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Knowledge of the Heart in the Earliest Literate Cultures

Abstract

Several ancient civilizations assigned a special status to the heart. It is nonetheless difficult to ascertain what was known of cardiac anatomy and function because the surviving artefacts are an incomplete representation of what the ancients knew.

Cuneiform is one of the world's oldest writing systems and it is based in part on logograms that resemble their referents and seem to depict actual objects and entities. Here, we discuss the intentional similarity between one form of the cuneiform sign ŠA₃, which was written as a rhombus with four equal compartments, and the four-chambered heart in mammals.

As references for our analysis, we review that anatomy can be the basis of early writing in ancient Chinese and that some detailed knowledge of the heart existed in ancient Egypt and pre-conquest Mesoamerica.

Translations of ancient cuneiform writing from Mesopotamia reveal quite detailed anatomical knowledge of sheep entrails, as the appearance of these entrails was interpreted as omens. Concerning sheep's heart, numerous terms were in use, but their anatomical meanings are largely obscure.

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The human heart, in contrast, was referred to by one term as a single entity. For a period around 2000 BCE the sign ŠA₃ was written as a rhombus with four compartments and it is regularly interpreted and translated as “heart”. In its full history, however, neither the form of the cuneiform sign ŠA₃ nor its related terms in both the Sumerian and Akkadian languages was restricted to the interpretation “heart”. We conclude ancient Mesopotamian scribes and specialists could have recognized the similarity between ŠA₃ and the heart, while there is currently no proof that ŠA₃ was meant to represent this organ.

Keywords: *ancient civilization, Mesopotamia, cuneiform, anatomy, ŠA₃, heart, history of medicine, Sumerian, Akkadian*

Wiedza o sercu w najwcześniejszych kulturach piśmiennych

Abstrakt

Kilka starożytnych cywilizacji przypisywało sercu szczególny status. Niemniej jednak trudno ustalić, co wiadano o anatomii i funkcji serca, ponieważ zachowane artefakty stanowią niepełne odzwierciedlenie wiedzy starożytnych.

Pismo klinowe jest jednym z najstarszych systemów pisma na świecie i opiera się częściowo na logogramach, które przypominają swoje desygnaty i zdają się przedstawiać rzeczywiste przedmioty i byty.

W niniejszym artykule omawiamy celowe podobieństwo między jedną z form znaku klinowego ŠA₃, który był zapisywany jako romb z czterema równymi komorami, a czterokomorowym sercem u ssaków.

Jako punkt odniesienia w naszej analizie wskazujemy, że anatomia może być podstawą wczesnego pisma w starożytnym języku chińskim oraz że pewna szczegółowa wiedza o sercu istniała w starożytnym Egipcie i Mezoameryce przed jej podbojem.

Tłumaczenie starożytnego pisma klinowego z Mezopotamii ujawnia dość szczegółową wiedzę anatomiczną o wnętrznościach owiec, ponieważ wygląd tych wnętrzności interpretowano jako znaki wróżebne. W odniesieniu do serca owcy używano wielu terminów, ale ich anatomiczne znaczenie jest w dużej mierze niejasne.

Z kolei ludzkie serce było określane jednym terminem jako pojedyncza jednostka. W okresie około 2000 r. p.n.e., znak ŠA₃ zapisywano jako romb z czterema komorami i jest on regularnie interpretowany i tłumaczony jako „serce”. Jednakże w całej jego historii ani forma znaku klinowego ŠA₃, ani powiązane z nim terminy, zarówno w języku sumeryjskim, jak i akadyjskim, nie ograniczały się do interpretacji „serce”. Wnioskujemy, że starożytni skrybowie i specjaliści z Mezopotamii mogli dostrzec podobieństwo między ŠA₃ a sercem, podczas gdy obecnie nie ma dowodów na to, że ŠA₃ miał reprezentować ten narząd.

Słowa kluczowe: *starożytna cywilizacja, Mezopotamia, pismo klinowe, anatomia, ŠA₃, serce, historia medycyny, język sumeryjski, język akadyjski*

1. Introduction

Our ancient ancestors may have recognized the heart as a distinct entity with a particular position in the body. For example, several scholars interpret the presence of a paleolithic blotch of ochre within the chest-region of a line-drawn mammoth in Pindal cave in Spain as the earliest human depiction of the heart, drawn at least 17.000 years ago (e.g. Bendersky 1997; Young 2003; Figueredo 2021). For millennia before the earliest known writing, people had (orally) transmitted notions of cardiac anatomy and function (Sheridan 2023, p. 2). Either way, we can presume that the heart was seen and likely consumed by pre-historic hunter-gatherers who preyed on large mammals and birds (Galetti *et al.* 2018). These animals have a four-chambered heart which is big – it constitutes 0.5–1% of the

relevant body mass¹ – and it is surrounded by lung tissue with a very different texture, weight, and color (Crile, Quiring 1940; Seymour, Blaylock 2000; Poelmann, Gittenberger-de Groot 2019). For ancient humans, the heart in large mammals would have been readily distinct from other organs.

Knowledge of the heart could have developed in large populations with vocational specializations related to butchering and ritual ceremonies, such as those found in urban centers some 5000 years ago around the Nile and the Indus, as well as in Mesopotamia and China (Zysk 1986; Englehardt *et al.* 2020; Xia *et al.* 2024). The information at our disposal for reconstructing these early historical cultures varies greatly and very little is known of other ancient cultures, such as those responsible for the “mega-cities” of Nebelivka and Maidanetske in present-day Ukraine (Videiko 2022; Gaydarska *et al.* 2023). When enough texts and artefacts do survive, they generally suggest that ancient cultures recognized the heart as an anatomical organ (Figueredo 2021).

