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Authors: Maximilian Koellmberger, Kirsti Witter

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REVIEW ARTICLE

Maximilian Koellmberger, Kirsti Witter

Use and meaning of the anatomical terms plexus choroideus and tela choroidea in veterinary and human medicine

Maximilian Koellmberger, Kirsti Witter, Plexus choroideus and tela choroidea

Department of Biological Sciences and Pathobiology, University of Veterinary Medicine, Vienna, Austria

Address for correspondence: Kirsti Witter, Department of Biological Sciences and Pathobiology, University of Veterinary Medicine, Veterinärplatz 1, 1210 Vienna, Austria, e-mail: kirsti.witter@vetmeduni.ac.at

ABSTRACT

The anatomical terms plexus chor(i)oideus (CP) and tela chor(i)oidea (TC) are listed without explanations in the official nomenclature handbooks Terminologia Neuroanatomica and Nomina Anatomica Veterinaria. Definitions of CP and TC exhibit discrepancies in medical dictionaries and anatomy handbooks. The aim of our study was to analyse this problem in detail and to discuss a possible unified use of the terms in science and teaching.

We conducted a systematic literature review based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses, identifying and analysing relevant scholarly articles. Additionally, comprehensive original handbooks on human and veterinary anatomy in English and other European languages were examined.

The definitions of the terms CP and TC differed considerably between articles and did not match the most frequently given explanations in handbooks. In general use, it seems to have become accepted that TC represents the smooth, thin part of the roof of third and fourth ventricles, and CP the frond- or fringe-like vascularised structures invaginated into lateral, third and fourth ventricles. However, it is controversial which tissue layers should be included in their description. Etymologically, only the vascular network should be termed (choroid) plexus, but embryologically and functionally, epithelium, pial connective tissue and vascular network form an inseparable entity. Similarly, the smooth part of the ventricle roof consists of

a (less) vascularised pia-derived stroma and lining epithelium. Including all these layers in CP as well as TC definition might be advisable and also corresponds to the use of the terms in clinical context.

Keywords: plexus choroideus, tela choroidea, terminology, nomenclature, choroid plexus, choroid membrane, systematic literature review, mammals

INTRODUCTION

The anatomical terms plexus chor(i)oideus (choroid plexus, CP) and tela chor(i)oidea (TC) are both listed without further explanations or definitions in the official handbooks on human and veterinary (neuro)anatomical nomenclature Terminologia Neuroanatomica [34] and Nomina Anatomica Veterinaria [111].

The recently updated Terminologia Neuroanatomica (integrating the chapter on nervous tissue of the formerly separate human histological nomenclature) assigns TC and CP to the same level of hierarchy, both subordinate to the term Pia mater cranialis. The Terminologia Neuroanatomica specifies Plexus choroideus ventriculi quarti, tertii and lateralis, but only Tela choroidea ventriculi quarti and tertii.

Similarly, Nomina Anatomica Veterinaria list Tela choroidea ventriculi quarti, Tela choroidea ventriculi tertii and Plexus choroideus ventriculi quarti, tertii et lateralis at the same hierarchical level immediately subordinate to Pia mater encephali. Additionally, Tela choroidea ventriculi quarti is immediately subordinate to the entry Ventriculus quartus and Tela choroidea ventriculi tertii to the entry Diencephalon. The Nomina Anatomica Veterinaria do not list CP under the entries for the single ventricles or brain parts.

Nomina Histologica Veterinaria [50] assign the term Plexus choroideus to the same level of hierarchy as Pia mater, but TC subordinate to CP.

From an etymological point of view, “plexus” means braid or plexus, in anatomy an interlacing of nerves, vessels or fibres [101]. Thus, in case of the CP it should designate the capillary net of the the cauliflower-like structures in fourth, third and lateral ventricles. However, usually it seems to be used for the complete cauliflower-like structure or at least for more than one of its layers (Fig. 1) [e.g., 43, 49, 51, 94, 106]. The Latin word “Tela” (web, loom) designates “tissue layer”, not providing any linguistic clue for the actual structure. As an English equivalent, choroid membrane is suggested [34].

Neither Terminologia Neuroanatomica nor Nomina Histologica Veterinaria provide any information on layers or tissues forming TC or CP, except listing the existence of a choroid

epithelium (Epithelium plexus choroidei [50] or Epithelium choroideum [34]) with choroid epithelial cells (Ependymocytus choroideus [34, 50] or Epitheliocytus choroideus [34]) for the CP, but not the TC.

Even in medical dictionaries, definitions of TC and CP differ slightly or are incomplete. The Webster-Merriam Medical dictionary [75, 76] defines TC as a fold of Pia mater roofing a ventricle of the brain, and the CP as a highly vascular portion of the Pia mater that projects into the ventricles and secretes cerebrospinal fluid. The French Vocabulaire Médical [28] does not provide any definition of CP, but lists TC (*toile choroïdienne*) of the fourth and third ventricle as large folds of the Pia mater that invaginate into the crevice between the lower surface of the cerebellum and the roof of the fourth ventricle or into the Fissura transversa of the brain, respectively. The English as well as the French medical dictionary disregard the choroid epithelium. According to the German Pschyrembel [88], TC is a structure consisting of the roof of the third and fourth ventricle together with the Pia mater, forming the basis for the CP. CPs are defined as “vascular networks; structures rich in vessels and nerves derived from the pia mater and invaginated into the ventricles, their villous surface being covered with ependyma”.

Similar discrepancies could be found when performing a cursory search in handbooks on human and veterinary anatomy.

There are few analyses of the terminology of CP [29 and selected references therein], but to our knowledge, no overview defining both CP and TC and explaining their relationship. The inconsistencies in CP and TC nomenclature have been pointed out before [101]. To research this issue, we conducted a systematic literature review to find publications using both terms and analysed how they are characterised and differentiated. Comprehensive original handbooks on human and veterinary anatomy in English and other European languages were included in the search. The aim of our study was to provide a suggestion on how to unify the use of the respective terms CP and TC in science and teaching (Fig. 1).

MATERIALS AND METHODS

As suggested for evidence-based anatomy studies [xx], the material was identified and analysed based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [78].

The database Scopus® was searched using the following search strings:

TITLE-ABS-KEY (plexus W/5 chorioid*) AND TITLE-ABS-KEY (tela W/5 chorioid*),

TITLE-ABS-KEY (plexus W/5 chorioid*) AND TITLE-ABS-KEY (tela W/5 choroid*),

TITLE-ABS-KEY (plexus W/5 choroid*) AND TITLE-ABS-KEY (tela W/5 chorioid*), TITLE-ABS-KEY (plexus W/5 choroid*) AND TITLE-ABS-KEY (tela W/5 choroid*). The phrasing ensured that both CP and TC were featured in a prominent position, i.e. in either title, abstract or keywords, regardless of the spelling (choroid-/chorioid-), in English as well as in Latin (plexus choroideus/choroid plexus). A preliminary search using equivalent search strings in Pubmed® yielded fewer results without differences to the Scopus search. Therefore, only Scopus results ("articles") were subjected to further analysis. No time limit was set for the search, which was carried out 23/08/2022. Additionally, comprehensive original handbooks ("handbooks") on human and veterinary anatomy in English and other European languages were identified, excluding translations (Fig. 2).

All publications were screened as shown in Figure 2. Duplicates that had to be excluded arose from the use of only slightly differing search strings. Other formal reasons for the exclusion of publications from further analysis was the language (Japanese), ineligible format (video) and unavailability of full text.

A total of 86 publications was analysed in detail. The publications were classified according to their type and to their main scientific field, separately for human and veterinary medicine. They were searched for the terms CP and TC and directly written or indirectly implied definitions for both terms, including their possible synonymous use. The results of this analysis were recorded.

Translation of relevant paragraphs was necessary for all languages except English and German. Sources in Slavic languages were translated by KW, all other sources by MK.

Statistics

The use of the terms CP and TC and, if given, their definitions were summarized and sorted into categories based on similarities of the record entries. The acquired data was analysed using descriptive statistics. The frequency of use of each definition and of the combination of CP and TC definitions was determined in relation to the total number of publications. The resulting percentages were represented using diagrams. Handbooks and articles were analysed separately as well as combined. Additionally, the publications were divided into groups by their scientific disciplines, countries of origin and decades of publication and evaluated as described above.

RESULTS

In total, 86 publications were analysed, including 28 handbooks [3, 4, 8, 10, 14-16, 20, 25, 30, 32, 33, 38, 41, 54–56, 62, 81, 83, 84, 86, 87, 95, 96, 100, 103, 105] and 58 articles (48 original articles [1, 2, 5-7, 18, 19, 21–24, 26, 27, 31, 37, 39, 40, 43, 44, 46, 47, 49, 51–53, 58, 61, 63, 65-74, 77, 78, 80, 94, 98, 101, 104, 106–110], 9 case reports [9, 11, 13, 17, 36, 48, 59, 89, 93] and 1 book chapter [6]). Publication dates of articles ranged from June 1927 [44] to December 2021 [94, 107]. The oldest included handbook was published in 1897 [16]. Languages of handbooks included German [4, 10, 32, 55, 62, 84, 87, 100, 105], English [16, 30, 41, 83, 96], Czech [20, 56, 81], Serbo-Croatian [95], Romanian [38], French [8, 15, 25, 103], Polish [14, 54] and Italian [3, 33]. Articles included 28 authored by scientists from institutions in an English-speaking country [1, 2, 6, 9, 11, 17, 18, 24, 36, 39, 40, 44, 46, 47, 51–53, 58, 69, 71–74, 77, 93, 101, 104, 107], 12 in countries of the Romance language family [5, 19, 22, 23, 49, 65–68, 108–110], 6 in Asia [37, 48, 63, 70, 80, 89, 94], 3 in a German-speaking country [26, 61, 98], 2 in Africa [7, 31], 2 in Eastern Europe [21, 59], 2 in South America [13, 106] and 1 in Scandinavia [43]. No correlation was found between the country of origin of the respective publication and use of definitions for CP and TC.

While handbooks covered exclusively the nervous system of the human and domestic mammals, articles dealt with humans and different mammals, except for two articles on frogs [52, 77] and two on zebrafish [27, 37]. Articles on the fish brain [27, 37] had to be excluded from further analysis, since the anatomy and development of the fish brain deviates significantly from that of other vertebrates [35].

