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An investigation of the pharmacological applications used for the Ancient Egyptian systemic model ‘*ra-ib*’ compared with modern Traditional Chinese Medicine

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ABSTRACT

Ethnopharmacological relevance: Ancient Egyptian texts only offer glimpses into their conceptual understandings of the inner-body and illness manifestation. Explanations of how prescribed *materia medica* were believed to work are rare and obscure, often resulting in modern approximations for ancient terminology such as ‘*ra-ib*’—an ancient Egyptian classification predominantly translated as ‘stomach’—leading to misunderstandings of historical texts, and therefore their use of pharmacology.

Aim of the study: To investigate the *ra-ib* and the explanatory models of illness from the Egyptian perspective, and to explore the link between these and the prescribed selection of *materia medica*. To then compare the conceptual mechanics of these treatment strategies with those of another non-Western tradition—namely Traditional Chinese Medicine (TCM)—to provide further insight into potential conceptual frameworks.

Materials and methods: We conducted a case study of a unit of Ancient Egyptian texts focusing on the *ra-ib*. Totalling 34 prescriptions, the first stage lexicographically analysed the texts using cognitive linguistic and translation theories to produce our new understanding. This enabled our comparison of the mechanics of *materia medica* usage within these texts with those found in TCM outlined by the *Pharmacopoeia of the Peoples Republic of China 2015* for the relevant ingredients.

Results: the study demonstrated that—rather than denoting the organ ‘stomach’—*ra-ib* instead constitutes a system running from the mouth, downward to the anus. This is best translated as ‘inner thoroughfare’, and changes the way in which we attempt to understand potential motivations in the selection of ingredients. By exploring common themes in the use of eleven securely translated ingredients from the Egyptian corpus and the *Pharmacopoeia of the People’s Republic of China*—representing a modern traditional system which understands the body via a series of interconnected systems—we were able to highlight certain themes which might be ‘universal’ to system-based traditions; this provided new insights into the Egyptian motivations for treatment selection.

Conclusions: Having gained the ancient view of the body and illness, cultural comparisons are important for providing further potential insights and clarifications of a discontinued historical healing tradition. The new

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understanding of the *ra-ib* from our study greatly changes the way in which we understand the dynamics of Egyptian ethnopharmacological source material from this period.

1. Introduction

Healing practices from ancient Egypt are recorded in the native language on papyri and ostraca of varying sizes dating from as early as c. 1900 BCE and at least as late as c. 250 CE (SAE, 2019). Larger well-preserved papyri from the late-second millennium BCE—including the Ebers and Edwin Smith Papyri—have been published in many languages over the past century, primarily in English (Ebbell, 1937), German, and French (notable recent translations include Bardinnet, 1995 and Westendorf, 1999; for a complete catalogue and discussion of publications, see SAE, 2019). These publications have made the texts accessible to the wider scientific community – from these, studies have focused particular attention to clinical reasoning for the use of *materia medica* in Egyptian healing compendia, particularly from modern biomedical understandings of anatomy and physiology (Campbell, 2007, 2008; Aboelsoud, 2010). However, the ancient texts only offer glimpses into Egyptian understandings of inner-body mechanics and illness manifestation; explanations of how prescribed *materia medica* were believed to work are rare and obscure, presenting a significant challenge to ethnopharmacological research. In what ways can we re-access and understand the plethora of motivations for ancient treatment selections?

To explore this question, we conducted a case-study where we first re-translated and philologically examined a ‘series’ (a grouping of texts within a papyrus, linked by an overarching focus, such as a body-part – discussed in our materials and methods section) comprising thirty-three ancient Egyptian texts, to extract and understand Egyptian concepts of physiology, pathogenesis, and treatment strategy. Each text in this series focuses on the ancient ‘anatomical’ classification ‘*ra-ib*’ (𓂏𓂏𓂏, literally: ‘mouth of the heart’), a term primarily understood as denoting the ‘stomach’ in Egyptological scholarship (Ebbell, 1937; Westendorf, 1999; Radestock, 2015; Lalanne and Métra, 2017; the online SAE project provisionally maintains the *communis opinio*; SAE, 2019), despite two proposals for an adjustment of this translation (Bardinnet, 1995, who opted for a literal translation ‘*l’entrée de l’intérieur-ib*’; Walker, 1996, who ultimately translated ‘thorax’). As noted by Imhausen and Pommerening (2010), a literal translation could only make sense if the conceptual significance is correctly expounded in a commentary, whereas approximations using modern terminology are misleading as they do not adequately express the ‘Egyptian point of view’. This paper understands this ‘emic’ point of view of *ra-ib* and its relationship with ideas of pathogenesis as being crucial for questioning the potential motivations for ingredient selection in treatment strategies for the *ra-ib*.

Rather than understanding the term to represent the ‘stomach’ organ, we re-evaluated *ra-ib* as representing an interconnected organ ‘system’ (Marieb and Hoehn, 2015) based on the implications provided by the series of texts. Our study thus needed to address three central questions: 1) to where did the limits of this system extend, 2) how was it conceptualised, and 3) what influence did this system have on the selection of ingredients used to treat illnesses associated with it. It should be noted here that our answers to our first two questions were not obtained based on our comparison, but solely by our methods of Egyptological analysis outlined in the materials and methods section. That said, they are the basis for our comparison, and therefore need to be explained in detail. For the purpose of this introduction, the answer to our first question can be summarised as ‘a system running from mouth to anus’, or—as the term is translated here based on the Egyptian compound *ra-ib* itself—‘the inner thoroughfare’. However, as our results show, it was more diverse than the Western notion of a ‘digestive system’, as the *ra-ib* constituted an ancient Egyptian ‘explanatory model’ (Quinlan, 2015) used to explain a diverse range of clusters of symptoms, each being

unique to one particular text within the *ra-ib* series. This fact raised more questions concerning the potential motivations for the selection of treatment strategies, than it would were *ra-ib* to represent more reductionist classifications such as ‘stomach’ or ‘thorax’. The systemic nature of *ra-ib* provided a rationale for our ethnopharmacological comparison with the principle and application of Traditional Chinese Medicine (TCM), the results of which we present here.