Ancient knowledge of the heart can be examined within four literate cultures, in which writing was invented autonomously, and in which medium-sized to large mammals were either hunted or domesticated. These civilizations are: Mesopotamia, around 3200 BCE (Cooper 2004); Egypt, around 3200 BCE; China, around 1200 BCE (Xia *et al.* 2024); and Mesoamerica, around 500 BCE (Englehardt *et al.* 2020). The four ancient cultures have a distinctiveness and richness that suggests their knowledge of the heart was developed autonomously.

Our primary aim in the present manuscript is to present a graphical similarity between the Mesopotamian cuneiform sign ŠA₃, which can be translated as ‘heart’, and the anatomy of the heart. Specifically, the cuneiform sign ŠA₃ could be written as a rhombus divided into four parts, and there are four chambers in the heart of mammals, including humans. This is suggestive of ancient knowledge of the anatomy of the heart, though as our research shows, this interpretation is ambiguous in its ancient context. While the design of ŠA₃ with four compartments was in use for a long time, the sign eventually changed to designs with little resemblance to the heart. Also, the semantic meaning of the cuneiform sign ŠA₃ encapsulated in Sumerian (/sha(g)/) and Akkadian (*libbu(m)*) often is translated as ‘heart’ but it also has more meanings including ‘under-belly’.² Our objective, then, is to discuss the possible intentional graphical correspondence between the cuneiform sign ŠA₃ and the four chambers of the heart. To establish what is plausible to have been known for an ancient people, we briefly review what previous research has shown other ancient cultures may have known of the heart, in ancient Mesoamerica, China, and Egypt (Roberts *et al.* 2019; Figueredo 2021; Zampieri *et al.* 2023). The purpose of this survey of knowledge of the heart is to offer examples of early anatomical knowledge, and not to suggest contact between the diverse cultures from which the knowledge originates.

2. Pre-conquest Mesoamerica

Aztec human heart sacrifice is famous and infamous through first- and second-hand European accounts from the time of conquest, around 1500 AD. Notwithstanding the colonizers may have inflated the scale of sacrifices and unwittingly mistaken some native capital punishment for sacrifice, ritual human heart and blood sacrifice did occur (Jansen, Jiménez 2022). Spanish eyewitnesses relay how swiftly the executioner would open the body, extract the beating heart – typically with cuts through the soft tissues just below the ribcage – and from there spread blood on sculptures of deities (Tiesler, Olivier 2020); executioners had precise knowledge of some human gross anatomy. Besides knowledge through sacrifice, there was the vocational title of ‘ticitl’ that has been interpreted as a medical specialist, and it is believed that books dealing with ritual healing were among the

¹ For a mammoth, this could translate into a heart that weighed 20 kg or more.

² Meanings of *libbu(m)*, which is an Akkadian word represented by the logogram ŠA₃, are multifold, and they include “heart, abdomen, entrails, womb, inside, mind, thought” and many more (CAD L, pp. 164–175).

enormous amount of lost native manuscripts (Boone 2008). What was actually known of the heart, however, is difficult to establish.

Ancient Mesoamerican illustrations and sculptures that refer to the heart, such as from Mayan, Mixtec, and Teotihuacan cultures, have a consistency in detail of naturalistic, stylized, and abstract elements (Robicsek, Hales 1984; Helmke, Nielsen 2011). Perhaps most revealing is an approximately 3000 years old effigy from the Olmecs, or ‘mother-culture’ of the Mesoamerican cultures (Diehl 2004, pp. 11–12, 165). Here, the presence of detailed knowledge of the overall structure of the heart can be inferred (Fig. 1). The effigy shows a man holding an oversized heart which is executed with such finesse that one can recognize the left and right ventricle, as well as the left and right atrium (Bendersky 1997). In the well-informed interpretation of Phoon (1998), the effigy also quite accurately displays the atrioventricular sulcus, the anterior-superior interventricular sulcus, and the aorta and the left and right pulmonary artery (Phoon 1998). Nonetheless, for all we know the artist may have been ignorant of the heart’s cavities. In the much younger illustrations, the heart is typically abstract and much simplified, as for example seen on Teotihuacan murals and in Mixtec picture manuscripts (Fig. 1; Helmke, Nielsen 2011; Jansen, Jiménez 2011).

From ancient Mesoamerica, no formal textual knowledge on structures of the heart survive, if it ever existed, but the heart was certainly recognized as an organ. Also, fairly big animals with four-chambered hearts were hunted or domesticated, including deer, rabbit, dog, large cats, monkeys, and turkey. Presumably, their hearts were observed and handled. On the basis of the available evidence, it is possible that native Mesoamericans knew of the human heart and its constitutive four chambers and major arteries for more than two and a half millennia.

Olmec effigy of man holding a heart (~1.000 BCE)



The heart of the Mixtec people is consulted in a cave



Fig. 1. Depictions of the heart from pre-Columbian Mesoamerica.

3. Ancient China

Ancient Chinese knowledge of organs and their function is perhaps best known through the treatise known as “The yellow Emperor’s inner canon of medicine” (Loukas *et al.* 2010). It expresses a complex system of correspondence between anatomy, inferred functions, and powers affecting organs and disease. There are rudimentary notions of the circulation of blood which precede the much later comprehensive investigations of William Harvey in his landmark book from 1628, known in shorthand as ‘*De motu cordis*’ (Loukas *et al.* 2016). The ancient categorization of solid organs as “zangs” (the yin) and hollow organs as “fus” (the yang) survives to this day although it is not broadly implemented in current medicine (Loukas *et al.* 2010). Accordingly, there is continuous

discussion, if not controversy, about the extent to which this ancient knowledge can be considered correct in the context of modern medicine (Xia *et al.* 2024).