All handbooks mentioned the CP, but in two of them, the term TC was not included [16, 30]. Similarly, all articles mentioned the CP, but the term TC was found in the text body of only 57 articles, the remaining one listing the TC exclusively in the keywords [44]. In none of the 86 publications, both terms were used synonymously.

Based on the interpretation of the terms CP and TC, the publications were classified into 11 categories separately for each structure. The categories included: “no definition”, “only epithelium”, “epithelium and blood vessels”, “epithelium, blood vessels and pia mater”, “only blood vessels”, “only pia mater”, “surgical wording”, “incomplete, but epithelium is mentioned as a part”, “incomplete, but pia mater is mentioned as a part”, “incomplete, but epithelium and blood vessels are mentioned as parts” and “non-pial-connective-tissue”. For graphical presentation the three categories containing incomplete definitions were merged into one. If not explicitly specified otherwise, the phrasing “covered by epithelium” was understood as including the epithelium. Two publications [30, 97] were put into two CP defining categories due to different possible interpretations of the describing phrases.

Examples of the wording used to define CP and TC for each category (excluding “no definition”) are given in Table 1. A complete list can be found in Supplement 1.

The number of occurrences of each definition is shown in Fig. 3. The most frequently used definition for the CP (24×) was “epithelium, blood vessels and pia mater” [1, 3, 5, 8, 10, 11, 14, 15, 17, 26, 30, 32, 33, 41, 43, 48, 51, 55, 81, 84, 94, 100, 105, 106] while the TC was most frequently (26 ×) defined as “only pia mater” [3, 14, 15, 24–26, 32, 38, 41, 48, 49, 54–56, 59, 62, 71, 84, 89, 95, 96, 100, 103–106]. Four definitions were only used for the CP [4, 7, 20, 24, 25, 30, 38, 40, 46, 54, 61, 63, 66, 68, 71, 74, 89, 95, 96, 103, 108, 109] while “non-pial-connective tissue” was only used for the TC [20, 36]. It is noticeable that 32 [1, 5, 6, 11, 13, 17–19, 31, 39, 44, 46, 51, 61, 65-68, 70, 72, 73, 80, 83, 86, 87, 93, 94, 98, 107–110] and 20 publications [6, 13, 18, 19, 21, 31, 59, 62, 65, 67, 70, 72, 73, 83, 86, 87, 93, 98, 107, 110] did not define the CP and TC, respectively.

The various combinations of definitions for CP and TC were also analysed. The most frequently occurring combination, found in nine handbooks [3, 14, 15, 32, 41, 55, 84, 100, 105] and in 12 publications in total [3, 14, 15, 26, 32, 41, 48, 55, 84, 100, 105, 106], defined CP as consisting of epithelium, pia mater and blood vessels, while TC was defined as only pia mater. Six handbooks defined CP as solely blood vessels and TC as only pia mater [25, 38, 54, 95, 96, 103], while another five described both CP and TC as epithelium, pia mater and blood vessels [8, 10, 14, 33, 81]. The most common combination in the articles was no definition of both terms (14 publications) [6, 13, 18, 19, 31, 65, 67, 70, 72, 73, 93, 98, 107, 110], followed by 6 articles where CP was defined as pia mater and TC was left undefined [1, 5, 11, 17, 51, 94]. Five articles defined both terms as epithelium [2, 52, 53, 58, 69], a combination which was not used in any handbook.

There was an apparent difference regarding the use of definitions for CP and TC when comparing the handbooks and articles (Fig. 4). In case of the CP definition, “epithelium, blood vessels and pia mater” was used in 47% of the handbooks [3, 8, 10, 14, 15, 30, 32, 33, 41, 55, 81, 84, 100, 105] but only in 17% of the articles [1, 5, 11, 17, 26, 43, 48, 51, 94, 106]. There was also a noticeable difference in defining the CP as only blood vessels. While rather common in the handbooks (27%) [20, 25, 30, 38, 54, 95, 96, 103] only 2% of the articles [66] defined the CP in this way.

In case of the TC definition, the most prominent difference occurred for “only pia mater”, which was the most common one in the handbooks (63%) [3, 14, 15, 25, 32, 38, 41, 54–56, 62, 84, 95, 96, 100, 103, 105] while only featured in 16% of the articles [24, 26, 47, 49, 59, 71, 89, 104, 106]. The percentage of publications without a definition for the terms of interest

was noticeably higher for articles (28% and 52% for CP [6, 13, 18, 19, 21, 31, 59, 65, 67, 70, 72, 73, 93, 98, 107, 110] and TC [1, 5, 6, 11, 13, 17–19, 31, 39, 44, 46, 51, 61, 65-68, 70, 72, 73, 80, 93, 94, 98, 107-110], respectively) compared to the handbooks (13% and 11% for CP [62, 83, 86, 87] and TC [83, 86, 87], respectively). For both terms the definitions used in articles were more diverse than in the handbooks. None of the handbooks contained incomplete definitions, while 17% (CP) [9, 24, 40, 44, 47, 61, 71, 74, 80, 89] and 4% (TC) [40, 47] of articles did.

Of the 56 analysed articles, 13 (23%) could be categorized as anatomical [21, 46, 61, 65–68, 70, 104, 106, 108–110], 9 (16%) as case reports [9, 11, 13, 17, 36, 48, 59, 89, 93], 9 (16%) as clinical [7, 18, 19, 22, 23, 31, 39, 49, 107], 6 (11%) as embryological [2, 52, 53, 63, 69, 101], 5 (9%) as histological [1, 24, 26, 46, 77], 4 (7%) as molecular biological [43, 51, 58, 80], 1 (2%) as physiological [44] and 10 (18%) as pathological [5, 6, 40, 47, 71–74, 94, 98]. One publication was classified into two fields of knowledge: anatomy and histology [46]. Fig. 5 demonstrates the usage of the individual definitions for CP and TC across the scientific disciplines. It can be noted that the “surgical wording” was used exclusively in clinical publications [22, 23, 39, 49]. The definition “epithelium only” predominated in embryological articles for both CP and TC [2, 52, 53, 63, 69]. Otherwise, there appeared to be no correlation between the usage of the definitions and the scientific disciplines.

The change of use of the CP and TC definitions over time is shown in Fig. 6. A specific trend could not be identified. However, the definitions used in articles were generally more diverse than in the handbooks, especially noticeable from the 1980s [2, 17, 40, 44, 52, 53, 58, 59, 65, 69, 74, 77, 80, 108–110]. Interestingly, before the 1980s the TC was generally defined as pia mater in handbooks [16, 32, 38, 56, 96, 103, 105] but not in journal articles.

DISCUSSION

Our systematic review of literature revealed that the terms CP and TC are indeed used differently in the scientific community, especially regarding the inclusion or exclusion of the ependymal cover and connective tissue of the pia mater.

The text corpus collected for this review is fraught by a number of limitations that are to be considered during analysis. While the analysed articles contained both keywords CP and TC, none of them specifically addressed the difference between these structures or the use of the terms. We are aware that a number of relevant publications might have been overlooked, if the CP and TC did not occur in title, keywords or abstract [e.g., 12, 79]. The search was limited as described to compare the respective author’s notion of both terms, even if no actual

definitions were given. Furthermore, searching for single term definitions would have yielded too many results for the intended in-depth analysis over the complete time period. A few publications found by single term search discuss the terminology of CP in detail [29 and references therein, 101], but to our knowledge, there is no equivalent work on TC nomenclature.

The collection of handbooks proved quite difficult. Some relevant handbooks might have escaped our attention. It was neither possible nor practical to collect the first or the most recent editions of the respective books. The oldest tomes were mostly not available for lending and were usually corrected and extended for later editions. The recent editions were often shortened to meet the requirements of a streamlined education in human and veterinary medicine. We analysed therefore the newest but still comprehensive handbook editions, or in the case of rarer material, those that could be sourced. The development of use of the terms CP and TC in books over time (Fig. 6) has therefore only a low informative value. A cursory comparison of representative older and newer editions of one traditional handbook on human [41, 42] and one on veterinary anatomy [84, 85] did not reveal any substantial differences. The explanations of the terms CP and TC were extended in [84, 85] but did not change in their meaning. In [41, 42] the hitherto missing TC definition was added. However, an in-depth historical analysis similar to a recent discussion on the neuroanatomy of the fourth ventricle would be desirable [97].

The interpretation of the wording used to define CP and TC was often challenging. Sentence constructions such as “the plexus is covered by a single layer of epithelial cells” were generally understood to include the epithelium in the forementioned structure [e.g., 46]. In case of incomplete [9, 24, 40, 44, 47, 61, 71, 74, 80, 89] or missing definitions (most surgical publications), the actual meaning of the terms CP and TC was deducted by implication as best as possible. For the “incomplete” example given in Table 1 [61] it seems that the authors include at least epithelium and capillaries in CP, whereas no information on connective tissue is given. Inconsistencies within the same source were only a problem of the handbooks [14, 30, 96]. In these cases, the various definitions within one source were counted separately for numerical analysis, for example [96] was included in the categories “only blood vessels” as well as “only pia mater” for CP.

The main difference between explanations of CP and TC in the analysed publications was the inclusion or exclusion of layers or structures. The definitions “vessels only” or “epithelium and vessels” were used exclusively for CP, whereas both TC and CP have been described to consist either only of pia mater, only of epithelium or of epithelium, vessels and connective

tissue (Fig. 3). While there was a preference of definitions in handbooks (CP = ”epithelium, blood vessels and pia mater”, TC = “only pia mater”), the meaning of the terms in articles was far more widespread (Fig. 4). Moreover, there was no clear historical trend (Fig. 6). It is therefore not possible to give a clear recommendation for the definition of CP and TC based on the frequency of use or historical development.

None of the analysed publications enlarged directly on the difference between CP and TC. In some cases, the CP was thought to develop from the TC [53, 56], as a vascular plexus inside the invaginating TC [41], or the TC was described to be involved in CP formation [2, 7, 8, 10, 25, 26, 30, 32, 36, 38, 41, 43, 48, 54, 55, 63, 69, 80, 83, 84, 87, 100, 101, 105–107]. The preferred use of the terms by pathologists and surgeons (e.g., “the choroid plexus was then partially removed and the tela choroidea divided and bent back” [22]) implied a macroscopic distinction rather than one based on the microstructure. A flat, thin dorsal ventricle roof without nervous tissue would be termed TC, whereas the complete cauliflower or frond-like structures invaginated into the ventricles CP (see e.g. [112] for illustrative mesoscopic photographs).

