On the origin of Ammon’s horn

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Received 1 December 2011; accepted 10 March 2012
Available online 28 August 2014

KEYWORDS
Ammon’s horn; History of neurology; Temporal lobe; Medical coinage

Abstract
Introduction: Greek and Roman worship of their gods and myths go back to Ancient Egyptian times. Images engraved in Greco-Roman coinage range from references to the assassination of Caesar and legendary stories like the arrival of a snake shaped demi-god Aesculapius to save the Romans from the plague, to invocations of major deities including Apollo the physician or Ammon the protector.
Development: Depicted with the horns of a ram, Ammon was adopted by the Greeks as an epithet of Zeus and later incorporated by the Romans as Jupiter. References to the cult of Ammon appear on tetradrachms minted for Alexander The Great and on provincial Roman coins struck under Claudius. It is thrilling to hold a coin depicting Marcus Aurelius with Salus on the reverse and think that it could have been handed to Galen in payment for his services. However, it is rare to find figures other than rulers on coins and the physician of Pergamum is no exception. Inspired by the Renaissance school of Padua, French anatomists in the Enlightenment (Garengeot in 1742 and Flurant in 1752) continued reviving ancient myths and named the curve-shaped-inner portion of the temporal lobe Ammon’s horn. Outstanding scholars who studied this primitive structure of the brain included Lorente de Nó and his mentor Cajal, whose portrait appeared on fifty-pesetas notes issued in 1935.
Conclusions: As primary sources of great archaeological and artistic value, Greco-Roman coins provide information about the origins of the myths and gods of classical antiquity and continue to inspire the arts and sciences to this day.
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PALABRAS CLAVE
Asta de Amón; Historia de la neurología;

Sobre el origen del asta de Amón

Resumen
Introducción: El culto a los dioses y su recreación artística en Grecia y Roma se remontan al Antiguo Egipto, según podemos comprobar al estudiar las monedas antiguas. Grandes

Please cite this article as: Iniesta I. Sobre el origen del asta de Amón. Neurología. 2014;29:490–496.
☆☆ This article presents an extended version of different lectures on numismatics and medicine delivered in the 3rd and 7th Neurohistory Sessions organised by the SEN. It also draws from the abstract On the origin of Ammon’s horn, which was accepted for presentation at the 26th Congress of the EFNS, Stockholm, 2012.
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Introduction

"'Jesus held up a coin with Tiberius in profile. / A profile without love— / power in circulation.'"*

According to an ancient African legend, mythology and history become indistinguishable after seven generations. Throughout its long history, Greco-Roman civilisation followed the custom of using metal images to immortalise the fortunes, ephemerides, patron saints, monuments, allegories, and diverse symbols, especially during the high Roman Empire. This resulted in the creation of numerous coins regarded as having great artistic and archaeological importance, and these pieces shed light on both the history and legends of ancient times. Pivotal deeds such as the assassination of Julius Caesar on the ides of March, the conquest of Judea, the eruption of Vesuvius, and the arrival of the Greco-Roman demigod Asclepius, in serpent form, to Tiber Island to save Rome from an epidemic mingle with the achievements of emperors or invocations of major gods such as Apollo the physician (during great plagues) or the Egyptian god Amun.

Nevertheless, devotional practices and the artistic depictions of the gods in Greece and Rome are rooted in Ancient Egypt. As such, temples dedicated to Egyptian gods were not uncommon in the Roman Empire. One example is the Temple of Isis in Baelo Claudia in Hispania; its ruins are found next to those of the Forum and the garum factories around the Bay of Bolonia in the province of Cádiz.