Recently, Xia *et al.* (2024) showcased convincingly how anatomy can be at the root of logograms in the earliest Chinese writing carved into so-called oracle bones some 3000 years ago. The meaning of the character *xìn*, for example, relates to head and it has a straight-forward resemblance to the neonatal calvaria's superior surface which is dominated by four bones joined by the cross-shaped anterior fontanelle (Fig. 2). A preprint by Tan *et al.* (2022) reproduces a number of ancient illustrations of this kind.

Xia and colleagues (2024) made a purely graphical interpretation of the word *xīn*, meaning heart. They suggest that an early form of the sign depicts the left atrium, the left atrioventricular valve, and the left ventricle (Fig. 2). The authors, however, do not discuss other plausible ways in which the sign could depict cardiac anatomy; there is a straight-forward resemblance of *xīn* on oracle bone to the superficial frontal appearance of the heart. In this alternative interpretation, the structure represented by the two 'valve' lines according to Xia and colleagues is perhaps more likely to reflect the superficially visible atrioventricular sulcus (Fig. 2). The heart then may have been seen as a single entity, or just 'heart', albeit with two lobes (i.e. the two atrial appendages). Regardless of the interpretation, the heart seems to have been known as a distinct structure some 3000 years ago in ancient China and the sign *xīn* appears to present parts of its anatomy.

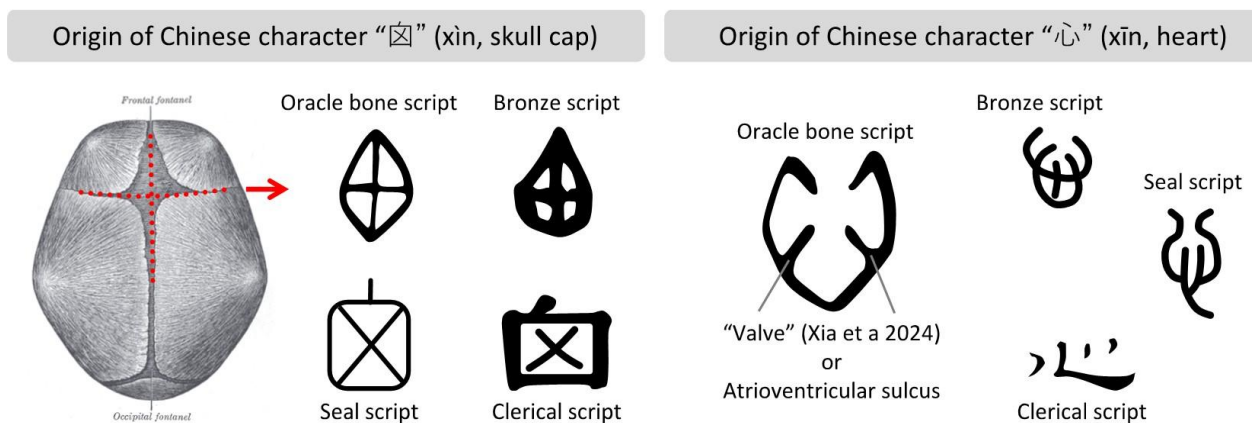


Fig. 2. Anatomical basis for early Chinese logograms and later written characters.

4. Ancient Egypt

The best attested deep historical knowledge of the heart comes from ancient Egypt. Two primary words are used, of which *ib* is earlier and is translated as “heart, mind, understanding, intelligence, will, desire, mood” (Kahl 2004, p. 19; Faulkner 1962, pp. 14–15; Erman, Grapow 1926, pp. 59–60). Later texts also use *h3ty* (Faulkner 1962, p. 160; Grapow 1954, pp. 61–72; Erman, Grapow 1929, pp. 26–27). Both terms designate the physical organ, though also the seat of thought and emotions as well as a center in general (Nyord 2009, pp. 55–126; Ritner 2006, p. 100 note 10; Ziskind, Halioua 2004). The writing of ‘heart’ was by the use of a logogram or a short series of hieroglyphs with phonetic readings followed by a logogram (Roberts *et al.* 2019), and *ib* and *h3ty* occasionally occur side by side as if designating different parts of the body (Erman, Grapow 1929, p. 27).

The logogram itself could be depicted stylistically minimalistic, although it could also occur in a more elaborate manner (Fig. 3). In the first case, the sign looks almost like a jar, and it cannot be excluded that its early meaning as “center” might have been intended somehow in its visualization (see Kahl 2004, p. 19). In the latter instances, it appears to illustrate an upright ovale with

approximately eight vessels attaching to its top and sides. If the major vessels of the normal human heart are summed, namely the two caval veins, the four pulmonary veins, the pulmonary trunk, and the aorta, they make eight vessels in total (Ziskind, Halioua 2004). In addition, in some representations of this logogram, lines within the central ovale are positioned such they are suggestive of the position of the ventricular septum and the atrioventricular sulcus (Fig. 3). There are, however, no unambiguous records from ancient Egypt on any specific structure of the heart (Roberts *et al.* 2019).

Although many Egyptian hieroglyphs convey a meaning that is different from what is visualized, this ancient hieroglyphic logogram of the heart is a case for a logogram with a direct correspondence between the illustration and at least one of its meanings. The ancient Egyptians would have had concrete knowledge concerning the physical shape of the human heart from the use of a specialized mummification process, during which the heart was removed. This method was established at an early point in their culture (Ikram 2010, p. 2).