The question remains which of the tissue layers shall be regarded as a part of CP and TC.

From an etymological point of view and following the conventions of anatomical nomenclature (cf. Plexus vasculosus, Plexus venosus; but also Plexus vertebralis externus/internus, Plexus pampiniformis and the nerve plexus), only the capillary network of the cauliflower-like structures (and possibly the stromal tissue surrounding them) should be termed CP [100]. However, this is only observed by few publications [20, 25, 38, 54, 66, 95, 96, 103] and does not meet the customs especially in surgical literature.

From an embryological point of view, publications discussing CP and TC ontogenesis in mammals [2, 41, 52, 53, 63, 69, 101, 102] agree on the general developmental principles: The dorsal roof plate of the cranial neural tube thins in certain regions, forming a single layer of cells. The pia mater anlage with its blood vessels adheres to them. Afterwards, the resulting membrane invaginates into the fourth, third and lateral ventricles, forming cauliflower-like stromal protrusions containing a prolific vascular net and covered with specialised epithelial cells that are continuous with the ependymal lining of the ventricles. From this point of view, CP as well as TC should both either be defined as including vascularised connective tissue and neuroectodermal epithelium (for CP, see [60, 91]), or both as connective tissue structures excluding the epithelium.

From a functional point of view, there is only very little helpful information to distinguish the tissue components of CP and TC. The CP has manifold functions, primarily cerebrospinal

fluid production [for review, see 57, 64, 82, 90]. Both CP epithelium and vascularised stroma play a central role in this process. The latter provides the liquid component itself via its fenestrated capillaries, while CP epithelial cells form the blood-cerebrospinal fluid barrier, preventing paracellular transport of substances with their intercellular junctional complexes and creating a unidirectional flow of sodium, bicarbonate and chloride via special transporter molecules, which powers the transcellular transport of water [64, 82, 90, 92]. Although the CP epithelium is inseparable from the underlying stroma from a morphological (Fig. 1) as well as from a functional point of view, the stroma is sometimes disregarded in CP definition [2, 53, 69].

In contrast to CP, there are virtually no publications on TC function and the involved tissue components. If at all, TC is simply regarded as a part of the ventricle roof [97] involved in CP formation [2, 7, 8, 10, 25, 26, 30, 32, 36, 38, 41, 43, 48, 54, 55, 63, 69, 80, 83, 84, 87, 97, 100, 101, 105–107]. At least in its roof function, epithelium as well as the pia-derived stroma are involved to form the physical barrier.

The function of CP and TC therefore does not provide any arguments for exclusion of tissue layers in their definition. Both structures need epithelium as well as their more (CP) or less (TC) vascularised stroma to fulfil their role. Interestingly we could not find any studies addressing possible differences between CP and TC epithelium, even if it is known that CP epithelium differs considerably from “normal” ependyma [see e.g. 41, 58, 100]. TC epithelial cells seem a bit smaller and denser than the large cuboid CP epithelial cells, and some figures in respective publications seem to show a differing metabolic equipment [99].

It remains to be ascertained if the ependymal cells covering the CP differ in shape, molecular composition and function from the ependymal cells of the TC, and if the connective tissue stroma of both structures can be differentiated from each other and from the normal pia mater covering nervous tissue.

CONCLUSIONS

The definitions of the terms CP and TC differ in different publications. It seems to have become accepted that TC represents the smooth, thin part of the roof of third and fourth ventricles, and CP the complete frond- or fringe-like vascularised structures invaginated into lateral, third and fourth ventricles, but it is controversial which tissue layers should be included in their description. For CP, only the vascular network should be termed plexus from an etymological point of view, but embryologically and functionally, epithelium, pial connective tissue and vascular network form an inseparable entity. Similarly, the smooth part

of the ventricle roof that can be identified macroscopically consists of a (less) vascularised pia-derived stroma and lining epithelium. Including all these layers in CP as well as TC definition also corresponds to the use of the terms in clinical context.

Article information and declarations

Author contributions

M. Koellmberger: adaptation and refinement of the study design; searching relevant publications; sourcing the material; translation from Romance languages; data acquisition, manipulation, analysis and interpretation; drafting and critical revision of the article

K. Witter: primary idea and conception of the work; study design; identification and sourcing of additional publications (handbooks); translation from Slavic languages; consultation and supervision; critical revision of the article

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Supplementary material

The supplementary material for this article can be found online at: https://journals.viamedica.pl/folia_morphologica/article/view/98803.

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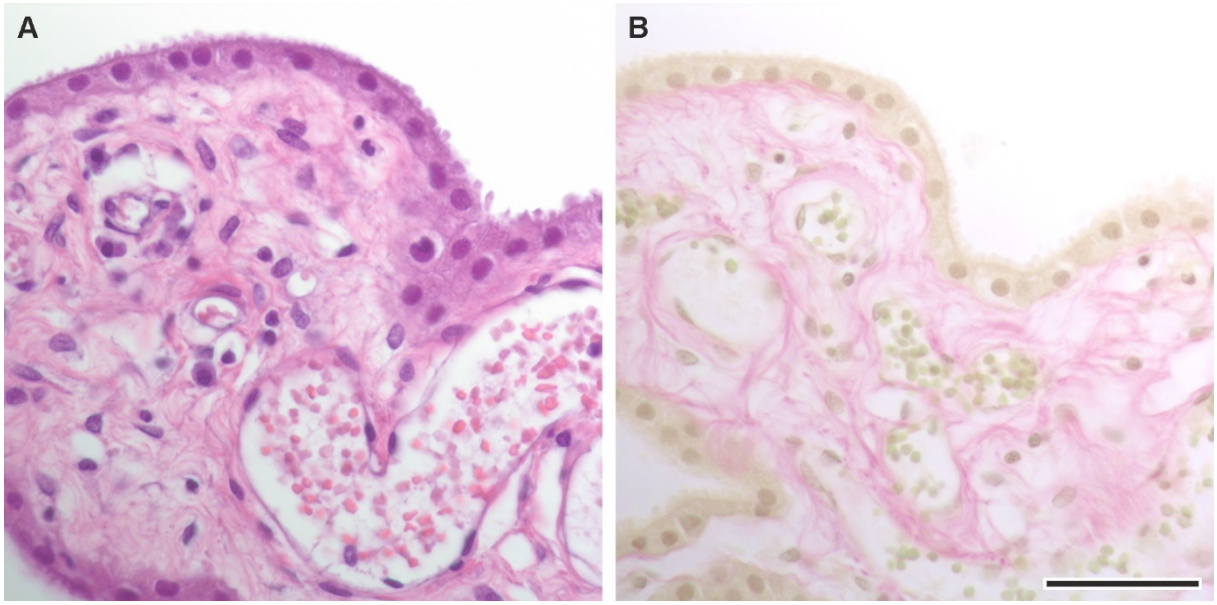

Figure 1. Plexus choroideus ventriculi quarti of an adult dog — detail of one villus. Histological section, (**A**) hematoxylin-eosin, (**B**) van Gieson staining. Note the considerable amount of connective tissue (shown in pink in B) surrounding the vascular network, and the cuboidal epithelium covering the villus. Scale bar: 50 μm.

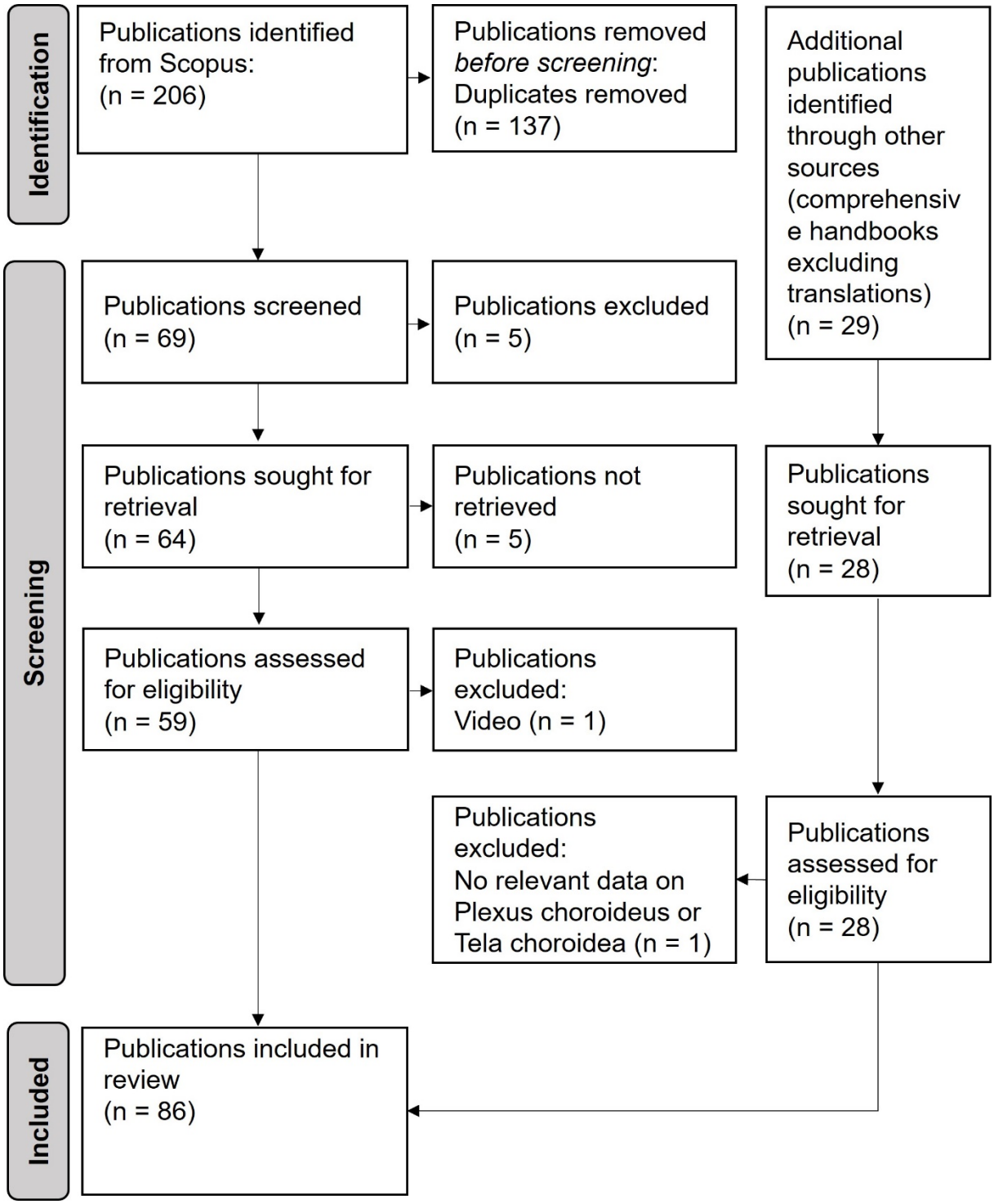

Figure 2. Flow chart illustrating the exclusion process for publications (adapted from PRISMA guidelines)

