SYNCHRONOUS AND PERIODIC EMERGENCE OF GREAT PHYSICIANS IN THE HISTORY OF ANCIENT GREECE, ROME, INDIA & CHINA

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Abstract

A periodicity of about 500 years has been discovered in the history of Graeco-Roman, Indian and Chinese medicine and documented by means of inferential statistics. Famous physicians emerged periodically and synchronously in all of these three cultural areas for at least two millenia or longer. Although medical achievements in India, China and Greece are considered to be an original, local cultural product. It is a surprising fact, that this periodicity as well as the times of maximum creativity have been foretold by Babylonian priests, who knew about this rhythm already before 700 B.C. What is the cause of this periodicity and synchronicity is left to be an open question.

Background

It is a well known but unexplained fact of cultural anthropology, that the growth of culture does not appear as a continuous one, but occurs in creative outbursts or waves. Great personalities in arts and sciences were not being born isolated or scattered along the time-axis but emerged in clusters. Periods of splendid achievements have been followed by centuries of mediocrity and epigonism until the next wave of original inspiration arrived. Many historians of art looked for some underlying law, which would govern the tides and ebbs of culture. The idea, that there could be some kind of regular pattern or periodicity in history, fascinated many explorers since antiquity until today.

Aim

To find out, whether there is a significant periodicity, which could be observed in the history of medicine.

Data

Three sets of famous physicians – 43 of Graeco-Roman, 18 of Chinese and 9 of Indian origin living between 700 B. C. and 1300 A. D. were analyzed. The lists of famous physicians were taken from Kroeber´s „Configurations of Culture Growth", one of the most comprehensive and renowned works in this field.[1] Kroeber also ranked qualitatively the relative importance of each physician - the very best among the best ones, like Hippocrates, Galenos, Avicenna were marked by an asterisk. That was taken into account by ourselves by counting such physicians as two. A score resulted, expressing the amount of creative activity in each country per each century (or each half century in the case of Greece).

Methods

Fisher's periodogram was used to search „blindly" for significant period lengths T. [2] In the second step, Halberg's cosinor regression was applied to test the presence of one leading period τ. [3] It was chosen with respect to the outcome of the periodogram. Results are presented as parameter point and 95% confidence estimates and in the form of graphs. Software used is made by Kubáček & Ondrejka and Kubáček & Valach. [4]

Results

Periodogram revealed the period lengths T of approximately 509 years for Graeco-Roman and 499 years for Chinese physicians to be the relatively most probable ones. Also in the case of Indian physicians the period lengths in the interval between 500 and 600 years appeared to be the most pronounced ones among all others. Thus in all three cases periodogram proposed very similar period

lengths. The candidate for a significant period length common to all three cultural areas can be only the one around 500 years.

This is why the period length of 500 years was taken into the cosinor computation. It was significant in the case of Graeco-Roman ($p < 0.001$) and Chinese ($p < 0.004$) physicians, and not very far from borderline significance ($p < 0.120$) in the case of Indian physicians. Nevertheless, the culmination in the estimated score of physicians has been identified in all three cases between the years 130-170 A. D. Accessory culminations appear in the successive time distances of 500 years back as well as ahead.

The scores of Graeco-Roman, Indian and Chinese physicians were also summed up and tested together. A distinct periodicity of circa 500 years (with $p < 0.0003$) culminating around the years 350 B.C., 150, 650, 1150 A.D. stands out (see Fig. 1). All results are summarized in Table 1.

Discussion

Obtained results are interesting in several ways. First of all, we discovered, that there exists indeed a rhythm, a regular periodicity in the history of medicine. Moreover, the period length is in all three cases nearly the same: great physicians in ancient Greece, Rome, India and China emerged approximately every 500 years.

Good historical evidence from ancient India is scarce and nine physicians is really a number too low to do statistics. Therefore, the rhythm in India is not statistically significant. But it is synchronous with China and Greece and in this context it gains importance (see Fig. 2).

It is surprising, that the waves of medical creativity in these three cultural areas are synchronous. The greatest Greek, Roman, Indian and Chinese physicians have been contemporaries. The father of Indian medicine Sushruta was a contemporary of the father of Western medicine Hippocrates in the 5th and 4th century B.C. Corpus Hippocraticum and Nei-ching, the classical Chinese handbook of medicine, have been both compiled simultaneously in the 4th century B.C. The famous Hippocratic oath, which doctors must pledge until today, was formulated at that time.

The second greatest Western physician Galenos lived in the 2nd century A.D. The famous physician Charaka was practising in India at the same time. And a group of distinguished physicians was active in China. The Charaka-samhita remained an authoritative treatise on Indian medicine for many centuries in a similar manner as the scriptures of Galenos in the West.

