Communication • DOI: 10.2478/v10134-010-0041-8 • Translational Neuroscience • 1(4) • 2010 • 335-337

Translational Neuroscience

VERSITA

A NOTE ON THE SEA-HORSE IN THE HUMAN BRAIN

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Abstract

It is commonly believed that the term hippocampus represents a shining example of inappropriate and fanciful anatomical naming, because this brain structure supposedly does not display any resemblance, striking or remote, to the little sea-horse fish known as hippocampus. The aim of this short historical notice is to demonstrate that, in fact, the hippocampus looks very much like the little sea-horse fish, as demonstrated by Gustav Retzius more than a century ago. However, to note this striking resemblance, one has to apply a proper method of anatomical dissection.

Keywords

Brain morphology • Hippocampal formation • Hippocampus • History of neuroanatomy

Received 15 December 2010
accepted 15 December 2010

The historical description and significance of the hippocampus (or hippocampal formation) have been subject of repeated reviews [1-14], but the real origin and meaning of the term hippocampus itself has been tackled by just a few [4,5,14]. While all authors agree that the term hippocampus was introduced by Italian anatomist and surgeon Giulio Cesare Aranzio (1530 – 1589) of Bologna (whose latinized name was Iulius Caesar Arantius - for biography, see [15], opinions differ with respect to both the exact date of this discovery and Aranzio's reasons for introducing the term hippocampus. With the exception of Meyer [6], all other authors state that Aranzio published his description of hippocampus in 1587, in the first chapter (pages 44-45), of his work entitled *De humano foetu liber*. However, it should be noted that work published in 1587 in Venice is in fact the third edition which combines in a single volume three earlier publications of Aranzio: his *De humano foetu*, his *Anatomicarum observationum*, and his *De tumoribus secundum locus affectum* [16]. The above quoted description of the hippocampus is in fact part of *Anatomicarum observationum*, as clearly testified by its list of contents (*Index Capitum Anatomicarum Observationum*) which sprovides the subject of the first chapters (pp. 43-45) as follows: Caput 1: *De cerebri ventriculis ab Hippocampo denominati*; Caput 2: *De plexibus Choroidibus per eosdem sinus distributis*; Caput 3: *De cerebri particulis Hippocampum referentibus*. The usually quoted passage is from the third chapter (pp. 44-45), which we reproduce here:

Horum ventriculorum basi, quae intro ad medium respicit, candida insurgens supereminet, & quasi adnascitur substantia, quae ab inferiori superficie, velut additamentum extollitur, psalloidique corpori, seu testudini est continua, ac per longitudinem, in anteriora, versus frontem protenditur inequalique, ac flexuosa figura predita est, quae Hippocampi, hoc est marini equuli effigié refert, vel potius, bóbycini vernis cádidi spinalis medullae initium hinc inde amplexantis, formá indicant*, de cuius usu alibi dicemus: huius particula caput referens tertio vocato ventriculo proxima est, reflexum vero corpus in caudam abiens, ad anteriora protéditur; quocirca ad superiorum differentiam, Hippocampi, vel Bombycini vermis ventriculos appellare libuit. Illud praeterea observatione dignum relinquitur, quod plexu e sinuum basi sublato, elegans quedam, atque admirabilis, exiguorum quamvis vasorum, propagation cóspicitur, quae in superioribus non est adeo artificiosa. Quod ad cavitates, & reliqua, sic habet*. For slightly different versions of translation of this passage in English, see [4,5].

Furthermore, the first work was originally published in 1564 in Bologna as *De humano foetu libellus* [17] and in Rome as *De humano foetu opusculum* [18]. This work was reprinted in Venice in 1571 [19] and in Basle in 1579 [20]. The other work, *Observationes anatomicae*, was first published fifteen years later, in 1579 [21].

In addition, Aranzio's discovery was not always reviewed in favourable terms. For example, Frederic T. Lewis described Aranzio as ([4], p. 216): „that rather dull pupil of Vesalius" and then stated that ([4], p. 213): „The flight of fancy which led Arantius, in 1587 [16], to introduce the term hippocampus is recorded in what is perhaps the worst anatomical description extant. It has left its readers in doubt whether the elevations of cerebral substance were being compared with fish or beast, and no one could be sure which end was the head." Similarly, Frederick Tilney ([5], p. 1): „Since the time of Arantius' suggestion no one has been able to discover any resemblance, striking or remote, between the part of the

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brain so labelled and the little sea-horse fish known as hippocampus". In recent reviews it was either vaguely suggested that „If the structure is removed from the ventricle, it resembles the horn of some animal" ([7], p. 5), or concluded that it was not the hippocampus in our modern terms but the dentate gyrus, which Arantius compared to a little sea horse or a silkworm [12].