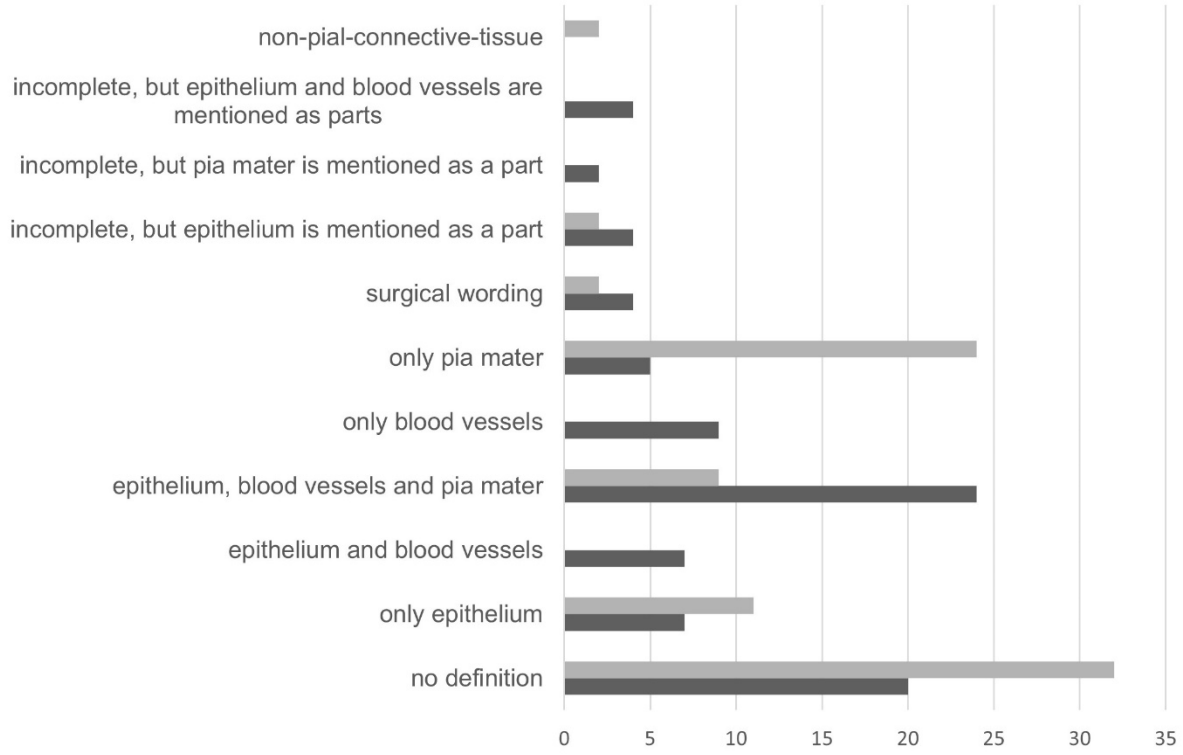

Figure 3. Comparison of Choroid plexus (CP, dark grey) and Tela choroidea (TC, light grey) definitions used in scientific publications. Note the high number of publications not defining the terms. If the involved tissue components are specified, CP is most frequently described to include the ependymal epithelium, whereas the TC does not.

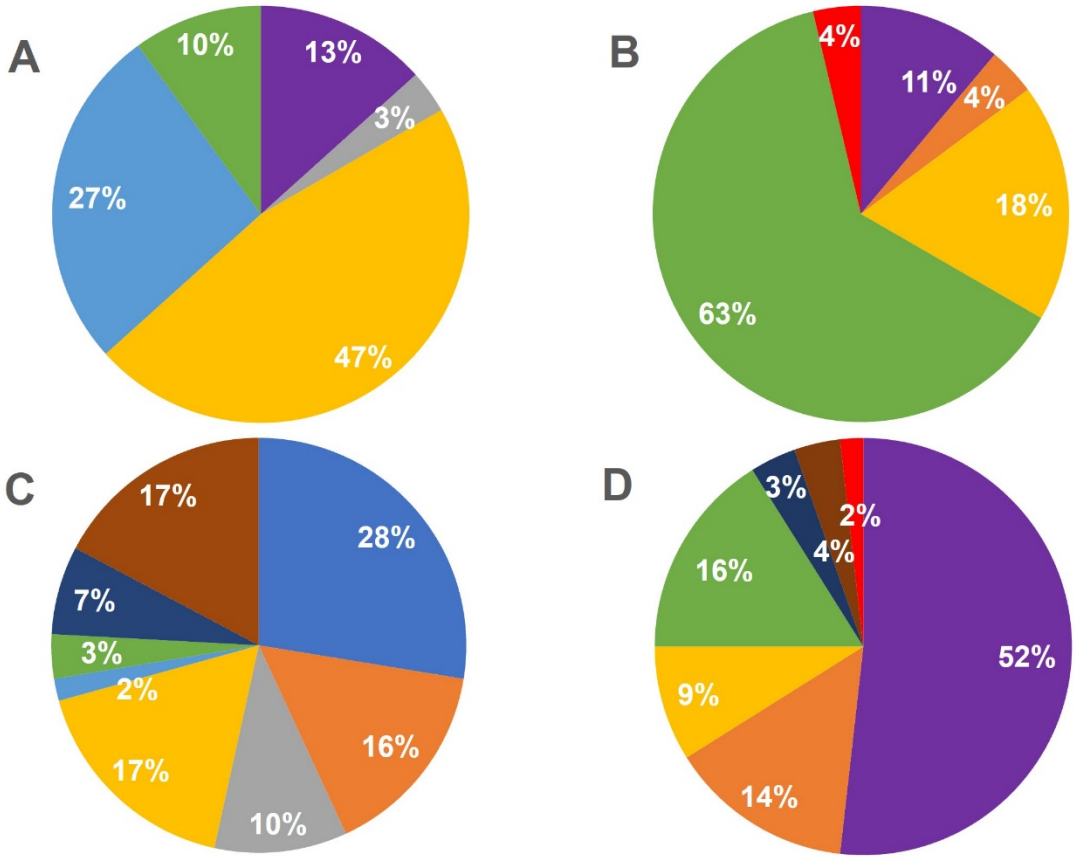

Figure 4. Percentage of use for each definition of the terms choroid plexus (**A, C**) and tela choroidea (**B, D**) differed among the individual source types. **A, B,** handbooks; **C, D,** articles. Purple: no definition; orange: only epithelium; grey: epithelium and blood vessels; yellow: pia mater, epithelium and blood vessels; light blue: only blood vessels; green: only pia mater; red: non-pial connective tissue; dark blue: surgical wording; brown: incomplete definitions.

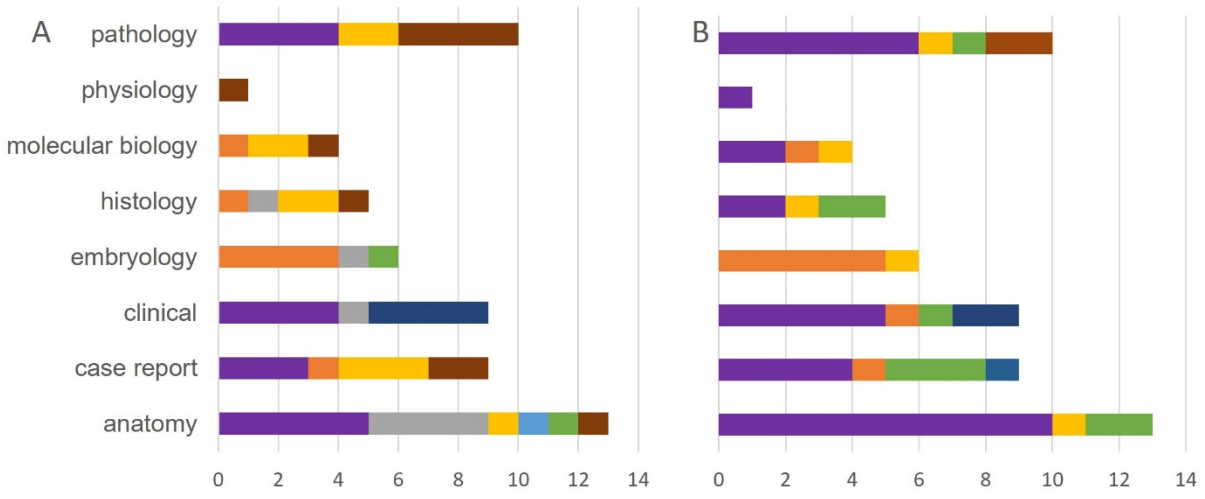

Figure 5. Choroid plexus definitions (**A**) and tela choroidea definitions **(B**) sorted by scientific discipline of the articles. Purple: no definition; orange: only epithelium; grey: epithelium and blood vessels; yellow: pia mater, epithelium and blood vessels; light blue: only blood vessels; green: only pia mater; dark blue: surgical wording; brown: incomplete definitions.