Procedure

"'I swear by Apollo, the healer, Asclepius, Hygieia, and Panacea…'"**

The sixth century BCE witnessed the rise of a new current in opposing disease, one that went beyond folk empiricism or mere superstition and which took the healer Asclepius as its reference. A century later, along the western coast of Asia Minor and its nearby islands, we find a type of medicine based on rational ideas inspired by pre-Socratic philosophers: the tékhne iatríkē (τεχνή ἰατρική) of the Hippocratic physicians, later known as ars medica among the Romans, consisting in taking action based on knowing why that action should be taken. The ideas of rational medicine and irrational religious beliefs coexisted harmoniously in ancient times; both forms were opposed to charlatanism, and both sprang from the same source. Together, they represent the basis of Western medicine. As the cornerstone of its ethical foundation, the precursor to modern deontological codes, and a faithful reflection of reason devoted to the service of medicine, the Hippocratic Oath recalls how the rational approach was incorporated into the irrational and religion-based earlier practices by invoking the Greek (and Roman) gods in its opening paragraph.

Medicine in Greco-Roman numismatics

You, who were the embodiment and ensign of Hispania, the Matron holding in her right hand, your symbolic harvest on the denarii and bronze coins of Hadrian, who with Italic honour this land…

Among the many numismatic references to mythology, we can find personifications of provinces including Hispania, Germania, Britannia, and Gallia, and also representations of traits or virtues such as Hope, Loyalty, Nobleness, or Health. Greek coins minted from the fifth century BCE typically represent Asclepius as a bearded man with a serpent (identified as Zamenis longissimus) entwined around his staff. A tetradrachm piece struck in Athens in the second century BCE (Fig. 1) features the god of medicine as described above with the Athenian owl on the reverse. Hygieia, the Greek goddess of health and the mythological daughter of Asclepius, was worshipped from the third century BCE and
And just as the pagan gods listed in the first paragraph of the Hippocratic Oath were censored in later Byzantine versions, no coins were struck with their images as of the fourth century CE. These later coins lacked the beauty and relevance of the coins invoking medicine that were crafted in high imperial Rome.\(^6\)

**Ammon in the transition from Egypt to Greece**

The etymological roots of the larger part of medical vocabulary are found in the so-called dead languages. A basic knowledge of Latin and Greek is often sufficient to dilucidate the meanings of such terms as hypo-glossus (beneath the tongue); syn-kinesis (coordinated movement); dys-kinesis (movement disorder); and many others. However, simply translating a medical term may be complicated by having to trace the origin of a proper name used in that term, as in the case of Cornu Ammonis or Ammon’s horn.

Ammun Kneph, Amun, or Ammon the Protector, was the supreme deity in the theogony of Ancient Egypt. Also known as Amen, meaning obscure, mysterious, or cryptic, Amun was the main deity of Thebes with a cult that reached its apex during the twelfth dynasty (20th century BCE). Before Ammenhotep IV banned the cult of Amun, and temporally dictated a monotheistic religion under the sun-god Ra, the Priest of Amun held the highest rank within Egyptian society.\(^7\) However, an evolved form of Amun, portrayed with a ram’s horns to denote the fertility and warlike nature of the ancient animal of the temple, made a forceful return as the supreme god of the New Empire; 4 pharaohs of the 18th dynasty took his name, including Tutankhamun, which literally means the living image of Amun. After the Egyptian conquest of Nubia (the region currently occupied by the Republic of the Sudan and corresponding to Ancient Ethiopia), a temple to Amun was built in the capital city of Napata at the foot of the sacred mountain of Jebel Barkal.\(^7\) In addition to his horns, Amun typically bears a sceptre and an ankhs, the symbol of the universal soul.