All the above mentioned reviews suggest that the shape of the hippocampus in the human brain may arouse various imaginative associations (such as silk-worm or sea monster, or ram's horn), but that the hippocampus clearly does not even remotely resemble to a little sea-horse fish. However, the aim of this short historical notice is to demonstrate that, in fact, hippocampus displays unmistakeable resemblance to the little marine fish – if one uses a proper method of anatomical dissection to reveal it. That type of dissection consists in striping off parts of the parahippocampal cortex and subjacent white matter, so that the ventral surface of the dentate gyrus becomes freely exposed. Such anatomical demonstrations were prepared and illustrated by Swedish neuroanatomist Gustav Retzius, in his magnificient monograph on the morphology of the human brain published in 1896 in Stockholm [22] (see Figure 1). Although the illustrations of Retzius are by far the best published, it should be noted that the same kind of dissection and illustration was first employed by Félix Vicq d'Azyr [23,24] who in his Plate XX and its description on p. 71-72 [24] depicted horizontal section through the cerebrum with the hippocampus standing out in the recognizable shape of the little sea-horse, as in the atlas of Gustav Retzius. Both atlases point to the same conclusion: in order to display the sea-horse appearance of the hippocampus, one has to dissect brain starting from its ventral (basal) surface, instead of exposing the temporal horn of the lateral ventricle by gradually removing dorsal parts of the cerebral hemisphere. Since Aranzio did not publish any illustration or detailed description of his dissection method, we will never know whether he introduced the term hippocampus because he really noted its uncanny resemblance to a little sea-horse by using the same anatomical approach as Vicq d'Azyr or Retzius. However, that possibility cannot be ignored, because the method of dissecting the brain starting from its ventral surface was already introduced by Aranzio's famous contemporary, Costanzo Varolio, as testified by Burdach ([1], p. 206).

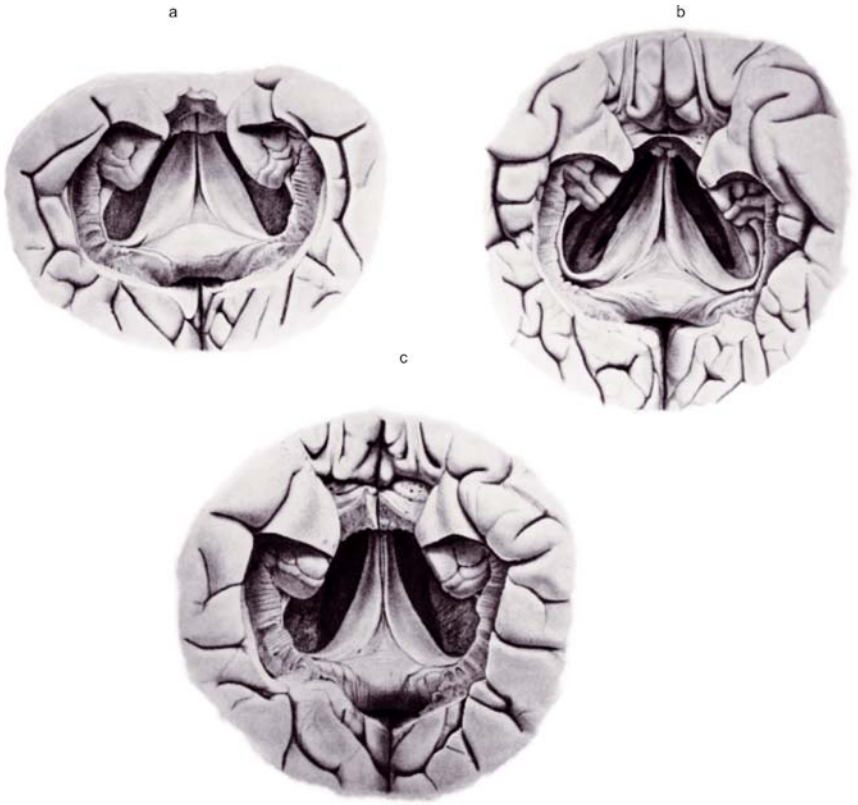

Figure 1. Reproduction of figures 1 (A), 2 (B) and 5 (C) from the Plate XLVI of Gustav Retzius's monograph on the human brain published in 1896. (Retzius 1896). After careful removal of cortex and subcortical white matter of the parahippocampal gyrus, the exposed ventral surface of the dentate gyrus and its rostral continuation displays a clear resemblance to the sea-horse, as depicted in brains of 27-year-old (A), 26-year-old (B) and 31-year-old (C) adult human males.

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