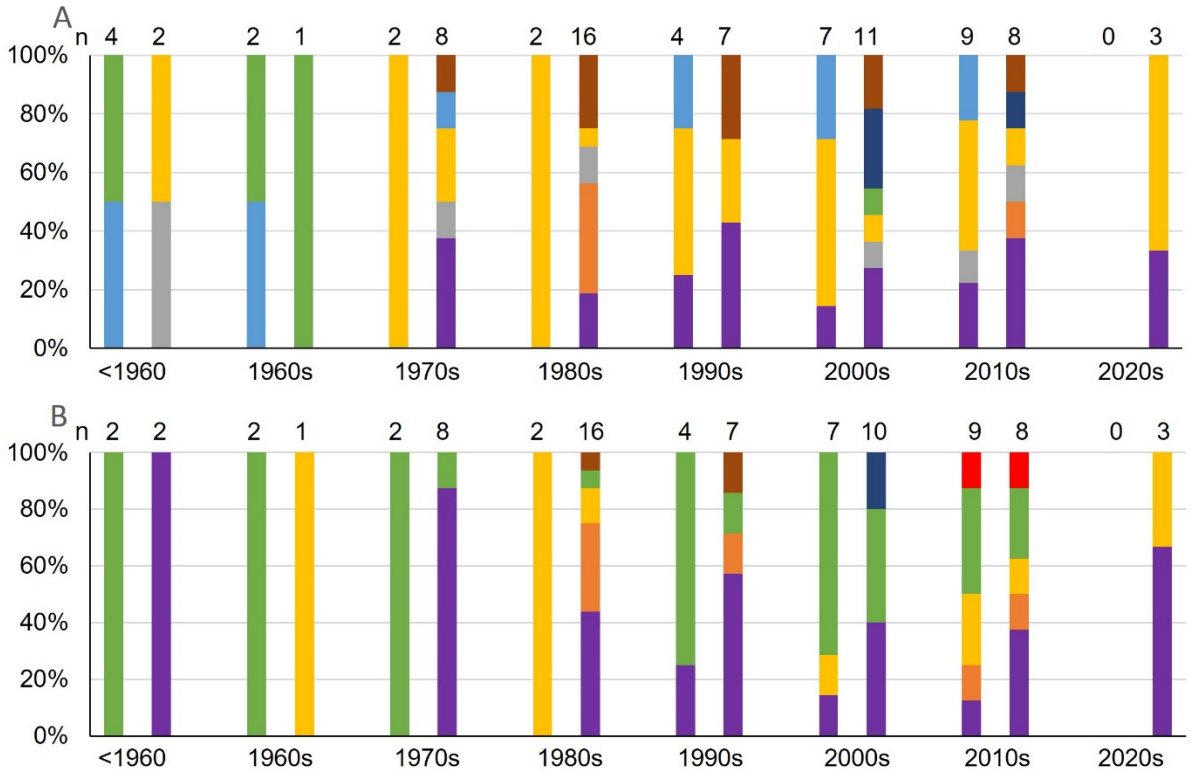

Figure 6. Changed use of choroid plexus (**A**) and tela choroidea (**B**) definitions over time; left column: handbooks; right column: articles; n: number of publications from the indicated decade. Purple: no definition; orange: only epithelium; grey: epithelium and blood vessels; yellow: pia mater, epithelium and blood vessels; light blue: only blood vessels; green: only pia mater; red: non-pial connective tissue; dark blue: surgical wording; brown: incomplete definitions.

Table 1. Example phrases defining the terms Tela choroidea (TC) and choroid plexus (CP) for the categories the publications were classified into

Category	**Wording example**
CP, only epithelium [2, 36, 52, 53, 58, 69, 77]	“These ependymal cells eventually differentiate into the choroid plexus of the ventricular system” [36]
TC, only epithelium [2, 4, 7, 9, 30, 52, 53, 58, 63, 69]	“The thin epithelial roof, the tela choroidea ventriculi tertii, spans between the striae medullares of both thalami” [4]
CP, epithelium and blood vessels [4, 7, 46, 63, 68, 108, 109]	“Effectively, the choroid plexuses are formed by proliferation of the pial vessels accompanied, towards the ventricle, by the ependymal membrane which covers them in their totality” [109]
CP, pia mater, epithelium and blood vessels [1, 3, 5, 8, 10, 11, 14, 15, 17, 26, 30, 32, 33, 41, 43, 48, 51, 55, 81, 84, 94, 100, 105, 106]	“From the vascular layer of the leptomeninx, the pia mater, blood capillaries lower themselves villous and knot-like into the thin walls and protrude into the ventricle. The capillary loops are covered by single-layered ependyma and are called plexus choroideus. The choroid plexus therefore consist of a lamina choroidea epithelialis and lamina choroidea propria” [84]
TC, pia mater, epithelium and blood vessels [8, 10, 14, 21, 33, 43, 74, 77, 81, 101]	“The wall of the brain ventricles consists only of a thin epitheial layer in these places — the lamina epithelialis, which consists of adapted ependyma. The lamina epithelialis is covered on the outside by pia mater, which is richly spanned by vascular networks; together lamina epithelialis and pia mater form the vascular veil — the lamina choroidea [Tela choroidea]” [81]
CP, only blood vessels [20, 25, 38, 54, 66, 95, 96, 103]	“Considering a structural point of view, the choroid plexuses essentially are constituted of arterioles, venoles and webs of capillaries of different calibers, irregularly curled up in themselves” [103]
CP, only pia mater [16, 56, 96, 101, 104]	“Two thickened portions of pia mater” [16]
TC, only pia mater [3, 14, 15, 24-26, 30, 32, 38, 41, 48, 49, 54-56, 59, 62, 71, 84, 89, 95,	“The tela choroidea ventriculi quarti consists of two-layered pia mater, which inserts between the bottom surface of the cerebellum and the roof part of the fourth ventricle” [62]

96, 100, 103-106]	
TC, non-pial-connective tissue [20, 36]	“The tela choroidea is a plate of connective tissue covered from the ventricle side by ependyma and on its surface by pia mater” [20]
CP and TC, surgical wording [22, 23, 39, 49]	After the choroid plexus was partially removed and the tela choroidea divided and deflected, the floor of the lateral recess of the fourth ventricle and the convolution of the dorsal cochlear nucleus became visible [23]
CP, Incomplete definition [9, 24, 40, 44, 47, 61, 71, 74, 80, 89]	Anatomical studies employing light microscopy, transmission electron microscopy and scanning electron microscopy have been performed upon the choroidal epithelium. In addition, light and transmission electron microscopic and freeze fracture studies have been executed on the choroidal plexus capillaries” [61]

Supplement 1

Koellmberger, Maximilian, Witter, Kirsti

Use and meaning of the anatomical terms plexus choroideus and tela choroidea in veterinary and human medicine

This supplement contains the original quotes on choroid plexus and tela choroidea from the 86 publications, which were analysed for this study. The quotes are sorted chronologically and are given separately for handbooks and articles. For complete source information, see chapter References of the article. The supplement does not include additional sources used in Introduction and Discussion of the main article. All changes to the original text, such as deletions, additions, and supplementary comments are marked by enclosing them in square brackets. Translations by MK and KW. It was not attempted to generate a correct English syntax, but to focus as best as possible on word-for-word correspondence between original and translation. National anatomical terms (e.g. “Sehhügel” for thalamus) were not translated.

Original quotes from the handbooks:

Gray, 1858:

p. 450: “It [pia mater] invests the entire surface of the brain, dipping down between the convolutions and laminae, and is prolonged into the interior, forming the velum interpositum and choroid plexuses of the fourth ventricle”.

p. 464: “The choroid plexus is a highly vascular, fringe-like membrane, occupying the margin of the fold of pia mater (velum interpositum), in the interior of the brain. […] In structure, it consists of minute, and highly vascular villous processes, the villi being covered by a single layer of epithelium, composed of large, round corpuscles, containing, besides a central nucleus, a bright yellow spot”.

p. 465: “Through this fissure [transverse fissure] the pia mater passes from the exterior of the brain into the ventricles, to form the choroid plexuses. Where the pia mater projects into the lateral ventricle, beneath the edge of the fornix, it is covered by a prolongation of the lining membrane, which excludes it from the cavity”.

Bradley, 1897:

p. 146: “Pia mater – this is similar to the same covering of the cord, being the vascular membrane. The velum interpositum is a remarkable dependency which insinuates itself between the cerebrum and cerebellum ultimately gaining the interior of the lateral ventricles, where it terminates in the choroid plexuses. A somewhat similar fold passes between the cerebellum and medulla oblongata and ends in the choroid plexuses of the fourth ventricle”.

p. 151: “The Choroid plexuses of the 4th Ventricle. – This is the name applied to two thickened portions of pia mater which lie between the restiform bodies and the cerebellum, one on each side. It is now customary to consider that these plexuses are shut off from the interior of the 4th ventricle by a thin membrane”.

Testut, Latarjet, 1948:

p. 874: “A la paroi postérieure du ventricule bulbo-cérébelleux se rattachent deux formations choroïdiennes, dépendant l’une et l’autre de la pie-mère. Ce sont: 1° la toile choroïdienne inferieure; 2° les plexus choroïdes du quatrième ventricule. Toute membrane choroïdienne est de dépendance de la pie-mère. Elle comprend deux feuillets a l’intérieur desquels se développent des anses vasculaires qui constituent les plexus choroïdes“. [Two choroid formations are attached to the posterior wall of the bulbo-cerebellar ventricle, which both depend on the pia mater. These are: 1st the tela choroidea inferior; 2nd the choroid plexuses of the fourth ventricle. The whole choroid membrane is dependent on the pia mater. It comprises two sheets towards the interior, which form vascular loops, which constitute the choroid plexuses].

p. 876f: “Les plexus choroïdes, lors de leur développent, refoulent devant eux cette membrane, s’en coiffent et font saillie dans la cavité ventriculaire ; mais ils ne sont pas a l’intérieur de la cavité”. [During their development the choroid plexuses push back the membrane in front of them, curl up and protrude towards the ventricular cavity; yet they are not inside the interior of the cavity].

p. 1058: “La pie-mère s’insinue dans l’intérieur ou, plus exactement, dans l’épaisseur du cerveau, en formant trois prolongements: deux prolongements pairs et latéraux, disposes sous forme de cordons, ce sont les plexus choroïdes ; un prolongement impair et médian, affectant la forme de membrane, c’est la toile choroïdienne supérieure. […] Les plexus choroïdes sont deux cordons rougeâtres et granuleux, en forme de J, occupant successivement les deux portions sphénoïdale et frontale des ventricules latéraux. […] La, ils forment, dans la plupart des cas un renflement, de forme et de dimensions variables, le glome choroïdien“. [The pia

mater insinuates itself towards the interior or, more precisely, towards the depths of the brain, and forms three extensions: a pair of two lateral extensions arranged in the form of cords, these are the choroid plexuses; and an unpaired median extension, taking the form of a membrane, this is the tela choroidea superior. […] The choroid plexuses are two reddish and granulated cords, in the shape of a J, successively occupying the two sphenoidal and frontal portions of the lateral ventricles. There they form an enlargement in the majority of cases, which variates in form and dimension; the glomus choroideus].

p. 1060: "Envisages au point de vue de leur structure, les plexus choroïdes sont essentiellement constitues par des artérioles, des veinules et des lacis de capillaires de différents calibres, irrégulièrement pelotonnes sur eux-mêmes. […] Rappelons que, sur la surface libre des plexus choroïdes, s'étale une couche de cellules épithéliales qui ne sont autres que les cellules épendymaires". [Considering a structural point of view, the choroid plexuses are essentially constituted of arterioles, venoles and webs of capillaries of different calibres, irregularly curled up in themselves. […] Note that, on the free surface of the choroid plexuses a coat of epithelial cells spreads, which are none other than the ependymal cells].

p. 1062: "La toile choroïdienne, étant une simple invagination de la pie-mère, présente la même structure fondamentale que cette dernière membrane". [The tela choroidea, being a simple invagination of pia mater, presents the same fundamental structure as the aforementioned membrane].