His place of worship, an oasis in the Libyan desert where the oracle of Siwa resided, was visited by successive waves of Greek pilgrims, a process which favoured Amun’s incorporation into Greco-Roman theology. In his description of Greece, Pausanias recalls the presence of many temples to Amun throughout Ancient Egypt, especially those in the capital city of Thebes and in Sparta.\(^7\) During the fifth century BCE, Pindar contributed to spreading the cult of Amun from Cyrenaica in Libya to Greece; a cart bearing a statue of the god was raised in Delphos. However, the first place in Greece where the god was depicted with a ram’s horns was in Megalopolis, the capital of the southern province of Arcadia.\(^8\)

**Ammon on Greek and Roman coins: medical connotations**

*What less can I do, but evoke the deeds/ sober and fertile, of the mule-drivers;/ labourers who preserve the trace/ of those priests with their pairs of oxen yoked/ moulding the contours of the Roman cities/ cast in bronze on dupondii of Obulco.*\(^9\)
Iatromathematics or astrological medicine was another invention of Hellenistic Egypt. Of the 4 fundamental parts of the human body, according to the doctrine of astral melothesia, Aries corresponds to the head. The *Iatromathematica of Hermes Trismegistus to the Egyptian Ammon* (subtitle: *Mathematical prescience of bed-ridden diseases, taken from astrological science*) is related to the *Sacred Book of Hermes to Asclepius* in that they view man as a microcosm.^9^ While we cannot overlook Amun’s role as a physician in his capacity as supreme god and protector, the main god of medicine in Egypt was Imhotep, a deified doctor linked to Asclepius.^7^

Egypt was overrun by the Persians in the fourth century BCE but then fell into the clutches of Alexander the Great. After the conquest, he proclaimed himself the son of Amun and was deified before the oracle of Siwa. A tetradrachm minted under Lysimachus in the northern Greek province of Thrace in the third century BCE bears on its obverse the diademmed head of Alexander, triumphant conqueror of Egypt, portrayed as Zeus Amun (Fig. 4). But the cult of the Egyptian god did not disappear once Greece and Egypt were under Roman rule; as in countless other occasions, it was adopted by the new civilisation, as can be seen in the example of a coin dating to the rule of Claudius. Its reverse side bears the influential Alexandrian symbol of Zeus Amun as a figure assimilated into Roman mythology as an epithet of Jupiter (Fig. 5).

A possible link between the Egyptian god and medicine, aside from his status as a supreme deity, is the fact that the Theban high priest of Amun (the highest authority in Southern Egypt and the earthly representative of the divine) was credited with a certain degree of empiric knowledge of medicine. Another link, although less probable, is that Apollo assigned divine status to the ram, as depicted on a coin struck in Troas (a city located on the coast of modern-day Turkey and renamed Alexandria Troas by Lysimachus after his immediate predecessor, Alexander the Great). On its obverse, we see the profile of the ubiquitous Greco-Roman god, with a ram on the reverse (Fig. 6). This can certainly be explained by the regard for that animal throughout antiquity, and the fact that it was frequently associated with other major gods, including Zeus, Hermes, and even Apollo. However, no clear correlation can be established between the Egyptian god and Apollo the physician (invoked by the Romans in times of plague, along with the other gods of healing in the Hippocratic Oath). On the other hand, the dried distillation of ram’s horn produces ammonia (from the Greek *ammoniakón*, meaning pertaining to Amun^10^). The salts of that chemical compound, found in abundance in the Libyan desert, were used to prevent potential epidemics.

**Resurgence of Greco-Roman mythology in the renaissance and introduction of the term ‘Ammon’s horn’ during the Enlightenment**

The Renaissance was a cultural and artistic movement that sought to return to the origins of classical antiquity by drawing from original sources and avoiding texts filtered by means of adulterated translations into Arabic or Latin during the Middle Ages. Efforts in the medical sphere focused on recovering Hippocratic and Galenic writings in the original Greek. One of the main innovations in Renaissance medicine, as opposed to approaches used in antiquity and the Middle Ages, was the creation of a new anatomical and structural paradigm based on the dissection of human cadavers and animal vivisection. The Galenic functional paradigm, in force prior to that time, was based exclusively on animal dissection since the dissection of human cadavers was prohibited in Greece and Rome. This gave rise to a chain of errors that marched on across the centuries. However, the new school in Padua, whose students included Andreas Vesalius and William Harvey, introduced a novel way of studying the human body in unprecedented detail. Here, the Greco-Roman gods and myths played an important role in that their names were given to different anatomical structures.