The next wave of great physicians appeared again 500 years later: in the 7th century A.D. A new group of famous physicians revised the Chinese materia medica. Their contemporary was Vagbhata in India and Paulus from Aegina in Byzantium, who used to be termed as the „father of surgery". The triad of the most famous Indian physicians – Sushruta, Charaka, Vagbhata – marks the same rhythm as the Western couple of Hippocrates and Galenos does.

The fourth wave of notable physicians in China coincides with the culmination of European cloister medicine in the 12th century. Hildegard from Bingen lived in this century and the famous medical faculty at the university in Salerno conferred the title „doctor" to physicians for the first time.

The synchronicity suggests, that there is some connection, but what kind of? Medical traditions in these three big cultural areas are considered to be original and a product of an independent development. It is hard to imagine, how they could be taken over from one another. There was no direct liaison between Europe and China before the travels of Marco Polo in the 13th century or between Greece and India prior to the expedition of Alexander the Great. If there were some stepwise take-overs of culture, one should expect, that medical knowledge arrives in neighbouring countries with a time delay, but not synchronously.

Finally, the medical knowledge could not be taken over because of its contents, which differs essentially. For instance, there was a common idea in antique medicine, which defined health as a balance among several elements. But the number of these elements was four in Greece (chole, melanchole, sanguis, flegma), three in India (kapha, pitta, vata), two in China (yin, jang) and these systems are incompatible. Another example: The Greeks have had excellent anatomists, whereas there is a notable lack of anatomical foundation in Chinese medicine. Instead, the Chinese developed acupuncture, which was unknown to the Greeks. These are original inspirations, independent achievements, and yet they took place at the same time.

Rather, it seems, that there is some more general factor at work, stimulating medical creativity at a particular time. If these synchronous developments are due to a common external stimulus, the question remains: what made this stimulus to return periodically?

Babylonian prediction

Even more surprising is the fact, that these waves of medical creativity seem to have been predicted. Ancient Babylonians used a calendar based on the belief that seven gods (corresponding to seven „planets" in our solar system, later seven archangels in the Christian era) alternate cyclically as spirits of time. Each one of them rules the world for 72 years; i. e. one and the same deity comes to rule the world each 504 years again (504 = 7 x 72). The Babylonian god *Nabu* (identified with Mercury) returns around the years -351, 153, 657, 1161 etc. These dates result from a calendar-system known long before 700 B. C., exact dates being quoted on excavated clay tablets.[5] Famous physicians do really emerge in the time-periods traditionally ascribed to the patron of medicine. Our inferentially statistical analysis identified this ancient rhythm (504 years) and its culmination (around 153 A. D.) surprisingly exactly (see Table 1).

It is noteworthy, that Babylonian *Nabu*, who was later identified with antique *Hermes* or *Mercury* and in Christianity with archangel *Raphael*, has been since the most ancient time considered to be the patron of physicians. There stood a shrine of Nabu in the city of Borsippa, where he was worshipped already in the 2nd millenium B.C. by Babylonian physicians.

Two efflorescences of the Greek cult of Asclepius took place in the 4th century B.C. and 2nd century A.D. – just as foreseen by the Babylonians. Also the most eminent Egyptian papyri on medicine were written down in one of the time periods, which the sacred ancient calendar ascribes to this deity. The first treatise on anatomy in the world history comes from the 29th century B.C., from the time of the Pharaoh Athotis, who according to the tradition laid down the foundations of Egyptian medicine.[6] Hence the very dawn of medicine fits very well into the rhythm mentioned above – it coincides with the culmination, which took place five full periods before Hippocrates.

Conclusion

A periodicity of about 500 years has been discovered in the history of Graeco-Roman, Indian and Chinese medicine and documented by means of inferential statistics. Famous physicians emerged periodically for at least two millenia. Further clues suggest, that the same rhythm may be at work since the beginning of history. Moreover, the waves of medical creativity in these relatively separated cultural areas were synchronous. Although medical achievements in India, China and Greece are considered to be an original, local cultural product.

It is a surprising fact, that this periodicity as well as the times of maximum creativity have been foretold as early as by the Babylonian priests, who knew about this rhythm already before 700 B.C. To look for causes of this periodicity or to interpret its meaning is left to be an open question.

Notes

[1] Alfred Louis Kroeber, *Configurations of Culture Growth*, Berkeley, University of California, 1969, pp. 116-120, 182, 197-198.

[2] R A Fisher, 'Test of significance in harmonic analysis', *Proceedings of the Royal Society*, London, 1929, Ser. A, **125**, pp. 54-59.

[3] Ch Bingham, B Arbogast, G G Cornélissen, J K Lee, F Halberg, 'Inferential statistical methods for estimating and comparing cosinor parameters', *Chronobiologia*, 1982, **9**, pp. 397-439.