Sisson, 1953:

p. 783: "Important folds of the pia extend into two of the great fissures of the brain. One of these passes in at the transverse fissure between the cerebellum and the cerebral hemispheres, and is continued so as to overlie the third ventricle; it forms the tela chorioidea of that cavity. Another fissure passes in at the fissure between the cerebellum and the medulla oblongata and forms the tela chorioidea of the fourth ventricle. They constitute paths to the deeper vessels and their edges contain vascular convolutions which are known as chorioid plexuses".

p. 793: "The recess between the lateral aspect of the medulla and the cerebellum is occupied by an irregular mass of villous projections of the pia mater, containing tufts of vessels; this is the choroid plexus of the fourth ventricle, and is the lateral edge of the tela chorioidea".

p. 799: "The layer of pia mater which actually forms the roof here is named the tela chorioidea of the fourth ventricle. It is triangular in outline and is closely adherent to the velum. It forms three fringed masses which contain vascular convolutions and are designated the median and lateral chorioid plexuses of the fourth ventricle (Plexus chorioideus ventriculi

quarti). They appear to lie within the ventricle, but are really excluded from the cavity by the epithelial lining, which they invaginate".

p. 803: "The roof [of the third ventricle] is formed in the strict sense only by the ependyma, above which is a fold of pia mater, termed the tela chorioidea of the third ventricle. The roof is invaginated by two delicate chorioid plexuses (Plexus chorioidei ventriculi tertii) which appear to lie within the ventricle, although they are excluded from the cavity by the epithelium".

p. 807: "The interval between the hippocampus and fimbria on the one hand, and the brain stem on the other, is a lateral continuation of the transverse fissure of the brain, and is occupied by a fold of pia mater, the tela chorioidea of the third ventricle. […] The lateral borders [of the tela] will be seen on the floor of the lateral ventricles, where they form thick, rounded bands containing convolutions of blood-vessels, known as the chorioid plexuses of the lateral ventricles".

p. 812: "This [plexus chorioideus ventriculi lateralis] is the thickened edge of a fold of pia mater, the tela choroidea of the third ventricle, which lies between the hippocampus and the thalamus. It contains convolutions of small blood vessels, and in old subjects there are often calcareous concretions in it".

Kolda, Komarek, 1962

p. 87f: "Pia mater encephali pokrývá mozek po cele ploše a vniká též do fissura longitudinalis a do fissura transversa. Z této se dostává v podobě duplikatur s mediální strany do komor mozkových, kde představuje útvary zvané telae choroideae, hustě protkané krevními cévkami, takže tu vzniká plexus choroideus. Tyto kyjovité a úponkovité útvary jsou oproti dutinám komorovým kryty pomoci lamina epithelialis / zbytku embryonálního zakladu roury nervové /, čímž jsou úplně odděleny od lumina komor. [The pia mater covers the entire surface of the brain and also reaches into the fissura longitudinalis and fissura transversa. From there it reaches as duplications of the pia mater from the medial side into the cerebral ventricles, where they form heavily vascularized structures called telae choroideae, so here a plexus choroideus is formed. These club- or vine-shaped structures are covered towards the ventricles by the lamina epithelialis /remnant of the embryonal neural tube/, which is why they are completely separated from the lumen of the ventricles].

Ghetie, 1967:

p. 606: “Pia mater craniana imbraca toate componentele encefalului, aderînd intim la substanţa nervoasa, căreia îi urmăreşte cu fidelitate toate accidentele de relief. Ceea ce o caracterizează in mod deosebit este faptul ca trimete in cavităţile ependimare ale prozencefalului si rombencephalului nişte prelungiri, remarcabile prin dezvoltarea lor, constituind pînzele coroidiene. Aceste pînze sînt prevăzute la rîndul lor cu bogate reţele vasculare, denumite plexuri coroidiene, ce au rolul de a secreta lichidul cefalo-rahidian. Ţinînd seama de situaţia lor topografica, pînzele si plexurile coroidiene corespunzătoare lor se împart in: cerebrale si cerebeloase. 1. Plexurile coroidiene cerebrale, rezultate din insinuarea pieimater prin fisura cerebrala, trecînd apoi printre trigonul cerebral si straturile optice, sînt alcătuite din doua componente: plexul coroidian al ventriculului III, situat deasupra straturilor optice, si plexurile coroidiene ventriculilor laterali, in continuarea precentului prin orificiile lui Monro. 2. Plexurile coroidiene cerebeloase sînt situate pe plafonul ventriculului IV, fiind alcătuite din o porţiune mediana, aşezata deasupra valului medular posterior, si doua porţiuni colaterale dezvoltate, dispuse sub lobii laterali ai cerebelului”. [The cranial pia mater coats every component of the encephalon, adhering intimately to the nervous substance, following every accent of relief. Making it characteristic in a special way is the fact that it sends a couple of extensions into the ependymal cavity by the prosencephalon and rhombencephalon, which are remarkable for their development, constituting choroid curtains. These curtains are provided in turn by rich vascular networks, called choroid plexuses, that are designed to secrete cerebrospinal fluid. Taking into account the situation of their topography, curtains and their corresponding plexuses are divided into: cerebral and cerebellar. 1. The cerebral choroid plexus results from pial insinuation into the cerebral fissure, then passing between the fornix and optical layers, consisting of two components: the choroid plexus of the third ventricle, situated above the optical layer and the choroid plexuses of the lateral ventricles, which are in continuation of the previous one through the foramen of Monro. 2. The cerebellar choroid plexus is situated on the roof of the fourth ventricle, being composed of a median portion sitting above the posterior medullary velum and two well-developed collateral portions, arranged below the lateral lobi of the cerebellum].

Nickel, 1975:

p. 73: “Lateral geht der scharfe Rand der Fimbria hippocampi und des Fornix in jenen Teil der medialen Hemisphärenwand über, der gewissermaßen auf der Entwicklungsstufe einer Lamina tectoria der embryonalen Hemisphärenblase verharrt und mit der Tela chorioidea prosencephali der Leptomeninx verklebt. Von dieser werden Blutkapillaren knötchen- und

zottenartig ins Lumen der Seitenventrikel vorgetrieben, wobei die ursprüngliche Lamina tectoria mitgenommen wird, die dann die Gefäßranken der Tela chorioidea als einschichtiges Ependymlager überzieht. Dieses wird als Lamina chorioidea ependymalis bezeichnet. Die von der Tela chorioidea prosencephali gelieferte Lamina choriodea propria und die Lamina chorioidea ependymalis bilden zusammen das Adergeflecht des Seitenventrikels, Plexus chorioideus ventriculi lateralis, das das ganze Cornu temporale und die Pars centralis der Seitenkammer einnimmt". [Laterally the sharp edge of the fimbria hippocampi and fornix merges into the part of the medial hemispheric wall that basically stays in the developmental stage of a lamina tectoria of the embryonal hemispheric vesicle and fuses with the tela chorioidea prosencephali of the leptomeninx. From here [Tela chorioiea prosencephali] capillaries are sent in knots and villi towards the lumen of the lateral ventricle, taking the lamina tectoria with them, which thus covers the vinelike vessels of the tela choroidea as a single-layered ependyma. This is called the lamina chorioidea ependymalis. The lamina chorioidea propria, which is provided by the tela chorioidea prosencephali, and the lamina chorioidea ependymalis form together the plexus chorioideus ventriculi lateralis, which occupies the whole cornu temporale and pars centralis of the lateral ventricle].

p. 91f: "Diese [Lamina tectoria ventriculi quarti] besteht aus einem einschichtigen Ependymlager, das von den Gefäßranken der Tela chorioidea rhombencephali größtenteils als Tela chorioidea ependymalis zottenartig ins Ventrikellumen eingestülpt wird. Die so entstehenden paarigen Adergeflechte des 4. Ventrikels, Plexus choroideus ventriculi IV, sind bei den Haussäugetieren mächtig entwickelt und lassen einen medialen und einen lateralen Anteil unterscheiden". [This [Lamina tectoria ventriculi quarti] consists of a single-layered ependyma, which largely gets protruded into the ventricular lumen by the vine-like vessels of the tela chorioidea rhombencephali. The thus formed bilateral plexus chorioideus ventriculi IV are strongly developed in domestic mammals and a medial and lateral part can be differentiated].

p. 93: "Die Gefäßranken der Adergeflechte weisen dagegen einen einschichtigen Ependymüberzug, die Tela choroidea ependymalis, auf, dessen kubische Zellen i.a. einen Bürstenbesatz besitzen und sich durch Einschlüsse verschiedenster Art im Zytoplasma auszeichnen. [The vine-like vessels of the plexus show a single-layered cover of ependyma, the tela chorioidea ependymalis, whose cubic cells have mostly microvilli and various inclusions in their cytoplasm].