Though it has been noted by Unschuld that ‘it is not possible to give a single definition of “traditional Chinese medicine” either in China or in the West’ (Unschuld, 2018, 142), TCM’s unique and recognisable general ideas of the body and health regulation, such as ‘theories about *qi*, a vital energy, which is said to flow along channels called meridians and help the body to maintain health’ remain central characteristics of its ‘different approach’ (Schroën et al., 2014; Cyranoski, 2018; here referred to as ‘perspective’, after Kuriyama, 2002). The *Pharmacopoeia of the People’s Republic of China* (PPRC)—the main point of reference of herbal drugs used according to TCM principles—references this unique perspective of the human body, for example where a plant’s ‘meridian tropism’ is listed (PPRC, 2015). Such an entry relies on the user’s acquaintance with TCM’s perspective that *qi*, meridians (better termed ‘conduits’, as the former is a ‘standard translation’ now considered ‘unsuitable and misguided’, Unschuld, 2018, 125), and ‘organ systems’ (Scheid, 2018) such as the ‘spleen-stomach system’, which is ‘not synonymous with the spleen in Western medicine anatomically’ (Wu, 1998; see also Rui-xin and Yue yun, 2019; Yuan and Xiaobei, 2020), are central to the objectives of physicians when they ‘*tong* in clinical practice’: “diffusing obstructions” (*xuan bi* 宣痹), “moving areas of stagnation” (*xing zhi* 行滞), “eliminating stasis” (*qu yu* 去瘀), and “purging” (*gongxia* 攻下) via the intestines or urination’ (Scheid, 2018, 139). These features of the more systemic perspective offered in TCM, and therefore that of the use of herbal medicine by PPRC, is culturally specific and not—as with the Egyptian term *ra-ib*—directly translatable, a ‘basic issue that any attempt at cross-cultural exploration faces’ (Lloyd, 2015). To circumvent this, we first gained a clearer indication of the types of illnesses in each unique text in the *ra-ib* textual series, and then sought only to compare those illness context(s) for which each Egyptian ingredient was prescribed with the context where the same ingredient occurs in the PPRC (2015).

This investigation was conducted with an objective of exploring the significance of potential ‘cross-cultural patterning’ or ‘relative universals’ (Trigger, 2003; Pommerening and Bisang, 2017; Althoff et al., 2019, 15–16). By relative universals, we mean similar concepts that have arisen or can arise at any time and in any place independently, i.e. irrespective of cultural contacts, with identical or comparable objects, properties, or practices. Thus the definition only calls for independent emergence in places that have not been in contact with each other. In our case concerning the selection of natural ingredients for treating symptoms, we are using two temporally and geographically disconnected cultures—one modern (China), one ancient (Egypt)—to minimise the chance that any identified potential universal be the result of cross-cultural or historical influences. This investigation into universals was not restricted to a simple identification of similar or dissimilar use patterns for corresponding *materia medica*, but more significantly to survey the role interconnected systems play in the cultural conceptualisation of treatment efficacy, and the implications this might have on our interpretation of possible motivations for ingredient selection in ancient Egyptian medicine.

2. Materials and methods

Within Egyptian healing papyri, constituent texts are oftentimes thematically categorised into ‘series’ or units of texts with a particular focus, and the ordering and organisation of these series within a particular papyrus varies depending on principles that still have to be examined further (Pommerening, 2017a). The subject of our investigation is the large coherent group of recipes dedicated to *ra-ib*. Thirty-three texts form one such series within the Ebers Papyrus (a document containing over 850 individual texts organised by theme into a variety of series, dated primarily by palaeography to c. 1550 BCE). They are all headed under the title *ššꜣw n mn rꜣ-ib* ‘wisdom/experience of one suffering from the *ra-ib*’. The *ra-ib* series provides a rationale for research, not only for its limited size of manageable data, but more significantly for the more detailed content of the series. Each text provides a unique series of illness-specific symptomatic and diagnostic information, followed by a treatment strategy tailored to that complex of symptoms (see supplement). A further *ra-ib* text—the only other example with an identical format—is included on the verso of the Edwin Smith Papyrus—dated to the same period. Compared with the texts found in the *ra-ib* series of the Ebers papyrus, those of the surrounding series are significantly less detailed, (being largely formulated more simply with variants of: *phr.t n.t X* ‘a remedy of X’ – where X represents an illness classification and the region of the body in which it was understood to manifest). These simple titles are followed immediately by instructions for preparing the remedy).

We first reproduced a transliteration of the text from the original hieratic-script (images from the online archives of the UBL (2019) and the NLM (2019)) and a retranslation according to modern Egyptological conventions and standards for translating ancient scientific texts (Allen, 2014; Pommerening, 2016a). These are attached in the supplement to our paper (see supplement). Each prescription entry includes an image of the original hieratic text, its transliteration into computerised hieroglyphic, the Egyptological transcription code of the sign-groups, and finally a translation; this was to enable the research to detect sign variations for seemingly identical terms indicating semantic shifts, as well as to allow the scientific procedure to be properly reproduced (for the proper conduct for researching historical texts, see Jütte et al., 2017; for ethnopharmacological research see the consensus paper by Heinrich et al., 2018). In the transcriptions and translations of the source material listed in the appendix, the texts are sectioned into title, symptom clause (s), diagnosis, treatment, and (if present) further information. Though these are not headed in the original document, structural markers make clear these distinct sections within the texts (Pommerening, 2016a). Such markers can be identified by the use of red ink by the ancient scribe—contrary to the black ink used elsewhere—to highlight the title of each text within the series, the diagnosis marker ‘then you would have to say X’ (where X is the diagnosis: *gd.hr=k r=f X*), and treatment introduction marker ‘you would have to make X’ (where X is the treatment strategy: *jri.hr=k X*). Red ink was also used to highlight the precise measurement prescribed for each ingredient. The ink colours are replicated in our transliteration, transcription, and translation using red and black fonts (see supplement). In accordance with current research, the measurements are noted in the ancient Egyptian dyadic fractions of *dja* (c. 300 ml) and *oipe* (c. 19.2 l) (Pommerening, 2005; see supplement).

As translating classifications of *materia medica* is particularly challenging for the study of any ethnomedicine, written or otherwise (Berlin, 1992; Lardos, 2015), exerted efforts were taken to ensure that the ingredients translated and compared in this study fit the identification criteria outlined in the recent guidelines set by Pommerening (2016b). In cases where a translation is not possible, the ingredient’s rendering in the transcription code (for example: *ššꜣ*, a modern code applied to represent the phonemes in the Egyptian spelling of the classification ‘*ššꜣ*’, together with the superordinate level of classification marked by the original script’s use of a ‘determinative’ (a symbol which serves to further classify a word, i.e.: *ꜥ*—plant/herb, *o*—

fruit/seed/powder/mineral etc., *ꜥ*—grain, and *ꜥ*—liquid/viscous/salve-like product; for example ‘*ššꜣ*—fruit/seed/powder/mineral’), is used as a substitute (Pommerening, 2016a, 2017a). Modern Latin binomials for plants are according to The Plant List (TPL, 2020; some entries include further designations following ‘syn.’ – these designations are those encountered in either the Egyptological literature or the PPRC that are considered a synonym of the ‘accepted’ name by TPL), and were acquired based on the approaches to *materia medica* translations outlined by Pommerening (2016b), which—among many other fundamental approaches—considers flora accessible in ancient times as supported by the archaeobotanical evidence (de Vartavan and Amorós, 1997).