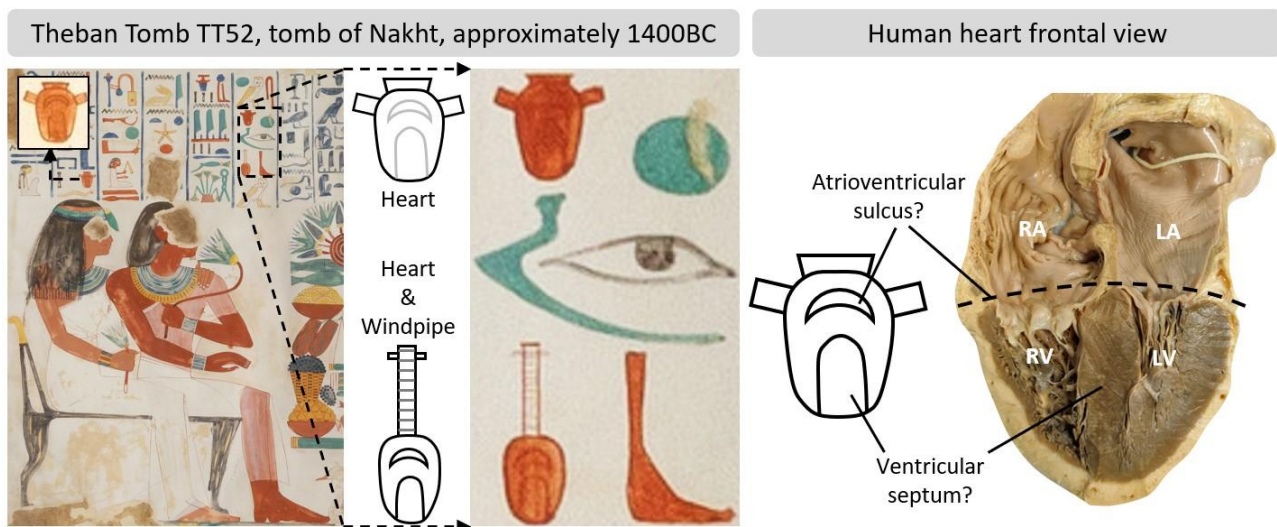


Fig. 3. Writing in ancient Egypt included anatomically informed logograms, including of the respiratory system and the heart.

As in the case of the ancient Mesoamericans and Chinese cultures, it seems plausible to suggest – albeit difficult to verify – that knowledge of structures of the heart existed among ancient Egyptians.

Regular cultural contact existed between ancient Egypt and Mesopotamia, as well as other regions. Though this contact may have been established already in the 4th millennium BCE (Joffe 2000), at the time when the cuneiform sign ŠA₃ is first attested, such contact was pronounced in the second half of the 2nd millennium BCE, also known as the Late Bronze Age. On the basis of a substantial political correspondence between state leaders dated to the 14th century BCE, discovered at Tell el-Amarna in Egypt, we know a fair deal about the exchange of, e.g., medical specialists in the brief period the archive spans (see Rainey 2014). At this time scholarly knowledge, including medical information, was transmitted over large geographical areas, along with the relevant specialists (Heeßel 2009; see Arbøll 2023, pp. 60–61). The exact impact these developments had on local medical knowledge and practice is the subject of ongoing research, but we can presume some practical knowledge was absorbed by local specialists when considered useful or otherwise relevant.³

³ This period post-dates the early form of the cuneiform sign ŠA₃, which may – or may not – have resembled a heart.

5. Ancient Mesopotamia

The history of the cuneiform sign ŠA₃ shows a development in its graphical representation and associated meanings in the Sumerian and Akkadian languages. Starting in the late 4th millennium BCE, the sign ŠA₃ was used to cover animals or products derived from these as well as non-animalistic commodities, objects, and titles (Falkenstein 1936, no. 748; Green, Nissen 1987, p. 280; Englund, Nissen 1993, pp. 289–290). ŠA₃ did not obviously depict a heart at this point (Fig. 4), and it had several diverse forms with significant variation (Falkenstein 1936, no. 748; Green and Nissen 1987, p. 280; Englund, Nissen 1993, pp. 289–290). It is possible that some of these forms were meant to represent the underbelly of an animal. There were three primary phonetic readings to ŠA₃, the older /sha/ and the later /lib/ or /lip/ (Borger 2010, pp. 165, 383–384). The older pronunciation also gave name to the sign itself on the basis of its reading in the ancient language Sumerian as /sha/ or /shag/. In Sumerian, the sign can be translated as “inner body, womb, belly, intestines, heart, in, inside, center, interior, middle” (ePSD2: šag). The later Akkadian phonetic readings /lib/ or /lip/, however, originated in the primary meaning of the logographic reading of ŠA₃ in the Akkadian language, namely the word *libbu(m)*. This term was regularly written ŠA₃-bi, possibly read *lib-bi*. The word could be used in various contexts to designate the “heart, abdomen, entrails, womb, inside, mind” (CAD L, pp. 164–176). Therefore, the term was related to anatomical regions in the body, and it could represent the seat of emotions (Böck 2009, p. 287). Yet, lexical material may not explicitly mention the sign. For example, a list of human body parts, known as Ugumu and transmitted in various forms in the early 2nd millennium BCE, does not appear to explicitly mention the heart (cf. DCCLT: OB Ugumu Varia; Westenholz, Sigrist 2008, p. 222).