Terms recovered from Greco-Roman mythology include *hippocampus*, proposed by Giulio Cesare Aranzio (1530–1589) as the name of the medial region of the temporal lobe.
because of its resemblance to a seahorse. In Greek mythology, Hippocampus was a sea monster that pulled Poseidon's carriage, flanked by tritons and Nereids. The mythological origins of this monster were recently explored from the point of view of the neurosciences.

However, French anatomists of the Enlightenment were the ones to coin the term Cornu Ammonis or 'Ammon's horn' to refer, for the first time, to this hidden and convoluted anatomical structure. Anatomists in the times of Vicq-d'Azyr had used the terms 'cornucopia' or 'horn of plenty' to refer to the lateral part of the fourth ventricle attached to the choroid plexus. In Greco-Roman iconography, the symbol is associated with harmony, peace, and happiness, as demonstrated by ancient coins.

Winslow's initial proposal, in 1730, was the term 'ram's horn' to refer to the medial region of the temporal lobe, as Lewis indicates. French anatomist Flurant was credited in 1752 with using the name 'Ammon's horn' to refer to that brain structure. Nevertheless, another French anatomist, De Garengeot, had been the true source of the term a decade earlier (Fig. 7). Since then, the name of the Egyptian god has been linked to medical literature.

**The junction of Ammon's horn and David's lyre**

Ammon, enraged violator,/ flees away on his pony.[…]
And when the four hoofs/ were just four echoes,/ David
with a pair of scissors/ cut the strings of his harp.

According to the dictionary of the Royal Academy of the Spanish Language, a salterio or psalterio (psaltery) is a stringed musical instrument composed of a triangular resonance chamber, narrower at the top where it is open. It is fitted with multiple metal strings that can be struck or plucked by the fingers. However, salterio in Spanish may also refer to the Book of Psalms in the Old Testament containing 150 psalms offering praise to God, most of which were composed by King David. The above verses by Federico García Lorca, inspired by stories in the Old Testament, refer to the incestuous rape of Tamar by her half-brother Amnon (not Ammon). Both were children of King David.

In anatomy, the connection between both medial temporal regions or Ammon's horns is established through the hippocampal commissure, also known as the psalterium, lyra, or David's lyre. This name was inspired by the Biblical victory of the King of Israel over the Ammonites in Jordan, whose capital city was Rabbath Ammon (modern-day Amman).

The base of the corpus callosum, presenting an inferior transversal convexity and anteroposterior concavity, provides the insertion point for the septum pellucidum. At that level, it is intimately attached to the trigone and forms a structure with fibers stretching obliquely like the strings of a lyre. This was what inspired French anatomist contemporaries of Vicq d'Azyr to name the commissure David's lyre, as has been highlighted by Bonell and Lacaba.

**As always, Cajal**

Bordering the surface or limbus of the lateral ventricles, stemming from the subiculum, folded in at the end like a garment ready for sewing, and consisting of the intralimbic gyrus, hippocampal digitation, and the hippocampal uncus, the structure known as Ammon's horn, the Cornu Ammonis, or hippocampus proper is a narrowing convolution that curls around the dentate gyrus to form the retrocommissural hippocampus. Dominated within by giant pyramidal cells, this winding structure sends numerous efferent bundles to the external part of the adjacent subiculum and septum pellucidum. In contrast, the majority of its afferent cells are axons proceeding from dentate granule cells in the entorhinal cortex.