While it is clear that ingredients used in treatment strategies were thought of as independent entities with their own paradigms of application (for discussions of herbal knowledge and the use of simples, see: Dawson, 1929; Betro, 1988; Tait, 1991; Ryholt, 2019), it should be noted that in the majority of Egyptian texts examined, the selected ingredients were combined with others, if not at least a type of oil, alcoholic substance, honey, or water (as is also common practice in TCM – the term is named ‘processing’) – excipients or solvents used for combination with herbal materials can be considered as an extraction procedure and will have significant impact on both bioavailability and bioactivity, reflecting on both the efficiency and safety of the *materia medica*, (Pommerening, 2006; Zhao et al., 2010; Chang et al., 2011; Wang and Franz, 2014). Addressing this issue in a detailed manner would excessively extend the scope of our investigation; therefore, with one exception, our focus was only to compare the contexts in which the *materia medica* occur in order to contribute an insight into the potential motivations of the initial selection of a singular ingredient within the composition, rather than to further elaborate on the motivations and pharmaceutical effect resulting from combining ingredients. The one exception is found in our discussion of the use of *Hordeum vulgare* L. in Ebers 206. In stark contrast to the remaining texts studied which list only the ingredients and the oils or liquids with which they are combined, Ebers 206 is uncharacteristically specific about the processing of this one ingredient, enabling our investigation to probe slightly deeper in our comparative analysis.

Following the translation process, a lexicographic analysis was conducted to determine the semantic fields of the two elements in the compound noun *ra-ib* – this used the comprehensive *Thesaurus Linguae Aegyptiae* (TLA, 2019) online research tool, an open-access lexicographic database in which ancient Egyptian lexemes and their occurrences (complete with references) can be searched. With this, our investigation into the three questions concerning the limits of the *ra-ib* system, its conceptualisation, and how this influenced the selection of treatment strategies within the Ebers and Edwin Smith papyri was then made possible. Ethnomedical traditions are the product of a balance between the biophysically observable and the human/cultural frameworks within which they operate (Kleinman, 1973; Quinlan, 2015); therefore, the application of conceptual metaphor theory (Lakoff and Johnson, 1980) to certain passages proved useful for gaining a general sense of the types of human experience (the ‘source domain’) which influenced the visualisation of *ra-ib* (the ‘target domain’), thereby allowing further gleanings toward an emic perspective.

From this, it was possible to better determine the relationship between the nature of the symptoms and the systemic model used to explain them, further elucidating the significant variation in the application of *materia medica* in this series of texts. This information could be compared with that supplied by the PPRC (2015) which—together with the supporting research publications cited—outline how and why such natural products are employed in TCM. Where an ingredient prescribed in a text from the *ra-ib* series occurred in the PPRC, we noted the types of symptoms cited in that particular text within the *ra-ib* series, and the parts of the body in which those symptoms manifested. Similar information (albeit concise and ‘modern’ in format) was then provided by the PPRC for comparison. By collecting and comparing the available information surrounding the use of each corresponding ingredient from the

two disconnected sources, we were able to consider the significance of potential universals, specifically with regard to the impact a system-based dynamic might have on the selection of *materia medica* in the Egyptian texts.

In contrast with far more extensive studies between historical traditions, examining more explicit and better documented material, as conducted by Kuriyama (2002) and Lloyd and Sivin (2003), we intentionally sought to use a modern tradition with accessible users for comparison with the comparatively inexplicit Egyptian source material. While future investigations are planned, comparing Egypt with other historical traditions, such as those temporally or geographically closer to ancient Egypt—i.e., Hippocratic, Galenic, and medieval European or Middle-Eastern traditions—would be problematic to our aim of grasping the significance of universals in disconnected traditions at this stage. The extent to which Egyptian medicine influenced later Hippocratic sources is still debated (see Steuer and Saunders, 1959; Ritner, 2007; cf. von Staden, 1989; Jouanna, 1999), and—historically speaking—classical and medieval sources are diachronically linked to some degree (Craik, 2015; Nutton, 2013; Pormann and Savage-Smith, 2007). Furthermore, while it is clear in cases that some ideas had already been transmitted between these regions and China (and vice-versa) in ancient times (e.g. Heydari et al., 2015; see also Unschuld, 2018, who even suggests that ‘it may be that the name Qi Bo [the healer named in the ancient Chinese medical text *Huang di nei jing su wen*, first or second century C.E (Unschuld, 2018).] is a faint echo of the name Hippo [crates], pp. 20–21), the actual extent of the influence is yet unknown. For now, the significant temporal and geographic disconnection between c. 1550 BCE and modern TCM can be reason enough to avoid discussions of diachronic and cross-cultural transmission.

3. Results and discussion

The title of each text in the *ra-ib* series is a variant of: ‘if you examine a man because of the suffering of an obstruction of the *ra-ib*’ (Russell, 2019); therefore, ‘an obstruction’ of the *ra-ib* is the common focus of each text. Before outlining the rationale of our new understanding of *ra-ib*, it is first necessary to clarify the nature of ‘obstruction’, or perhaps ‘blockage’, represented by the Egyptian word *shena* (šn) (𓂏𓂐) (TLA, 2019). Following the three phonetic hieroglyphs which spell out the radicals of this noun (that is, its constituent consonants, as the hieroglyphic script does not mark vocalics) is its ‘classifier’, the so-called ‘flesh-determinative’: 𓂏. This indicates that it was in some way conceptualised as being part of or related to the body or its anatomical structures, or at least that it denotes a ‘fleshy’ or ‘meaty’ substance to a certain extent (see Pommerening, 2017a). The precise fabric of the obstruction varies depending on the text within the *ra-ib* series – it can be an obstruction of food (Eb. 188, 189, 205, 207, and 211); specified or unspecified bodily substances which ‘knot’ (š) and ‘uplift’ (š), e.g. blood, faeces, and pus (Eb. 190, 193, 198, 202, 203, 204); conceptualised substances which are, or can in the Egyptian view become pathogenic (such as *st.t* and *whdw*) (Eb. 192, 195, 199, 200, and 206); or caused by the spirits of deceased ancestors or demons (Eb. 191, 194, 201, and 209) (Russell, 2019). These specifications of the obstruction, when present, are often found in the diagnostic clauses of a text within the series, for example in Ebers 193: ‘it is a swelling of faeces which has not yet knotted’ (*shn pw n hs nj š.t=f*), Ebers 192: ‘it is the putrefaction of his *st.t*-bodily-fluid which cannot descend to his groin with his *st.t*-bodily-fluid’ (*shwš w pw n.w st.t=f nj hš.n <=> r nph.w=f*), and Ebers 196: ‘it is a *hmnw.t*-accumulation of raised-matter which cannot be brought up’ (*hmnw.t pw n.t š.w nj šš.n.tw=f*) (see supplement). While many of the terms in these extracted clauses are yet obscure to us (such as ‘*st.t*-bodily-fluid’ or ‘*hmnw.t*-accumulation’), the superordinate-classification ‘obstruction’ is diverse. Furthermore, the latter two examples further illustrate the need for this obstruction to descend (*hš.i*) or be brought up (*šš.tw*) to restore health, a notion especially evident in expressed purposes of remedies such as in Ebers 198:

‘you have to make it [the obstruction] descend (*hš.i*) with a remedy’ (*rđi. šr=k hš.i <=> m phr.t*). These extracts imply a particular emphasis on the restoration of health by removing an obstruction of the *ra-ib*.