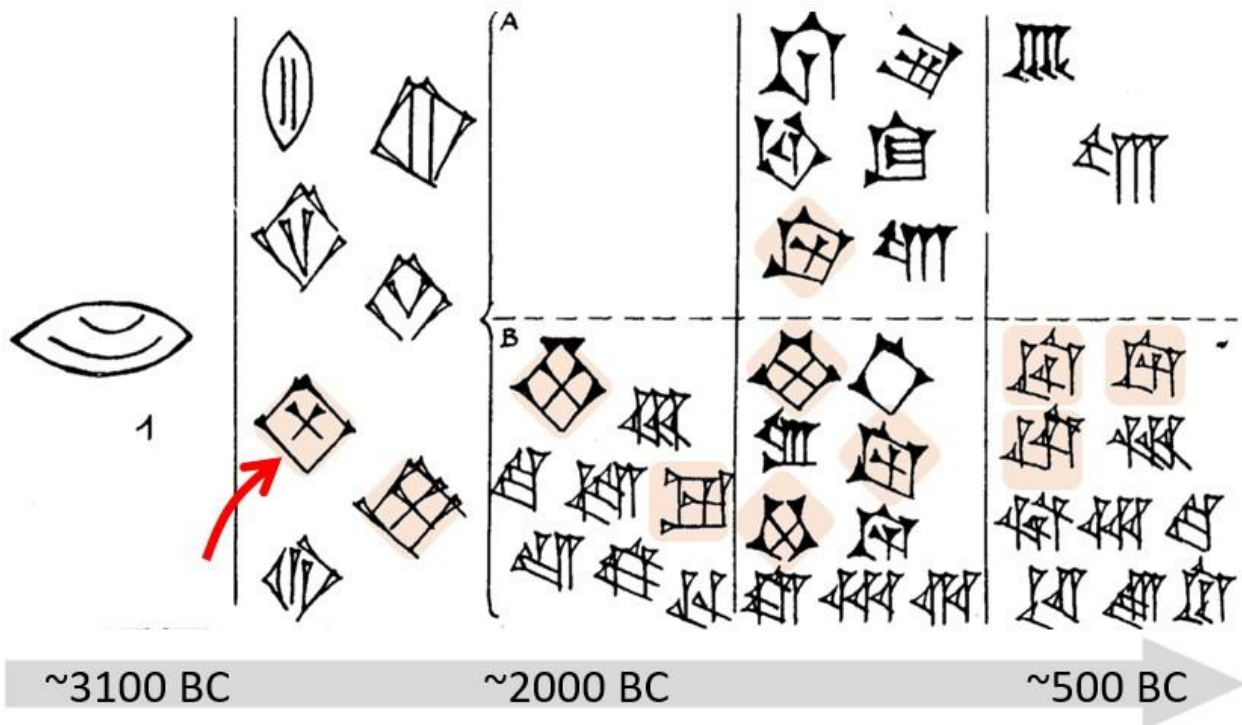


Fig. 4. Simplified overview of the chronological development of the cuneiform sign ŠA₃, adapted from (Labat 1995).

Regardless of the semantic nuances inherent in the cuneiform sign ŠA₃, people in ancient Mesopotamia had knowledge of organ anatomy, likely acquired through the butchering and sacrifice

of animals such as goats, sheep, pigs, and various birds. Perhaps the most visually striking evidence of such knowledge is the anatomically accurate clay models representing sheep organs, most frequently of the liver, but also of the intestines, lungs, and kidneys (Fig. 5). The modelled organs were designed for understanding omens, namely extispicy, also known as interpretation of liver or entrails of sacrificed sheep. Extispicy was a formalized procedure where a specialist performed a ritual to obtain a positive or negative answer from the gods.⁴ To this end omens were observed in the form of significant features in the tissue, which were believed to have been written therein by the divine. The clay model illustrated in Fig. 5 was designed to explain various zones of the tissue for reading omens of the sheep liver. While several liver models exist, no models of the heart have ever been found, to the best of our knowledge.⁵ The oldest group of clay liver models originate in the western Syrian city Mari and can be dated to the 19th or 20th century BCE (Koch 2015, p. 70) and liver omen traditions may find their orally transmitted roots at some point in the 3rd millennium BCE (Koch-Westenholz 2000, pp. 11–15).⁶



Fig. 5. Clay model of a sheep's liver with marked zones for ancient omen interpretation and cuneiform writing, dated to 1800–1595 BCE.

Most of what we know of Mesopotamian extispicy comes from an extensive corpus of cuneiform writing on clay tablets from the turn of the 2nd millennium BCE onwards. These are texts in the Akkadian language, which also mention the heart at times. The heart's importance for extispicy was much less than that of the liver (Starr 1990, p. XXXIX). Concerning the heart of sheep

⁴ See Koch 2015 with further references.

⁵ It should be noted that the model CTN 4 no. 60 contains an illustration of the heart in relation to the lungs.

⁶ See Richardson 2006 for a late 3rd millennium BCE reference to possible collections of omens.

specifically, several terms were in use, which have been interpreted by Assyriologists, e.g., “the rear of the heart” (*warkat libbim*), “above the heart” (*elēnum libbim*), “the joint of the heart” (*kisir libbim*), “the thick part of the heart” (*kubur libbim*), “the middle of the heart” (*qabliat libbim*), “the right side of the heart” (*imitti libbim*), “pericardium” (*šaman libbim*), “the fortress of the heart” (*dūr libbim*), and “the apex of the heart” (*rēš libbim*) (Jeyes 1989, pp. 77–78). The ambiguity inherent in some words should be noted, as, e.g., *tal libbim* refers to “the lintel of the entrails”, i.e. the diaphragm, and *reš libbim* in other contexts refer to the epigastrium (Jeyes 1989, p. 77). Accordingly, *libbum* did not solely designate “heart” in all contexts, not even in extispicy (CAD L, pp. 164–175). It should be noted that the possible diffusion of such concrete anatomical knowledge to specialists outside the omen specialists’ profession is a matter of ongoing scholarly debate.