[4] L Kubáček, P Ondrejka, 'Periodogram Analysis, Computer Programme', Bratislava, ComTel, 2001. L Kubáček, A Valach, 'Time Series Analysis with Periodic Components', Computer Programme, Bratislava, ComTel, 2002.

[5] Emil Páleš, *Angelology of History*. *Parallel and Periodic Phenomena in History*, Bratislava, Sophia, pp. 66-98. In Slovak.

[6] Heinz Schott, *Die Chronik der Medizin,* Dortmund, Bertelsmann, 1993, p. 18.

PHYSICIANS	PERIOD-LENGTH	CULMINATION	PROBABILITY OF ERROR
Graeco-Roman	509 [years]	130 A. D.	$p < 0.001$
Indian	580	132 A. D.	$p < 0.120$
Chinese	499	169 A. D.	$p < 0.004$
Together	**522**	**154 A. D.**	**$p << 0.001$**
Expected	*504*	*153 A. D.*	

Table 1.: Results of the chronobiometric analysis of the scores of 70 greatest Graeco-Roman, Indian and Chinese physicians living between 700 B.C. and 1300 A.D. Their periodicity coincides with the time-periods of god Nabu in the Babylonian hieratic calendar.

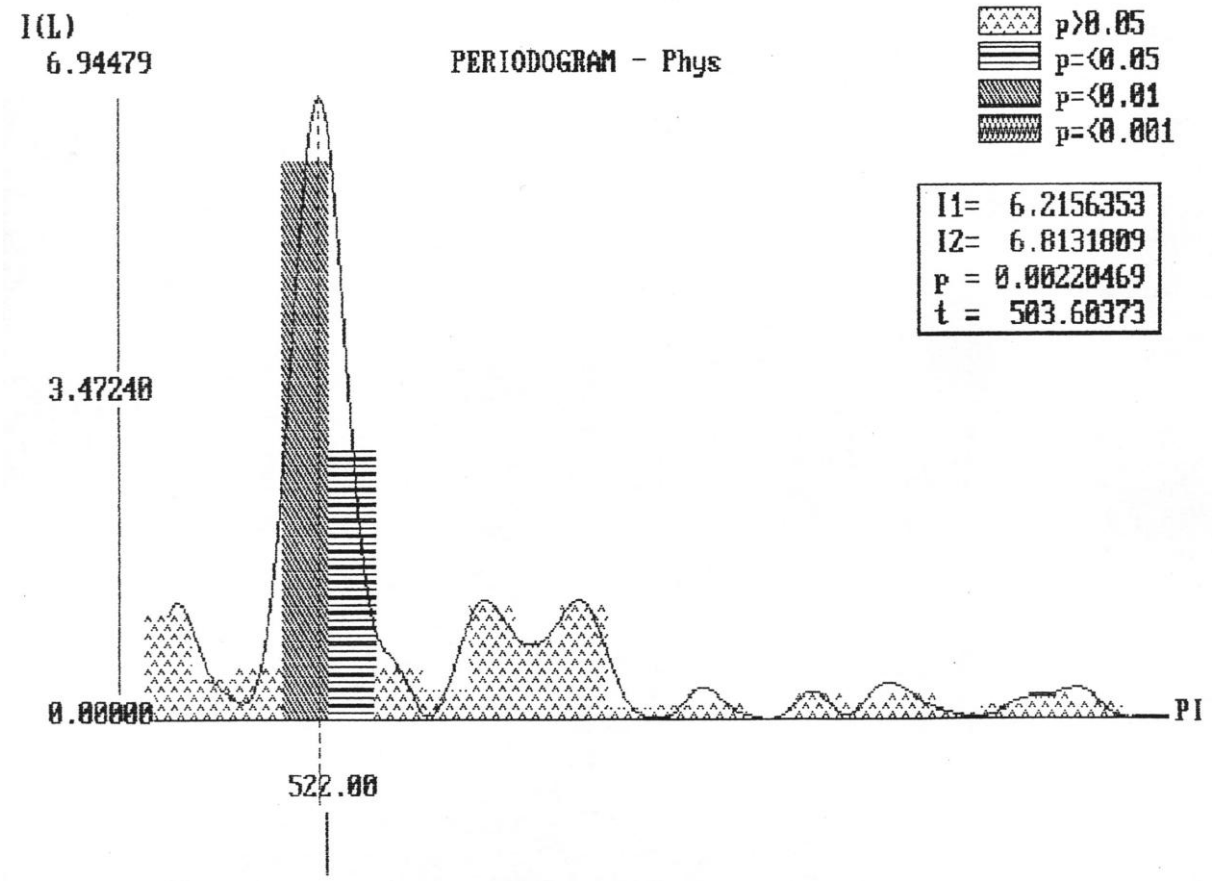

Fig. 1.: Periodogram resulting from a 2000-year record of century frequencies in occurrence of 70 most famous Graeco-Roman, Indian and Chinese physicians living between 700 B.C. and 1300 A.D. On the horizontal axis are period-lengths (from the longest to the shortest). On the vertical axis is a function expressing statistical significance. The interval of statistically significant period-lengths of circa 500-years is high-lighted by darker columns.