The term *ra-ib* itself is a compound noun consisting of *ra* (r), 𓂏 ‘mouth/opening’ (TLA, 2019), and *ib* (jb, 𓂏𓂐) ‘metaphorical heart’ (Nyord, 2009; cf. *haty* (hš.ty, 𓂏𓂐𓂏) ‘physical heart’, Nyord, 2009; TLA, 2019; cf. Bardinet, 1995, ‘l’entrée de l’intérieur-ib’). As noted by Walker (1996), the term *ra* denotes more than the physical lips to include the oral cavity (from whence he posited the translation ‘thorax’, or more literally ‘cave of the heart’). Our analysis found that the *ra-ib* compound noun belonged to a series of Egyptian classifications which denote something even less spatially restricted than the notion of a cavity or ‘cave’; this will here be labelled the ‘*ra-X* paradigm’. A search of these within Egyptological dictionaries (TLA, 2019) produces a list of designations for compound nouns composed in the first element with ‘*ra*’, ‘mouth/opening/door’ (r), 𓂏; the spatial limitations of which should be understood as specific to the compound noun in question, as the classification was not as spatially restricted as in the English or German sense. Instead, it was observed that compound nouns of the *ra-X* paradigm also include designations denoting passageways or thoroughfares, as in names for topographical features such as *rš-hnw*, the ‘opening of the *hnw*-mountains’ – the ancient name for the Wadi Hammamat, a natural corridor of over 200 km formed by a dry river-bed connecting the Red Sea and the Nile, (locative qualifications could also be applied, as in *hr.y rš-hnw* the ‘Upper region of the opening of the *hnw*-mountains’). Designations from conceptual domains also employ the *ra-X* paradigm: *rš-sšw*, the name for a region of the underworld literally meaning ‘opening of dragging’, was conceptualised and even depicted in funerary texts and illustrations as a thoroughfare through which the barque of the sun-god Re was dragged during his nightly journey through the Netherworld (Fig. 1) (Hornung, 1963; Richter, 2008). Spatially obscure designations also occur, such as *rš-hn.t* ‘the opening of the Fayyum’, the ancient name for the modern settlement of el-Lahun, which straddled the waterway between the main flow of the Nile and the Fayyum Oasis. Regardless of spatial obscurities, a classification within this paradigm is characterised by an ‘A to B’ dynamic: thus, *rš-hnw*, the Nile (A) to the Red Sea (B); *rš-sšw*, the realm of the living (A) to the realm of the dead (B); and *rš-hn.t*, the Nile (A) to the Fayyum (B). As the lexical components of *ra-ib* fit the *ra-X* classificatory paradigm, thus denoting a passage and not an opening, we were able to return to our three questions: 1) what were the limits of this system; where did A begin and B end, 2) how was the inner trajectory conceptualised, and finally 3), how did this conceptualisation influence the action of selecting treatment strategies?

An answer to question 1) can be found through an examination of the frequency with which other anatomical terms (marked in writing with the use of a 𓂏 flesh-determinative) occur within the texts. This highlights the types of issues categorised as problems with the *ra-ib*, such as pain/discomfort of upper joints, lower joints, and symptoms which manifested upon the back, or with the nose and eyes, as well as the areas through which treatments for the *ra-ib* were believed to descend – notably from mouth to anus. The examination also indicated areas of higher association, such as the mouth, rear, belly and metaphorical heart (*jb*). If we accept *ra-ib* belonging to the *ra-X* paradigm, then *ra-ib* appears to mark a spatial entity between the mouth (A) and rear (B) – a thoroughfare through the metaphorical heart (*jb*) and belly/body (*h.t*) of a human being. This clearly denotes a term less reductionist than ‘stomach’ in the biophysical sense or a colloquial general sense, and a more systemic model such as perhaps the Western notion of the ‘digestive system’. However, while many of the descriptions of anatomical functions seemingly pertain to a digestive capacity, assuming the term is the exact equivalent of the modern notion is misleading. While the symptoms of an obstructed *ra-ib* manifested as pain and discomfort in areas which might conjure notions of a modern ‘digestive system’, such as the metaphorical heart (*jb* 𓂏𓂐, Eb. 188, 196, 198, 205, 206, and 207), the ‘abdomen’ (*h.t* 𓂏, Eb. 188, 189, 197, 205, and 207), the ‘intestines’ (*qšb*

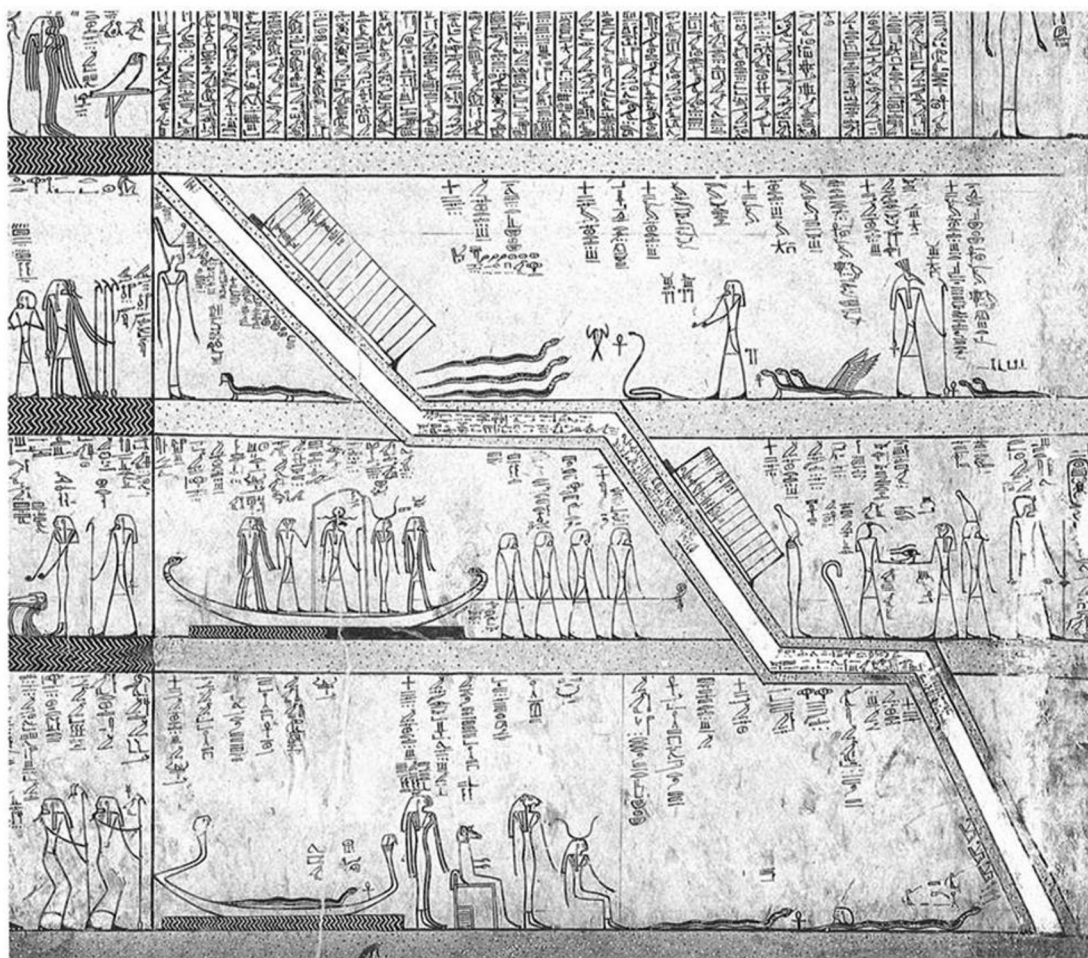


Fig. 1. Amduat rosetau.