Waldeyer, Mayet, 1976:

p. 293: “Die Tela choroidea, das zarte bindegewebige Häutchen, über die dem Plexus Gefäße zugeführt werden, liegt unter dem Crus fornicis“ [The tela choroidea, the delicate membrane of connective tissue, which supplies the choroid plexus with blood vessels, lies under the crus fornicis].
p. 295: “Zwischen den beiden jetzt freigelegten Thalami erscheint eine dünne Bindegewebsplatte, die Tela choroidea ventriculi tertii, die aus Pia mater Gewebe hervorgegangen ist”. [Between the two now exposed thalami appears a thin sheet of connective tissue, the tela choroidea ventriculi tertii, which originated from pia mater tissue].
p. 352: “Die Tela choroidea des Seitenventrikels wird ganz, die des III. und IV. Ventrikels stellenweise durch kleine Gefäßknäule, die sich aus der Pia mater entwickeln, in das Ventrikellumen vorgestülpt. Die mit ependymalem Gewebe überzogenen Gefäßknäule, Plexus choroidei, produzieren den Liquor cerebrospinalis“ [The tela choroidea of the lateral ventricle is completely, the one of the third and fourth ventricle partially projected towards the ventricular lumen by small bundles of blood vessels which develop from the pia mater. These bundles, covered by ependymal tissue, plexus choroidei, produce liquor cerebrospinalis]

Ellenberger, Baum, 1977:

p. 790: “Die Pia mater encephali dringt auch in den Sagittal- und Querspalt ein und von letzterem nach dem Hohlraumsystem des Gehirns vor. […] Diese Fortsetzungen der Pia mater sind m.o.w. verdickt und heißen Telae chorioideae. In ihr lockeres Bindegewebe sind viele Blutgefäße eingelagert; Telae chorioideae und Blutgefäße bilden die Adergeflechte, Plexus choroidei. Diese sind an den Stellen, wo sie scheinbar im Gehirn liegen, von der Lamina epithelialis , dem Rest der embryonalen Epithelschicht der Gehirnblasenwand, überzogen und durch sie vom eigentlichen Hohlraumsystem des Gehirns vollständig getrennt“. [The pia mater encephali also penetrates the fissura longitudnalis and transversa and extends from the latter towards the ventricular system of the brain. […] These extensions of pia mater are more or less thickened and are called telae choroideae. Many blood vessels are embedded in their loose connective tissue. Telae choroideae and blood vessels form the choroid plexuses. In the places, where they seem to lie inside the brain, they are covered by the lamina epithelialis which is the remnant of the embryonal epithelial layer of the brain wall and by her are completely separated from the ventricular system of the brain].
p. 802: “Die Tela ist mit Gefäßgeflechten versehen und bildet hier einen seitlich von außen sichtbaren, die Apertura lateralis bedeckenden Plexus choroideus rhombencephali“. [The tela is equipped with networks of blood vessels and forms here a plexus choroideus

rhombencephali, which covers the apertura lateralis and can laterally be seen from the outside].

p. 813: “Die Plexus sind also nur Duplikaturen der Pia mater mit reichlichen Blutgefäßzotten, die an der dem Ventrikel zugekehrten Seite ihrer Oberfläche von der mit der Pia eingestülpten einschichtigen Lamina epithelialis bedeckt sind”. [The plexuses are mere duplicatures of pia mater with many villous blood vessels, which are covered on their surface facing the ventricle by the single-layered lamina epithelialis].

p. 827: “An ihrer peripheren Oberfläche sind alle Laminae choroideae mit der Pia mater verwachsen, die an solchen Stellen mächtig verdickt und blutgefäßreich ist, als [Gefäßvorhang oder] Tela choroidea bezeichnet wird und zahlreiche Gefäßzotten gegen den Hohlraum vortreibt; es sind dies die Plexus choroidei“ [On their peripheral surface all laminae choroideae are connected to the pia mater, which is thickened and vascularized in these places, called tela choroidea and sprouts numerous villous blood vessels towards the cavity; these are the choroid plexuses]

R. Najbrt et al, 1982:

p. 270f: “Na mozku nacházíme místa, kde stěna původní neurální trubice nezbytněla nervovými a gliovými buňkami. Stěnu mozkových komor v těchto místech tvoří pouze tenka epiteliální blána – lamina epithelialis, tvořená pozměněným ependymem. Na lamina epithelialis přiléhá z vnější strany hebká plena, bohatě protkaná cévními sítěmi; epiteliální blána a hebká plena dohromady tvoří cévnatou rousku lamina choroidea. […] Cévní sítě v cévnaté rousce zmohutňuji a kryty epiteliální blanou se vchlipují do mozkových komor. Vytvářejí tak vychlípené cévnaté žlázy – plexus choroidei, které do mozkových komor vydávají mozkomíšní mok“. [In the brain we find locations where the wall of the former neural tube has not thickened by proliferation of neurons and glia cells. In these places the wall of the brain ventricles consists only of a thin epitheial layer– the lamina epithelialis, which consists of adapted ependyma. The lamina epithelialis is covered on the outside by pia mater, which is richly interlaced by vascular networks; together lamina epithelialis and pia mater form the lamina choroidea. […] The vascular networks in the lamina choroidea become more pronounced and invaginate, covered by the lamina epithelialis, into the brain ventricles. Thus they form the vascular glands – the plexus choroidei, which secrete cerebrospinal fluid into the brain ventricles].

Benninghoff, 1985:

p. 46: “In bestimmten Bereichen des Endhirns, Zwischenhirns und Rautenhirns ist die Wandung der Ventrikel auf eine einzige Zellage reduziert, die Lamina epithelialis choroidea. Diese steht in kontinuierlicher Verbindung mit der Ependymauskleidung der übrigen Ventrikelwand. Eine Basallamina grenzt die Lamina epithelialis choroidea vom gefäßreichen leptomeningealen Bindegewebe ab. Die gefäßführende Bindegewebsplatte wird – zusammen mit der Lamina epithelialis – auch als Tela choroidea bezeichnet. Über weite Areale ist die Tela choroidea unter Bildung zahlreicher, oft bäumchenartig verzweigter Zotten in das Ventrikellumen eingestülpt. Die ganze Bildung wird Plexus choroideus genannt. Jede Zotte wird von einer einschichtigen Lage kubischer Epithelzellen bedeckt und ist von lockerem Bindegewebe und Blutgefäßen ausgefüllt“. [In certain areas of the telencephalon, diencephalon and rhombencephalon the ventricular wall is reduced to a singular layer of cells, the lamina epithelialis choroidea. It is continuously connected with the ependymal coating of the rest of the ventricular wall. A basal lamina separates the lamina epithelialis from the vascular leptomeningeal connective tissue. The vascular sheet of connective tissue together with the lamina epithelialis is also called tela choroidea. Across wide areas the tela choroidea is invaginated towards the ventricular lumen by countless, often treelike branched villi. This whole formation is called choroid plexus. Each villus is covered by a singular layer of epithelial cells and contains loose connective tissue and blood vessels].

p. 79: “Epithel, Blutgefäße und mesenchymales Stroma bilden zusammen den Plexus choroideus der Seitenventrikel. Auch die Plexus choroidei des III. und IV. Ventrikels entstehen in ähnlicher Weise aus Aussackungen von verdünntem Epithel (Lamina epithelialis choroidea) der Hirnwand“. [Epithelium, blood vessels and mesenchymal stroma form together the choroid plexus of the lateral ventricle. The choroid plexuses of the third and fourth ventricles develop in a similar way from the thinned epithelium (lamina epithelials choroidea) of the brain wall].

p. 119: “Im Bereich der Medulla oblongata ist die Deckplatte auf eine einschichtige Lage von Epepndymzellen reduziert, die Lamina epithelialis choroidea (früher Lamina tectoria). Sie baut mit der ihr aufliegenden Pia die Tela choroidea ventriculi quarti auf“. [In the area of the medulla oblongata the roof plate is reduced to a single layer of ependymal cells, the lamina epithelialis choroidea (formerly lamina tectoria). It forms together with the pia, which covers it, the tela choroidea ventriculi quarti].

p. 129: “Ein Teil der Tela choroidea bildet die Plexus choroidei ventriculi quarti, die in den Ventrikel hineinhängen und Liquor cerebrospinalis absondern. Die Plexus bestehen aus ventralwärts vorgewachsenen Gefäßschlingen des leptomeningealen Anteils der Tela, die vom

sog. Plexusepithel überzogen sind, dem eingestülpten Teil der epithelialen Lamelle“. [A part of the tela choroidea forms the plexus choroidei ventriculi quarti, which hang into the ventricle and secrete liquor cerebrospinalis. The plexuses consist of ventricle-ward invaginated loops of blood vessels of the leptomeningeal part of the tela which are covered by the so-called plexus epithelium, the invaginated part of the epithelial lamella].

Koch, 1993:

p. 345: “Die den Laminae epitheliales anliegenden Piaabschnitte sind meist besonders gefäßreich (Tela choroidea) und bilden mit den Laminae epitheliales zusammen stark gefältelte, tief in die Gehirnkammer hineinragende Adergeflechte (Plexus choroideus)“ [The parts of the pia mater adjacent to the laminae epitheliales are highly vascularized and together with the laminae epitheliales form highly folded meshes of blood vessels (plexus choroideus)]

p. 421: “Die Pia mater ist an der Stelle, wo sie die Lamina epithelialis bedeckt, stark vaskularisiert, so daß man diesen Bereich der Pia als Tela choroidea bezeichnet. Sie ist mit der Lamina epithelialis innig verbunden und drängt sich mit ihr in die vierte Gehirnkammer vor, wölbt sich aber auch deutlich sichtbar seitlich vor. Wir nennen dieses geflechtartige Gebilde – die Lamina epithelialis ist ja mit freiem Auge nicht sichtbar – den Plexus choroideus ventriculi quarti“. [Where the pia mater is covered by the lamina epithelialis, it is highly vascularized, so that this area of the pia is called tela choroidea. It is intimately connected with the lamina epithelialis and protrudes towards the fourth ventricle but also visibly towards the sides. We call this formation – the lamina epithelialis is not visible to the naked eye – the plexus choroideus ventriculi quarti].

p. 461: “Der kaudale Teil des kaudalen Marksegels besteht nur noch aus Ependym, das durch starke Gefäßranken der Tela choroidea jederseits ins Innere der vierten Gehirnkammer vorgebuchtet wird, so die beiden bilateralen Plexus choroidei ventriculi quarti darstellend“. [The caudal part of the medullary velum consists only of ependyma which on each side is invaginated by the strong vines of blood vessels of the tela choroidea towards the interior of the fourth ventricle, representing the plexus choroidea ventriculi quarti].