Besides texts explicitly relating to extispicy, Mesopotamian cultures also left behind an abundance of medical texts. The so-called Nineveh Medical Encyclopedia mentions *libbum* in some context where it is interpreted by researchers as “heart”, e.g., “his *libbum* is fearful / restless / upset” (e.g., Al-Rashid 2014, pp. 173, 192), but in other contexts *libbum* clearly refers to the insides (regularly marking the word in the plural), or to parts of the abdomen like the *rēš libbim* to the “epigastrium” (Scurlock 2014, pp. 77, 80, 97, 113, 189, 201, 203). At the same time, the human heart appears to be described primarily by *libbu(m)* (see Geller 2007). Also, many texts that mention ŠA₃/*libbu(m)* largely did not concern the heart as an organ, but focused on the abdomen and the gastrointestinal tract, as well as mental alterations, such as a condition translated as “heartbreak” (Böck 2014, pp. 111–119; Al-Rashid 2022, pp. 30, 38–48; cf. Scurlock and Andersen 2005, pp. 166–169). In terms of function, there were vague notions about the heartbeat and pulse and there are ambiguous descriptions possibly linking the heart with the heartbeat in some texts from especially the first millennium BCE (Attia 2022, pp. 28–31). We will later in the article consider references in literary texts, which offer some promising interpretations of the cuneiform sign ŠA₃ and its meanings in Sumerian and Akkadian as the anatomical heart.

There is a temptation to extrapolate ancient knowledge of the heart from the translated cardiac terms so close to terminology of modern cardiology, including “base” and “apex” (Zampieri *et al.* 2023). The Mesopotamian term “right side of the heart” is so familiar in cardiology that one almost forgets to consider the apparent absence of the antonym (which would be “left side of the heart”). However, to the ancient Mesopotamians, some of these terms signified markings made on the entrails pressing against the liver in a way that is different from that of modern anatomy (Koch 2015, p. 79), and extispicy texts were also focused on recording holes made by parasites (Koch-Westenholz 2000, pp. 65–66, 70). While it is conceivable that the ancient Mesopotamians knew of the four chambers of the heart, the evidence we have considered so far does not give indications thereof.

Ambiguities aside, ŠA₃/*libbu* could certainly refer to the heart in animals and likely also the human heart (e.g., Couto Ferreira 2009, pp. 265–266). In the following, two examples are presented to illustrate how far back the notion of the heart may be traced in general scribal contexts:

(1) In a tale of the Sumerian king Lugalbanda that is dated to the end of the 3rd millennium BCE, he dreams he wrestles a wild bull to the ground and tears out its heart before presenting it to the sun: “Like an athlete he chased after the red bull, the bull of the mountains, like a wrestler he subdued it. He tore out its heart, he set it before the rising sun” (George 2003, p. 476 and n. 112; cf. Vanstiphout 2003, pp. 122–123: “Like a *bullfighter* he must take on the brown buffalo, the highland buffalo; like a wrestler he must subdue it. Its strength will leave it. When he sacrifices it before the rising Sun ...”). The concept was written with the sign LIPIS̄, translated as “inner body, heart” among other nuances. Though the exact meaning here can also be a transferred meaning such as “its strength will leave it” (*ibidem*).

(2) In the Gilgamesh epic, in the recension dated to the late 2nd or first millennium BCE, Gilgamesh touches the body of his deceased friend Enkidu: “He felt his *heart*, but it was not beating anymore”

(George 2003, pp. 654–655 tablet VIII line 58). In this instance, it is almost impossible that the term *libbu* should refer to the stomach or abdomen in general, as it is difficult to correlate with a verb designating clear movement, i.e., “to beat, throb” (*nakādu*, see CAD N/1, pp. 153–154), though it cannot be excluded that one might translate the sentence in a less clear manner.

The cuneiform texts that mention the insides of the body could use a sign, ŠA₃. It is in various periods written as a rhombus divided into four compartments by two orthogonal lines (Fig. 6). There is then a graphical semblance between the sign and the four chambers of the heart, and it is tempting to regard ŠA₃ as an intentional depiction of these parts. This proposition is partly motivated by the observation that cuneiform writing was largely logographic when it emerged around 3200 BCE (Cooper 2004). At this time signs provided schematic visual representations, for example of fish, ox, and grain (Englund 1998; see recently Kelley *et al.* 2025 for a new perspective on the origins of cuneiform writing). Later, the use of signs became more sophisticated by the addition of phonographic values, i.e. signs representing sounds of syllables, and they could now be use as determinatives meant to designate objects, places, and gods (e.g., Crisostomo 2019, p. 24, 142). This transition coincided with a graphical change of the earlier curved drawings to more linear and abstract combinations of impressed wedges (see Labat 1995). Elsewhere, as discussed above, Chinese script underwent a similar transformation (Fig. 2). With time, ŠA₃ also could be written with an abstract design, but the highlighted signs in Fig. 6 document a long use of ŠA₃ written as having four compartments (Labat 1995, pp. 176–179; Gelb 1961, p. 231; Mittermayer 2006, pp. 172–173). Noticeably, this was not the case at the inception of the sign in the late 4th millennium BCE.