m_3^c $\Delta \Delta \Delta \Delta$, literally: ‘the actual coils’; Eb. 191, 194, 204, and 208), and the rear-end/anus ($p_3w.yt$ $\Delta \Delta$, Eb. 188, 191, 194, 198, and 207), they extend beyond this to include the manifestation of symptoms—suggesting a direct or indirect connection—with the eyes/nose/face ($jr.ty/fnd/h_3 t$ $\Delta \Delta \Delta \Delta$, Eb. 192 and 195), the upper arm and breast region (gb/mnd $\Delta \Delta \Delta \Delta$, Eb. 191 and 194), the physical heart ($h_3 ty$ $\Delta \Delta$, Eb. 219 and 220), the extremities ($t \Delta \Delta$, Eb. 189 and 205, see also legs, $w.r.ty$ $\Delta \Delta \Delta \Delta$, Eb. 206), the skin ($h_3 w$ $\Delta \Delta \Delta$, Eb. 197), the back (psd $\Delta \Delta \Delta$, Eb. 200) and the uterus ($jd.t$ $\Delta \Delta$, Sm. v), among others (see supplement).

The answer to question 2) can be accessed by applying conceptual metaphor theory as first posited by Lakoff and Johnson (1980) to informative passages of the text, the source domains from which the *ra-ib* is visualised are more complex than a simple biophysical observation of digestion and defecation. Such passages as in Papyrus Ebers (in the following abbreviated as Eb. with a text number following Westendorf, 1999) Eb. 198 ‘you will find it (the obstruction) having clogged and crossed over the canal, his metaphorical heart (*jb*) is narrowed and his *ra-ib* is parched’ exhibit visualisations, which originate in a society primarily grounded in a riverine environment (for other clear examples, see Eb. 204 and 205 in the supplement). The restriction to travel resulting from the ‘clogging’ (q_b_3) of a ‘canal’ (*mr*) in this riverine environment can be seen in an inscription marking the restoration of a canal during the reign of Tuthmosis III, who found a canal (*mr*) clogged (q_b_3) with stone (Gasse and Rondot, 2007). The terminology used in our source material mirrors that used to explicate a circumstance in which an obstruction prevents transportation through a canal, the difference being the fabric of the obstruction in the *ra-ib*, as noted above, which is

of course more body-specific. As the ancient Egyptian lived experience was dependant on the flow of the Nile, it is unsurprising to find riverine metaphors (‘source domains’) being used to visualise more obscure ‘target domains’ (Lakoff and Johnson, 1980) such as inner bodily functions.

Obtaining a sound answer to question 3)—how the Egyptian model of *ra-ib* influenced the selected treatment strategies—is an even more complex challenge. Gleanings toward focus and intent of prescribed remedies can—in a few cases—be extracted from short descriptions of medicaments in the texts. For example, in Eb. 188 it can be deduced from the symptoms ‘he finds it heavy/difficult to eat bread’, and the directions ‘the man drinks (the remedy) for four days until you empty out his belly’ that the digestive capacity of the system is the singular focus. This remedy uses an unknown ingredient and date seeds (*Phoenix dactylifera* L.), which are mashed and strained with water. While one cannot elaborate further on the unknown ingredient ($p_3h-sr.t$), one might speculate that perhaps the rationale behind the application of date seeds (*P. dactylifera*) is found in its ability to stimulate digestion due to presence of polyphenols in that seed (Sirisena et al., 2018). The diagnosis clause interprets this as a ‘thing (i.e. condition) of the *miset* ($mjs.t$, likely to be translated as liver: TLA, 2019)’, suggesting it is this area of the body which is either part of, or at least connected to the *ra-ib* system. The symptoms described and treated are categorised within the *ra-ib* explanatory model with specific focus on its relation to the liver (*miset*).

Suggesting that each *ra-ib* remedy is therefore digestive in nature is problematic: ingredients applied elsewhere in the source material are diverse, and no two treatment strategies are identical. Eb. 192 and 194 list symptoms manifesting especially as vomiting and inflammation in

the eyes and a running nose – the diagnosis explains that this is caused by the putrefactive substance *setet* (st.t 𓂏𓂏𓂏𓂏) not being able to descend to the patient's groin-area (nph.w 𓂏𓂏𓂏𓂏). The remedy for this is to be taken 'until his eyes open and his congestion departs and is descended with the *setet*-substance' – it includes an indeterminable type of grain-based cake or bread, and wormwood (*Artemisia absinthium* L.), which is placed in a vessel and filled with onion (*Allium cepa* L.), all of which is finally processed with beer and then eaten with the fatty flesh of a cow and an indeterminable class of beer. Here, the model explaining the occurrence of these symptoms is an obstruction to the regular descent of *setet* through the *ra-ib*. However, are the selected ingredients again motivated by stimulating digestion? It is especially interesting here that this is the only use of onion (*A. cepa*) within these texts; perhaps one could speculate the reaction of the eyes to chopped onion contributed sympathetic significance – if indeed we are to understand the individual symptoms (and not the system-based explanatory model) motivated the treatment prescribed in each case. The diversity of the variables obscuring the answers to question 3) thus motivated our investigation into the significance of potential universals in the conceptualisation of treatment efficacy in systems-based models.

In comparing Egyptian *materia medica* with those which correspond to entries in the PPRC, we found eleven securely translatable ingredients (Table 1). One ingredient corresponded at both a superordinate and subordinate level – *Hordeum vulgare* L. The remaining entries are variant subspecies of corresponding genera according to Linnaeus's plant taxonomy. It should be noted that while many subspecies have shared therapeutic applications such as anti-inflammatory and anti-pain effects, the therapeutic effects of plants are attributed to their secondary metabolites effected by both genetic variations and environmental growth conditions (Wink, 2015).

The nature of the correspondences between the PPRC and the *ra-ib* cases presented a variety of results. Firstly, many of the entries show significant differences in the purposes for which they are employed. The differences in usage patterns found could be attributed to any number of variables (cf. Pommerening, 2017b for Egyptian use of analogy) – a more detailed evaluation of these was outside the parameters of our case-study as it requires at the very least a complete study of more than 800 remedies which constitute the Ebers Papyrus.