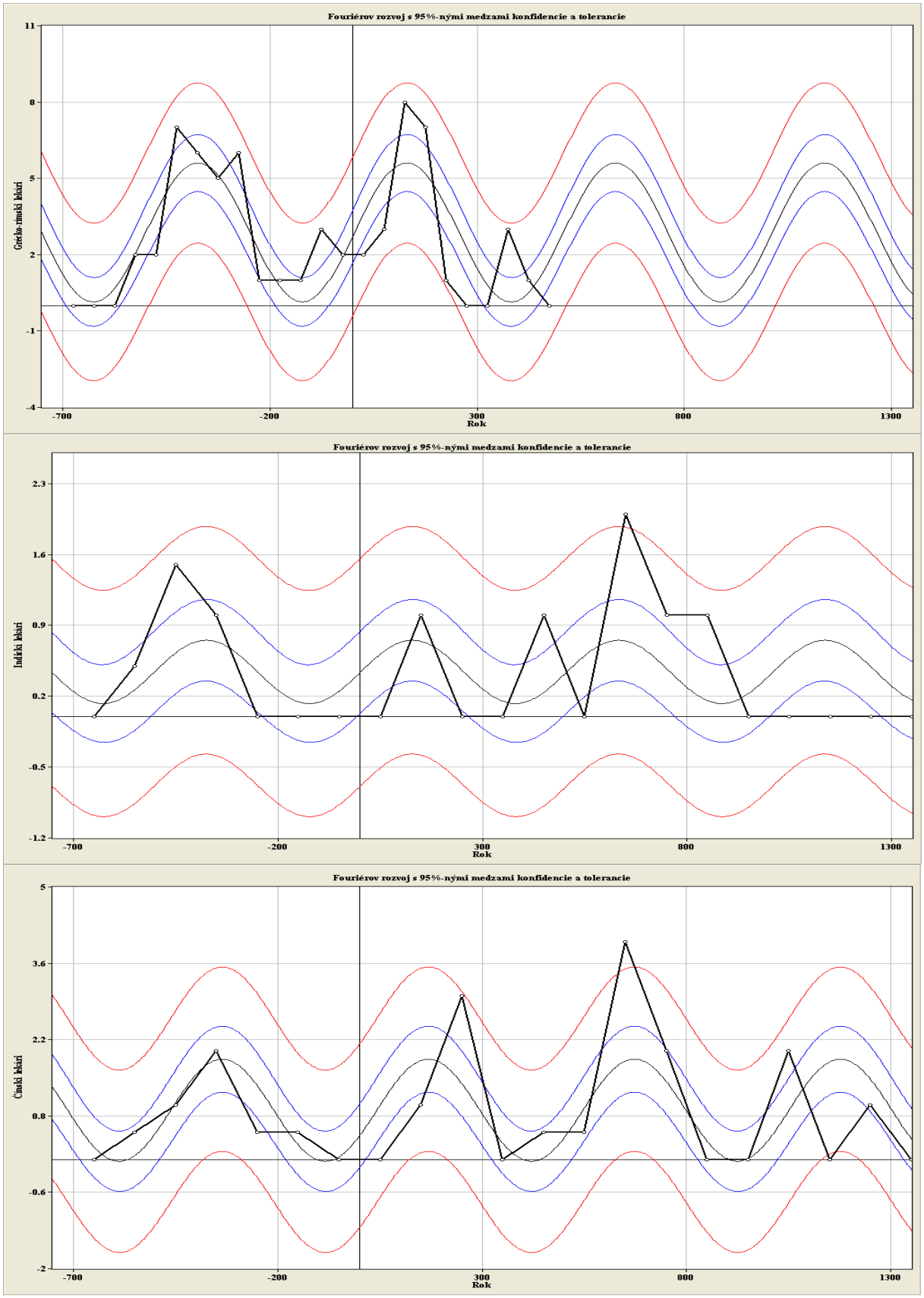

Fig. 2.: Chronograms of the half-century and century frequencies of famous physicians in the history of Greece & Rome (above), India (in the middle) and China (below). On the horizontal axis is time from 700 B.C. to 1300 A.D. On the vertical axis is the score of creative activity in medicine. Besides the data (broken line with the dots) the periodic approximation function (middle sinusoid) with its 95% confidence (narrower) and 95% tolerance (broader) corridors is shown. Note that the rhythms of all three approximation functions are nearly exactly synchronous.