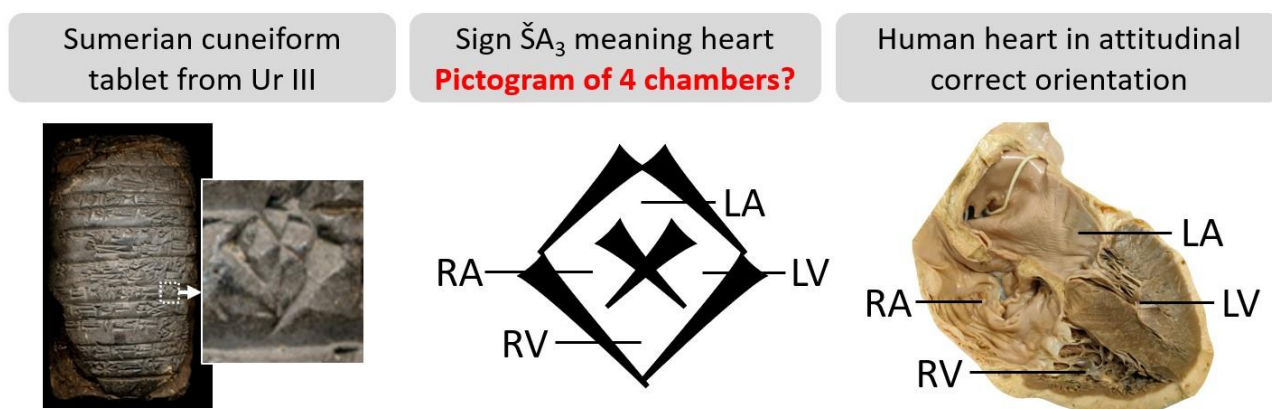


Fig. 6. Ancient cuneiform text and the sign ŠA₃, which could be used to signify the insides and the heart.

That the words ŠA₃/*libbu* refers to the heart is a necessary condition for the sign being a logogram of the heart, but in a critical assessment of our hypothesis one can also question whether the design of the cuneiform sign ŠA₃ with four compartments is optimized for illustrating the heart. In the heart, the point of the heart – the apex – is divided by the ventricular septum. Inside the frame of the cuneiform sign ŠA₃, two dividers extend to the four sides of the frame rather than to any corner, or apex. If the dividers are rotated 45 degrees counter-clockwise they extend to the corners of the frame and this configuration resembles more the heart of animals such as pig, sheep, ox, deer, dog, lion, chicken, and duck (Fig. 7; Rowlatt 1990; Crick *et al.* 1998; Macías *et al.* 2022). This modernly adapted form did not exist in ancient times. In the intact thorax of human, the heart’s apex is pointing to the left and the right ventricle free wall is mostly parallel to the diaphragm (Crick *et al.* 1998). This setting can be approximated if the adapted cuneiform sign ŠA₃ is rotated 45 degrees counter-clockwise (Fig. 7). Most likely, however, to appreciate this orientation the ancient specialists would have had to view the heart while it was situated in the thoracic cavity, and human autopsies were not

performed in Mesopotamia (Arbøll 2021, p. 61). Either way, it would have been within the capabilities of a Mesopotamian writer to imprint the wedges of the cuneiform sign ŠA₃ such that it gave a better presentation of cardiac anatomy.

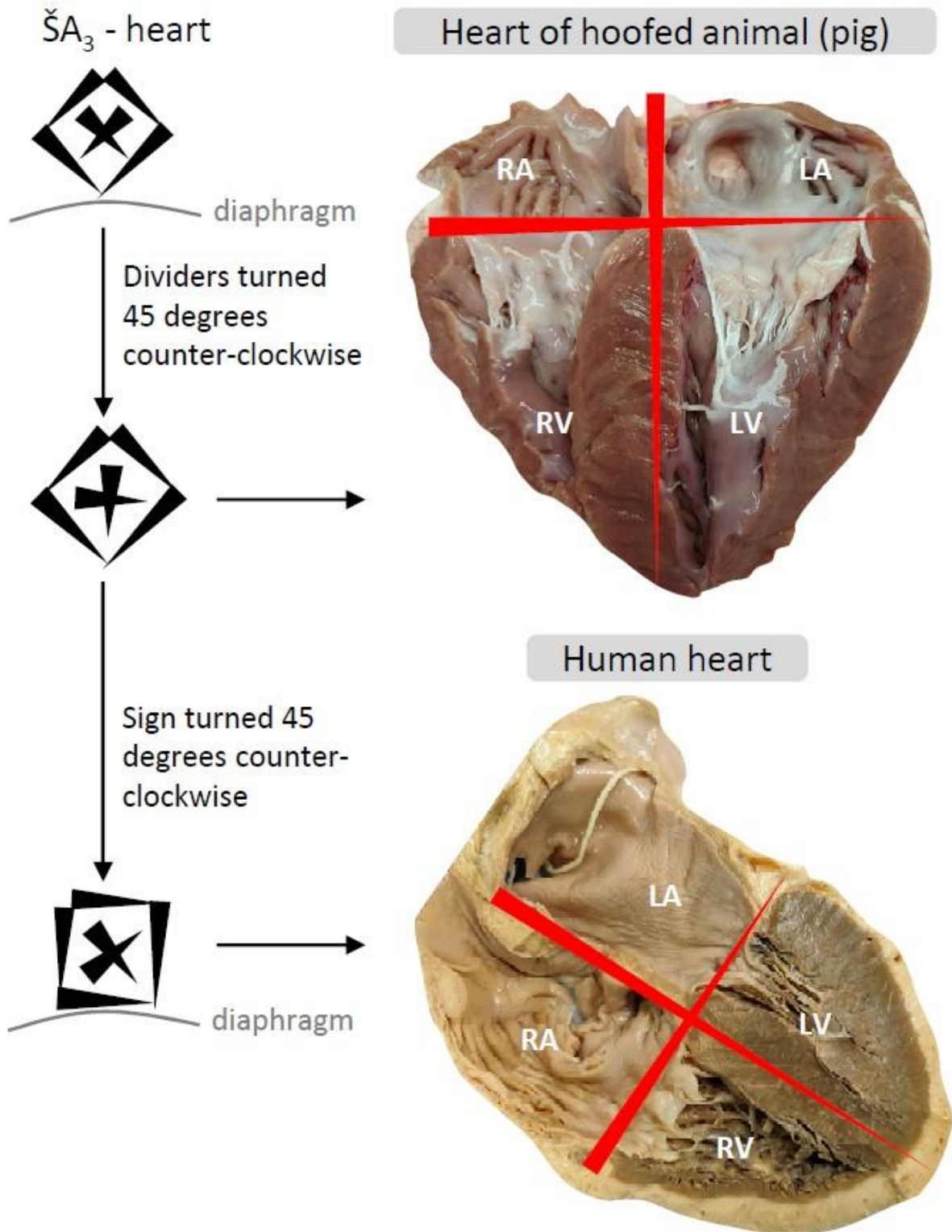


Fig. 7. Modern adaptations to ŠA₃ such that it represents better the actual cardiac anatomy.