The investigation presented five parallels, which were unique in the questions they raised of the Egyptian use of *materia medica*. The first was observed in the processing and use of *H. vulgare*. In the uncharacteristically more detailed directions of Eb. 206, 'fresh/green' and 'undried' barley (*H. vulgare*) (i.e. capable of germination) is instructed to be 'heated with water without letting it boil' before being mixed with date seeds (*P. dactylifera*). Malted barley (*H. vulgare*) was used in ancient Egyptian beer manufacture, and dates (*P. dactylifera*) were perhaps one of the many ways in which the brew could be sweetened (Samuel, 2000; Metcalfe, 2016); however, to assume that Eb. 206 is simply a recipe for beer fails to acknowledge the potential therapeutic value and significance of its inclusion within a prescribed remedy – not least because the text itself labels it 'a secret method relevant to the physician' (sp.w n. w sstj r hr.y swnw), and that 'beer' (hmq.t) and 'sweet beer' (hmq.t ngm.t) are prescribed throughout the Egyptian medical texts (see examples in supplement; Metcalfe, 2016). The use of barley (*H. vulgare*) in Egyptian medicine is currently appreciated only as a potential vehicle for other pharmaceutically active ingredients (Germer, 2008); however, the value of this unusually detailed preparation method is comparable to a use of *H. vulgare* in the PPRC. *Mai Ya* 麦芽—the earliest citation of which is found in the Yaoxing Lun 药性论 (Treatise on the Nature of Medicinal Herbs) dating to the Tang Dynasty (7th Century CE) (Zhen, 2013)—is prepared in modern TCM by soaking the seed in water warmed to around 25–40 °C, until the sprout grows up to 0.5 cm. Unlike the Egyptian instructions, *Mai Ya* is then dried, stir-baked until browned and the *Hordei Fructus Germinatus* is removed, before being consumed. Despite the differences in preparation, the phytochemical processes involved during barley germination have a medicinal value. According

to current research, germinating barley grains contain maltose and dextrin derived from the degradation of starch in the endosperm of the grain during its germination (Andriotis et al., 2016). Maltose and dextrin are able to mildly promote the secretion of gastric acid and pepsin in the stomach – these have a noticeable effect on treating abdominal cramps and diarrhea (Marieb and Hoehn, 2015). Based on the description from the PPRC (2015), dyspepsia is caused by the movement of *qi* being blocked by the digestive system; using *H. vulgare* promotes the circulation of *qi* by improving the digestive function of the spleen-stomach system, thereby promoting the digestion of food. While the cultural models are unsurprisingly different, they share a common element: both traditions indicate the need to remedy a type of blockage or obstruction, perhaps indicating a universal in the perception of illness and health restoration in system-based traditions (see Scheid, 2018).

Eb. 205 instructs the physician to administer his remedy for a digestive complaint 'after it (the *ra-ib* or obstruction therein) has been soaked in "water of barley (*H. vulgare*)" (mw jt)'. The placement of the specification for preparing a liquid from germinating barley in Eb. 206 (immediately following Eb. 205) might suggest that the former 'water of barley' is an abbreviation of the same instruction. Both texts point towards treating a type of abdominal discomfort, suggesting that the selection of this treatment was motivated by the specific symptom, though its efficacy was understood within the conceptualisation of the overarching explanatory model of an obstructed *ra-ib*. While the preparation methods of *Mai Ya* and the instructions Eb. 206 share interesting similarities, they are not identical as ultimately the latter produces a drink; the limitations of our case-study therefore mark the need for further investigation.

A second and basic parallel was observed with the use of the rhizomes from *Cyperus esculentus* L. and *Cyperus rotundus* L. in the *ra-ib* texts (classified as 𓂏𓂏 w'h, there is no Egyptian distinction between rhizomes from *C. esculentus* and *C. rotundus*, both of which are abundantly present on the archaeobotanical record (de Vartavan and Amorós, 1997)) and the rhizome from *C. rotundus* in the PPRC. From Egyptian archaeological and pictorial evidence, the rhizomes were (and still are) used as a food-stuff in Egypt (Manniche, 1989). In the two occasions that the rhizome was prescribed in the *ra-ib* texts, it appears as a main ingredient (in both it is the first listed in the recipe, with 1/2 *dja* used in Eb. 205 and 1 *dja* used in Eb. 212; though note that in Eb. 212 this is combined with an equal amount of raisins). While the ailment treated in Eb. 212 is unspecified, the symptoms of Eb. 205—the remedy, which first prescribed 'water of barley' (*H. vulgare*), noted above—suggest treatment of digestive discomfort. In TCM, the rhizome of *C. rotundus* is used to distend pain in the chest and hypochondrium, as well as stiffness and oppression in the epigastrium and abdomen, treating distention and fullness. This result is consistent with the motivation for selecting 'water of barley' in Eb. 205, noted above.

A third parallel was found in the use of species of *Artemisia*. Returning to Eb. 192 and 194, the remedy treating a patient who vomits considerably and whose symptoms are at his forehead 'while his two eyes are inflamed and his nose runs', our investigation suggests that the Egyptian motivations for the selection of *materia medica* were more complex than simply stimulating digestion or resolving abdominal discomfort. Aside from the aforementioned speculation about the singular use of onion to treat these symptoms, it was of particular interest to note that TCM uses *Artemisia annua* L. to treat malaria, fever, jaundice, and heat-stroke: symptoms of which are more attuned to those noted in Eb. 192 and 194. While the Egyptian diagnoses are explained as putrefaction from an obstruction of *setet*-substance within the broader *ra-ib* systemic model, our investigation again suggested that it was the symptoms observed rather than the explanatory model itself which in this case directed the selection of onions (*Allium cepa*) and wormwood (*Artemisia absinthium*), to be consumed via the *ra-ib*. These symptoms are notably dissimilar from those noted above, further illuminating the system-based dynamic of how the Egyptians perceived remedies to work within the *ra-ib* model.

Table 1Cross-examination of the uses of Egyptian and Chinese *materia medica*.

