms as proportionate organization of time-lengths, but it was now the center of a web of concepts that irrigated the whole medical theory and practice.

It is worth noticing though that, as in Herophilus' time, there is no evidence that rhythm was already in any way conflated with frequency and that it began consequently to lose its classical metric basis for a more mathematical one. Although Herophilus' measurement techniques of the pulse frequency seem to have had mixed success among his successors—even in the Herophilean sect, none of his followers seems to have employed his water-clock—the usefulness of this measure was still recognized and extensively debated. However the debate was not about the distinction or similarity between frequency and rhythm but between frequency and speed, the former denoting the number of dilations during a certain amount of time, while the latter referred to the quickness of the artery dilation. According to Wellmann, all of Book 5 of Archigenes's *On Pulses* was devoted to discuss the latter difference. Similarly, von Staden notices that the same distinction played a prominent role in the Galenic treatises (1989, p. 284, n. 156).

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