6. Synthesis

Purely graphical analyses in previous publications have proposed that cardiac anatomy is presented in Egyptian hieroglyphs and Chinese oracle bone writing. In this manuscript we have discussed whether the same can be said of Mesopotamian cuneiform writing. As shown, the case is ambiguous, and we have presented arguments for and against the proposition.

That the heart can be understood to comprise four chambers may have been recognized already in ancient civilizations in Mesoamerica approximately 3000 years ago, while in contemporary Egypt and China the heart was perhaps seen as a solitary entity. In ancient Mesopotamia, the four compartments of the cuneiform sign ŠA₃ could suggest the recognition of four chambers to the heart in some periods. While the expansive vocabulary pertaining to the heart of sheep is suggestive of detailed anatomical knowledge, it is perhaps more likely to reflect concepts related to extispicy rather than having a one-to-one correspondence with modern anatomy. When exactly the cuneiform sign ŠA₃ came to designate the heart as a physical organ is still uncertain, though it is possible this occurred in the 3rd millennium BCE. During this process, perhaps the increasingly standardized shapes of the cuneiform sign ŠA₃ coalesced with its meaning of the heart.

One question that remains, is whether the scribes who wrote the cuneiform sign ŠA₃ had access to relevant anatomical knowledge? In the 3rd millennium BCE this seems unlikely (see Veldhuis 2011, pp. 72–73), as the majority of individuals with a working knowledge of the body, such as butchers or healers, are largely assumed to have been illiterate. Moving into the early 2nd millennium BCE, however, it is clear that various specialists were involved in writing. For example, either the omen specialists themselves, or scribes taking notes, were engaged in formulating omen reports concerning the appearance of the organs of sacrificial animals, including the heart (Koch-Westenholz 2002, p. 131 note 6; Starr 1975, pp. 242–243). In later periods various specialist professions with diverse anatomical knowledge were definitely literate (see Koch 2015). Perhaps they appreciated the semblance of the four compartments in the cuneiform sign ŠA₃ and the four chambers of the heart. On balance, nonetheless, we assess that the cuneiform sign ŠA₃ was not designed at its origins, nor intentionally modified in later periods, to illustrate the physical heart.

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List of illustrations

Figure 1. Depictions of the heart from pre-Columbian Mesoamerica. An 11 cm high ceramic effigy of man holding a four-chambered heart. Photo by Justin Kerr. URL: https://research.mayavase.com/portfolio_hires.php?search=&date_added=&image=6042&display=8. (Accessed 03/07/2026). Mixtec writing including a stylized heart, showing “Lord 2 Rain ‘Twenty Jaguars’ (Ocoñaña)” consulting the Heart of the Mixtec People in a cave (Jansen and Pérez Jiménez 2011: 305). Adapted from Codex Añute, p. 6–II (Bodleian Library MS. Arch. Selden. A. 2). Ao, aorta; LA, left atrium; LP, left pulmonary artery; LV, left ventricle; RA, right atrium; RP, right pulmonary artery; RV, right ventricle.

Figure 2. Anatomical basis for early Chinese pictograms and later written characters. Oracle bone script is approximately 3000 years old. While the oracle bone heart character has been interpreted by Xia and colleagues as showing an atrioventricular valve, the character may just as well be a superficial representation of the heart. The image of the neonatal skull cap is adapted from *Wikipedia* (URL: <https://upload.wikimedia.org/wikipedia/commons/b/b3/Gray197.png>), the eight Chinese characters are redrawn from Xia *et al.* (2024).

Figure 3. Writing in ancient Egypt included anatomically informed logograms, including of the respiratory system and the heart. Logograms of the heart often comprise internal symbols exhibit substantial resemblance to the atrioventricular sulcus and the ventricular septum. LA, left atrium; LV, left ventricle; RA, right atrium; RV, right ventricle. Image of wall painting is adapted from image in Public Domain from The Met. (URL: <https://www.metmuseum.org/art/collection/search/548578> (accessed 03.07.2026)).

Figure 4. Simplified overview of the chronological development of the cuneiform sign ŠA₃, adapted from (Labat 1995). The red arrow indicates one of the earliest instances of ŠA₃ written with four compartments. The signs with a colored background are those that retains a strong resemblance to the early design.

Figure 5. Clay model of a sheep’s liver with marked zones for ancient omen interpretation and cuneiform writing, dated to 1800–1595 BCE. Museum number BM 92668. URL: https://www.britishmuseum.org/collection/object/W_1889-0426-238 (accessed 03.07.2026).

Figure 6. Ancient cuneiform text and the sign ŠA₃, which could be used to signify the insides and the heart. The sign could hypothetically be an abstract illustration of the heart with its four chambers. LA, left atrium; LV, left ventricle; RA, right atrium; RV, right ventricle. The photo of the tablet OIM A7885 is adapted from the Cuneiform Digital Library Initiative online (P145901).

Figure 7. Modern adaptations to ŠA₃ such that it represents better the actual cardiac anatomy.