Egyptian Classification	Modern classification approximation	Egyptian applications in <i>ra-ib</i> cases (Eb. 188–216; Sm. v)	Ingredient used in TCM	Medicinal applications in TCM
Acacia Tree: <i>šnd.t</i> 	<i>Acacia nilotica</i> Delile.	Leaf applied to the back for pain-relief (Eb. 200); resin used in a drink to 'invigorate his character' when belly is narrowed (Eb. 205); resin and leaf used to remove an undefined 'obstruction in his right side' (Eb. 210).	<i>Acacia catechu</i> (L.f.) Willd.	Hemostasis, wound treatment, cough and phlegm treatment, also treats eczema.
Acacia Resin: <i>qmy.t</i> 				
Onion: <i>ḥd</i> 	<i>Allium cepa</i> L.	Eaten to treat an obstruction of bodily-fluid (<i>st.t</i>) causing vomiting, inflamed eyes and a running nose (Eb. 192, 195).	<i>Allium chinense</i> G. Don., or <i>Allium macrostemon</i> Bunt <i>Allium sativum</i> L. <i>Allium tuberosum</i> Rottler ex Spreng.	Used for chest/abdominal pain and angina pectoris, as well as diarrhea. Used for detoxification, removing swelling, as an insecticide, stopping diarrhea, dysentery, treating coughs, and for treating tuberculosis. Special nutritional applications for liver and kidney systems concerning pain in waist and knees, also treats enuresis urinary frequency and white vaginal discharge. Used for hemostasis, as a pain killer, and to prevent itching. Used against fever, heat stroke, malaria, and jaundice. Used against heat stroke, jaundice, and to prevent itching.
Artemisia: <i>s'm</i> 	<i>Artemisia absinthium</i> L.	Drunk to treat coughing believed to be caused by hardening under the flanks (Eb. 190), and to cause a blood-clot to descend (Eb. 198); eaten to treat an obstruction of a bodily-fluid (<i>st.t</i>) causing vomiting, inflamed eyes and a running nose (Eb. 192, 195).	<i>Artemisia argyi</i> H.Lév. & Vaniot <i>Artemisia annua</i> L. <i>Artemisia scoparia</i> Walldst. & Kitam., or <i>Artemisia capillaris</i> Thunb.	Used against dysmenorrhea and postpartum stasis; also used for pain relief and to activate the blood, incl. chest pain, stomach pain, pain in abdomen, and pain caused by rheumatism.
Incense: <i>snḫr</i> 	<i>Boswellia</i> sp. (<i>Boswellia sacra</i> Flueck.? (syn.: <i>Boswellia carteri</i> Birdw.))	In a drink to remove an undefined 'obstruction in his right side' (Eb. 210); eaten to treat an undefined obstruction (Eb. 214, 216); in an auxiliary fumigation with Commiphora for lack of menstruation caused by an obstruction of blood in the uterus (Sm. v.)	<i>Boswellia sacra</i> Flueck. (syn.: <i>Boswellia carteri</i> Birdw.; syn.: <i>Boswellia bhaw-dajiana</i> Birdw.)	
Myrrh: <i>'ntjw</i> 	<i>Commiphora</i> sp. (<i>Commiphora gileadensis</i> (L.) C. Chr.? (syn.: <i>Commiphora opobalsamum</i> (L.) Engl.) <i>Commiphora myrrha</i> (Nees) Engl.?)	Drunk to cause a blood-clot to descend (Eb. 198); to remove a demonic obstruction in the right side causing unspecified symptoms (Eb. 209); mixed with other ingredients and applied to the vagina as an auxiliary treatment to make blood descend from the uterus; used in a further auxiliary fumigation for the same purpose (Sm. v.).	<i>Commiphora myrrha</i> (Nees) Engl. (syn.: <i>Commiphora molmol</i> (Engl.) Engl. ex Tschirch).	Used for dysmenorrhea, eye complaints acting upon the Liver Meridian, postpartum stasis; also for pain relief, incl. chest, stomach, or abdominal pains, and pain caused by rheumatism. Relieves stasis and swellings.
Chufa: <i>w'ḥ</i> 	Rhizome of <i>Cyperus esculentus</i> L. or <i>Cyperus rotundus</i> L.	Used in a drink to 'revive his character' when the belly is narrowed (Eb. 205); included against undefined obstruction (Eb. 212).	<i>Cyperus rotundus</i> L.	Distending pain in the chest and the hypochondrium. Stiffness and oppression in the epigastrium and abdomen; treats distention and fullness.
Fig: <i>d</i> 	<i>Ficus carica</i> L.	Drunk to remove an obstruction of faeces causing excessive vomiting (Eb. 202), and against another undefined obstruction (Eb. 212).	<i>Ficus microcarpa</i> L.f.	Used as an anti-inflammatory and as an expectorant. Works well against coughs, chronic bronchitis, and asthma.
Sycamore fig: <i>nq'w.t</i> 	<i>Ficus sycomorus</i> L.	Drunk to remove an obstruction of faeces causing excessive vomiting (Eb. 202); and to make bad-meat which causes intense digestive complaints to descend through the body (Eb. 207); leaf and fruit drunk to treat undefined obstruction in the left side (Eb. 210).		
Haematite: <i>djdj</i> 	Haematite	Eaten in a remedy using red-coloured ingredients to eradicate thirst and cure the abstract 'restlessness of his metaphorical heart' (Eb. 197)	Haematite	Used against dizziness, tinnitus, vomiting, belching, hiccups, loss of breath, hematemesis, and epistaxis.
Barley: <i>jt</i> 	<i>Hordeum vulgare</i> L.	Water/liquid of/from barley used to soak an obstruction causing digestive issues (Eb. 205). Barley water prepared from germinating seeds, sweetened with dates, and drunk to treat discomfort from digestion caused by a bodily-fluid (<i>st.t</i>) obstruction (Eb. 206).	<i>Hordeum vulgare</i> L.	Stimulates digestion, releases food accumulation, and distends pain in the epigastrium and abdomen.
Zizyphus: <i>nbs</i> 	<i>Ziziphus spina-christi</i> (L.) Desf..	Bread from or fruit (Jujube) of applied topically to treat unspecified obstructions (208, 213); leaves drunk to treat an unknown obstruction (210).	<i>Ziziphus jujuba</i> var. <i>spinosa</i> (Bunge) Hu ex H.F.Chou <i>Ziziphus jujuba</i> var. <i>inermis</i> (Bunge) Rehder	Special nutritional applications for the heart and liver systems. Relieves mental stress and good for sleep-loss and to stimulate dreaming. Used for eating less, loose stool and asthenia.

The final fourth and fifth parallels were noted between the uses of species of both *Boswellia* and *Commiphora*. The Egyptian text (Edwin Smith verso 9) records a treatment for a woman ‘suffering from her *ra-ib* for whom nothing has come as menstruation’ – this is diagnosed as ‘an obstruction of blood in her uterine system’. The main part of the remedy was a drink from an indeterminable seed/fruit/powder (*wjṁ*, *ḥḥ*, *ḥḥ*, *ḥḥ*) that was drunk alongside smearing the vagina with a mixture from an indeterminable quality of oil, cumin, galena, and myrrh (without reference of quantity) ‘which causes the blood to descend from her’. Should the first method prove unsuccessful, an unknown type of plant was then to be cooked in oil and smeared, and both myrrh (*Commiphora* (uncertain species, potentially *myrrha* (Nees) Engl., or *gileadensis* (L.) C. Chr (syn.: *Commiphora opobalsamum* (L.) Engl.), see Vartavan and Amorós, 1997)) and incense (*Boswellia* (uncertain species, potentially *sacra* Flueck (syn.: *Boswellia carteri* Birdw.), see Vartavan and Amorós, 1997).) were used to fumigate vagina. In the PPRC, both *Boswellia sacra* Flueck. (syn.: *B. carteri*; syn.: *Boswellia bhaw-dajiana* Birdw.), and *C. myrrha* (syn.: *Commiphora molmol* (Engl.) Engl. ex Tschirch) are ingested orally to treat pain relief in the chest or abdominal regions, and pain caused by rheumatism; more significantly, both are used to treat dysmenorrhea. Again, though the method of application is ultimately dissimilar, the parallel motive is notable.