While studying Ammon's horns, Cajal described the stratum oriens or interneuronal layer wedged between a band of white matter (the alveus) and a layer of pyramidal cells. This gives rise to the distinctive curved shape that lets us identify this part of the brain macroscopically. Filled with polymorphic corpuscles, this interneuronal layer or stratum narrows in its medial and superior segments due to the accumulation of non- pyramidal cells with short axons. These cells were precisely described by the great Aragonese neuroscientist in the late 19th century. In addition to the classic Histology of the Nervous System of Man and Vertebrates, his other important studies on this part of the brain include Studies on the human cerebral cortex. Here, Cajal describes the anatomical details of this convoluted brain structure (Fig. 8). Ammon's horn is the archipallial region of a brain distinguished, at this level, by its simple cortex: the archicortex or allocortex. This type of cortex is phylogenetically prior to the layer covering the more complex, evolved, and consequently less organised neocortical framework with its 6 layers or strata. The initials CA, standing for Cornu Ammonis, are used to delimit structural borders in Ammon's horn. The reverberating circuits CA1—CA4 were described by Cajal's last direct student Rafael Lorente de Nó, who was in his time the leading figure in Spanish neurophysiology. He presented the trisynaptic loop that integrates this area as follows: (1) entorhinal cortex — dentate gyrus; (2) dentate gyrus — CA3; (3) pyramidal cells in CA3 — axon collaterals
linking CA3 with CA1.24 CA1 is also known as the 'Sommer sector' because of the pioneering studies by German scientist Wilhelm Sommer. His predecessors Bouquet and Cazauielli also produced important works describing atrophy or sclerosis of this vulnerable area of the brain, which is the pathological substrate associated with temporomedial epilepsy.25,26

Numismatics and philately are almost exclusively dedicated to recalling emperors, kings, governors, monuments, ephemerides, deities, or virtues associated with the human condition and its circumstances. Despite serving as the personal physician to three emperors (Marcus Aurelius, Commodus, and Septimius Severus, in that order), Galen of Pergamon (130–216 CE) never appeared on coins; that rare privilege was reserved for Apollo, Asclepius, Salus, and Telesphorus.6 Even in our times, it is very rare to see a scientist depicted on currency, but there are examples such as Freud in Austria or Darwin in the UK. With the above in mind, Cajal’s appearance on a Spanish banknote issued on the first anniversary of his death should grant us an idea of his legendary social status which transcended his works as a scientist and as the father of modern neurology (Fig. 9). To paraphrase Tranströmer’ whose quote begins this study,

Cajal’s numismatic presence can be summarised as wisdom in circulation.

Conclusions

The supreme Egyptian god Amun was assimilated by the Greeks as an epithet of Zeus. Amun was depicted with the horns of a ram, and evidence of his cult remains on Greek tetradrachms dating to Alexander the Great and consular medallions from the reign of Claudius. French anatomists of the Enlightenment borrowed the custom (from the school of Renaissance in Padua) of mentioning myths and gods of Classical Antiquity, and therefore named the curved medial temporal cortex Ammon’s horn. Just as the god Amun and his attributes represented the universal soul according to ancient beliefs, the known regulatory function of the emotions and memory processes could earn this area of the brain the nickname of “the seat of the soul”. Cajal was one of the many researchers of this primitive brain structure. Further proof of this Spanish neuroscientist’s significance was that he was drawn on 50-peseta notes issued in 1935. It is now unlikely that we will see the return of Ammon’s horn and the face of Cajal on Greek drachmas and Spanish pesetas.

Conflicts of interest

The author has no conflicts of interest to declare.

Acknowledgements

All images of coins were taken from a personal collection dedicated to medical references in Greco-Roman numismatics. The collection was begun in the middle years of the last century by Pascual Iniesta Quintero (1908–1999), one of Spain’s pioneer researchers in this field.

Many thanks to María Ángeles Ceballos Hernansanz, Víctor Fernández-Armayar, and Antonio Martín Araguz for inviting me to participate in the Third and Seventh Neurohistory Sessions, held in Italy and Greece respectively, presenting my lectures on medicine and numismatics. I would also like to thank Javier de Felipe and María Ángeles Ramón y Cajal for locating and granting me permission to use the drawing of Ammon’s horn featured in this article.

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