A further philological question was raised by our investigation into the uses of these ingredients in both traditions. Elsewhere in TCM, *B. sacra* and *C. myrrha* are used against eye complaints; they are ingested to act upon the Liver Conduit. This treatment strategy centres on the connection of this conduit to the eyes (a connection also made in biomedicine—dry, red, or itchy eyes being symptomatic of liver dysfunction—and developmental biology, which suggests the connection is embryogenetic (Keeton and Gould, 1986)). Z- and E-guggulsterones derived from the *Commiphora* genus have been found to exert their anti-inflammatory properties by suppressing activation of NF-κB and expression of NF-κB-regulated gene products and thereby preventing the expression of inflammation related protein in eye tissues (Shen et al., 2012)). Unlike in TCM, the Egyptian sources do not impart direct explanations as to why ingredients are used; in the ancient source material incense (*B. sacra*) and myrrh (*C. gileadensis* and/or *C. myrrha*) were employed as ingredients in prescriptions which omit symptom descriptions entirely. Each have a wider use in the Egyptian healing compendia outside of the source material studied here; both were applied topically to treat burns, wounds, and swellings; myrrh was applied externally in a selection of eye remedies, and incense ingested to treat the belly, liver, extremities, and skin (Germer, 2008). Eb. 210, 214, and 216 include incense in remedies to be consumed, and in Eb. 209 myrrh was consumed to fight an obstruction believed to be caused by a demon without further symptom specification. While their frequent usage in topical applications for burns, wound treatments, and swellings suggests that the effects of their antibacterial or anti-inflammatory properties were recognised, their use in a systems-based tradition necessitates further consideration of the explanatory models within which the remedies were understood to operate (cf. Pommerening, 2017b). An alternative method of treatment for extremities and symptoms in other areas of the body might therefore be by being consumed to act upon the *ra-ib* to treat those areas with which the *ra-ib* is connected, much like treatments in TCM to treat the eyes by acting upon the Liver Conduit. Rather than solely explaining their frequent use exclusively with cultural semiotics (i.e. because incense and myrrh were used in religious ceremonies), this analysis further presents a theoretical paradigm established from an emic perspective for consideration – a perspective which does not obviously translate for the layman acquainted only with an elementary understanding of modern medicine.

4. Conclusions

Readjusting our understanding of *ra-ib* from ‘stomach’ to an ‘inner thoroughfare’, running from the mouth to the anus, answers our first

question concerning the limits of this system. It not only better fits the lexical components of the term itself, it also fits the metaphors employed to illustrate the problems caused by the obstruction of the system (such as the use of riverine terminology). These inferences indicate how the system itself was conceptualised, providing an answer to our second question. This significantly alters the manner in which we understand the Egyptian perspective of the body, at least in a healing context – its physiological processes, and the selection of *materia medica*, the third and final question posed during our investigation. The latter’s diversity reflects the range of symptoms whose origin was explained as an obstruction to the more holistic system. The result of this is a potential conceptual blending between the selection of ingredients preconceived as being useful for treating the specific symptoms manifesting in diverse regions of the body, and those which were known to increase digestion to varying degrees and therefore perhaps more focused on remedying the perceived cause of the illness – the obstruction of the inner thoroughfare and the need to push this cause downward through the body, as implied by many passages within the *ra-ib* series.

In certain cases, our comparative analysis with TCM and the PPRC suggested particular *materia medica* could have been selected in accordance with symptoms, such as *A. absinthium* for symptoms familiar to the illnesses for which the PPRC prescribes other species of *Artemisia* (notably *A. annua*), and *B. sacra* and *C. myrrha* for symptoms familiar to dysmenorrhea, for which the PPRC also prescribes these resins (though again it must be noted that the application methods are distinctly different). Similar symptom-based motivations would therefore exist for the selection of ingredients in the other prescriptions within the *ra-ib* series, for which no parallels in the PPRC were identified, as well as in the more basic prescriptions found elsewhere in the large corpus of ancient Egyptian remedies which typically forego any inclusion of symptoms or diagnoses. The striking parallel in the processing and use of *H. vulgare* could be consistent with this as its use potentially points towards symptoms of digestive discomfort, against which the processed product had been observed empirically as a useful treatment. However, the preparation’s potential ability to stimulate digestion might also be consistent with the need to remove and ‘make descend’ the cause of illness—the obstruction to the thoroughfare—in order to restore health, suggesting the explanatory model motivated the treatment strategy. Of course from an Egyptian perspective, the motivation for selecting ingredients based on any empirical observation of their efficacy against certain symptoms and the motivation for selecting ingredients based on the perspective of the explanatory model need not be mutually exclusive. Rather, certain ingredients could have been perceived as being useful for removing certain types of obstructions—such as the use of *A. absinthium* and *A. cepa* for that caused by the ‘*setet*-substance’, against which they were used in Eb. 192 and 194—which were diagnosed according to particular types of symptoms. This helps to explain the diversity of ingredients and potentially even ingredient clusters prescribed in the remedies which make up the *ra-ib* series. For now, quite how pervasive this concept of obstruction is to the Egyptian culture (i.e., beyond the *ra-ib* texts) is yet to be determined by ongoing research, though its significance in these texts could hint at a potential relative universal within traditions which generally have a more systemic perspective, where health is equated with free-flow (as seen with *tong* in TCM, Scheid, 2018) and the absence of obstructions (as with *shena*) in bodily systems. Indeed, future comparative investigations would be needed to confirm such a potentially generalist hypothesis.

Finally, beyond the parallels observed in the internal usage of *materia medica*, the study also suggests that this Egyptian perspective—that of the inner thoroughfare and the areas of the body where illnesses associated with it manifest as symptoms—could further explain the ingestion of certain ingredients more commonly used elsewhere in the corpus for topical applications, such as the use of *B. sacra* and *C. gileadensis* and/or *myrrha* for burns or wounds. Whereas in modern TCM the internal application of the natural products associated with specific extremities is proven by clinical experimentation (such as the use of *C. myrrha* acting

upon the liver conduit to treat inflammation of the eyes), empirical reasoning does not necessarily always need to justify the Egyptian motivations for treatment selection, which could in cases potentially operate on the basis of its explanatory models and systemic perspectives of the body alone.

In closing, the relative universals outlined by our study were not only found in the types and motivations of ingredient selection between these two disconnected cultures, but more importantly in the system-based paradigms by which they understand efficacy, whether accurately or otherwise. It is this which qualifies dynamic philological considerations for future attempts at exploring ancient motivations for the selection of treatment strategies.

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Appendix A. Supplementary data

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