Gray, Williams, 1995:

p. 242: “The vascular pia mater (Tela choroidea), in an inverted V formation cranial to the apertures, invaginates the ependyma to form vascular fringes- the vertical and horizontal parts of the choroid plexus of the fourth ventricle”.

p. 246: “The roof plate of the diencephalon, rostral to the pineal gland (and continuing over the median telencephalon) remain thin and epithelial in character and is subsequently invaginated by the choroid plexuses of the third ventricle. […] Here, and elsewhere, choroid plexuses develop by the close apposition of vascular pia mater and ependyma without intervening nervous tissue. With development, the vascular layer is infolded into the ventricular cavity and develops as a series of small villous projections, each covered by a cuboidal epithelium derived from the ependyma”.

p. 910: “In two regions, the fore- and hindbrains, parts of the neural tube do not generate nerve cells but become thin, folded sheets of highly vascular secretory tissue, the choroid plexuses”.

p. 940: “Finally, the ependyma is highly modified where it lies adjacent to the vascular layer of the choroid plexuses. Here the cells resemble those of the circumventricular organs, except that they do not have basal processes but constitute a cuboidal epithelium resting on a basal lamina adjacent to the externally applied pia and capillary layer (with fenestrated endothelium). Cells have numerous long microvilli with a few cilia interspersed; they have many mitochondria and large Golgi complexes and their nuclei are basally placed. Tight junctions forming a transepithelial barrier and desmosomes occur between the cells and the lateral margins of the cells are highly folded. All of these structural features accord with the secretory activity of these cells, which are responsible for the formation of most of the cerebrospinal fluid”.

p. 1203: “In the lateral and third ventricles, the choroid plexus is a part of the tela choroidea, which has a core of meninges invaginated during development along a linear region of the medial hemispheric wall where no nervous tissue develops. Hence, leptomeninges (pia mater) are directly in contact with the ventricular ependyma as the two tissues fuse to form the choroid plexus, which otherwise consists chiefly of small blood vessels, capillaries and nerve fibres. […] As described above, two layers of pia mater fuse to form the tela choroidea of the third ventricle (as usually termed, although the choroid plexus of the lateral ventricles are extensions of it). […] The roof of the fourth ventricle develops as a thin sheet in which pia mater is in contact with the ependymal lining of the ventricle and there is no intervening neural tissue. This thin sheet forms the tela choroidea of the fourth ventricle”.

p. 1204: “The choroid plexus has a villous structure with the stroma composed of meningeal cells derived from pia mater. […] An epithelium derived from ependyma, coats the surface of the choroid plexus. It is a low cuboidal epithelium with numerous microvilli but few cilia on the surface. […] Immunocytochemistry has shown that the epithelial cells contain S100

protein and the enzyme carbonic anhydrase C. In this way, the choroid plexus epithelium can be distinguished from ependyma which does not express carbonic anhydrase C. […] Phagocytic cells are present in the stroma of the choroid plexus".

Netter, 1997:

Labelled figures only, citation/translation not applicable

Rouvière, Delmas, 2002:

p. 21: "Le voile médullaire inferieur s'unit a la face profonde de la pie-mère, qui forme à ce niveau la toile choroïdienne inferieure ou toile choroïdienne du quatrième ventricule". [The medullary velum unites itself with the underside of the pia mater, which at this level forms the tela choroidea inferior or tela choroidea of the fourth ventricle].

p: 43: "Nous dirons en décrivant l'enveloppe la plus interne du system nerveux central cérébro-spinal, que cette enveloppe recouvre directement et dans toute son étendue le système nerveux central et qu'elle envoie dans toutes les dépressions des replis qui revêtent exactement leur surface. C'est ainsi qu'elle s'invagine dans l'anfractuosité profonde qui sépare la face inferieure du cérébellum du toit de la partie bulbaire du quatrième ventricule, sous la forme d'un large repli, appelé toile choroïdienne inferieure ou toile choroïdienne du quatrième ventricule". [We will explain and describe the innermost coating of the central cerebrospinal nervous system; this coating covers the central nervous system directly and to its whole extent and envelops it in all recesses and folds and follows its surface exactly. This is how it also invaginates itself into the deep fissure, which separates the inferior side of the cerebellum from the roof of the bulbar part of the fourth ventricle, in the form of a large fold, called tela choroidea inferior or tela choroidea of the fourth ventricle].

p. 44: "Sur le feuillet antérieur ou bulbaire de la toile choroïdienne se trouvent deux cordons longitudinaux, places de part et d'autre de la ligne médiane, hérissés de villosités formées par des houppes vasculaires: ce sont les plexus choroïdes médians. Les plexus médians se continuent, à leur extrémité supérieure, avec des plexus choroïdes latéraux". [Atop the anterior or bulbar sheet of the tela choroidea lie two longitudinal cords, placed on both sides of the median line and studded with villosities formed by vascular hoops: these are the median choroid plexuses. The median choroid plexuses merge at their superior ends into the lateral choroid plexuses].

p. 90: "Elle [pie-mère] forme un repli qui est la toile choroïdienne supérieure". [It [pia mater] forms a fold which is the superior tela choroidea].

p. 90: “[…] les bords latéraux épaissis forment les plexus choroïdes du troisième ventricule. La toile choroïdienne supérieure présente de chaque côté de la ligne médiane deux plexus choroïdes saillant dans le ventricule moyen […]; ce sont les plexus choroïdes médians. Les plexus choroïdes médians s’étendent d’arrière en avant de la base jusqu’au sommet de la toile choroïdienne. Arrives là les plexus médians s’infléchissent en dehors , l’un à droite, l’autre à gauche ; ils croisent la face intérieure des colonnes du trigone en regard du bord supérieur du foramen interventriculaire et se continuent au-delà avec les plexus choroïdes latéraux“. […the thickened lateral borders form the choroid plexuses of the third ventricle. The tela choroidea superior presents on each side of the midsagittal line two choroid plexuses projecting towards the ventricle […]; these are the median choroid plexuses. The median choroid plexuses extend from back to front and then from base to top of the tela choroidea. Having arrived there the median plexuses bend outwards, one to the right, the other to the left; they cross the interior side of the columns of the fornix facing the superior border of the interventricluar foramen and continue beyond as the lateral choroid plexuses].

p. 91: “Dans tout ce trajet, les plexus choroïdes latéraux sont revêtus et séparés de la cavité du ventricule latéral par une lame épithéliale épendymaire“. [On their whole path the lateral choroid plexuses are coated and separated from the lateral ventricle by an ependymal lining of epithelium].

p. 104: “Cette lame épithéliale est refoulée vers la cavité ventriculaire par les plexus choroïdes du ventricule latéral“. [This epithelial lining is folded into the ventricular cavity by the choroid plexuses of the lateral ventricle].

p. 105: “De même que celles-ci, elle est refoulée vers la cavité ventriculaire par la partie correspondante du plexus choroïde de ventricule latéral, qui présente à ce niveau un renflement, le glomus choroïdien, saillant dans la cavité ventriculaire“. [In the same way, it is invaginated into the ventricular cavity by the corresponding part of the choroid plexuses of the lateral ventricles, which at this level present the glomus choroideus, protruding towards the ventricular cavity].

p. 135: “Nous avons déjà décrit les toiles choroïdiennes supérieure et inférieure, constituées par les replis que la pie-mère envoie d’un part dans la fissure transverse du cerveau, d’autre part entre la moelle allongée et le cérébellum“. [We have already described the superior and inferior tela choroidea, consisting of of pia mater folds, the first one intruding into the transverse fissure of the brain and the second one between the medulla oblongata and cerebellum].

Nickel et. al, 2004

p. 76: “Da sich der Binnenraum zum IV. Ventrikel ausweitet, bleibt die ursprüngliche Deckplatte im hinteren Abschnitt jedoch dünn und bildet als Lamina tectoria mit dem angrenzenden gefäßreichen Bindegewebe der Leptomeninx die Tela choroidea rhombencephali“. [Since the interior space expands to become the fourth ventricle, the initial roof plate remains thin in its caudal part and forms as the lamina tectoria together with the adjacent vascular connective tissue of the leptomeninx the tela choroidea rhombencephali].

p.192: “Die Wand der Hirnventrikel bleibt stellenweise außerordentlich dünn. Sie besteht dann nur aus dem einschichtigen Ependym. Die Wände verharren gewissermaßen auf der Entwicklungsstufe einer Lamina tectoria der embryonalen Hirnbläschen, die mit der Tela choroidea der Leptomeninx verklebt ist. Solche Abschnitte gibt es in unterschiedlicher Ausdehnung in allen 4 Ventrikeln, am ausgedehntesten im Dach der Rautengrube. Von der Gefäßschicht der Leptomeninx, der Pia mater, senken sich Blutkapillaren knötchen- und zottenartig in die dünnen Wände ein und ragen in die Ventrikel hinein. Die Kapillarschlingen sind von einschichtigem Ependym überzogen und werden als Plexus choroideus, Adergeflechte, bezeichnet. Der Plexus choroideus besteht entsprechend aus einer Lamina choroidea ependymalis und einer Lamina choroidea propria”. [In some places the ventricular wall remains remarkably thin. There it only consists of singular-layered ependyma. The walls remain effectively on the developmental stage of a lamina tectoria of the embryonal cerebral vesicle which is fused with the tela choroidea of the leptomeninx. Such structures occur in different sizes in all four ventricles, the largest one in the roof of the fossa rhomboidea. From the vascular layer of the leptomeninx, the pia mater, blood capillaries lower themselves in the shape of villi and knots into the thin walls and protrude into the ventricles. The capillary loops are covered by single-layered ependyma and are called plexus choroideus. The choroid plexus therefore consists of a lamina choroidea ependymalis and a lamina choroidea propria].

p. 203: “Unter dem Fornix verdickt sie [Pia mater] sich zur gefäßreichen Tela choroidea prosencephali, von der unter Einstülpung der Laminae choroideae ependymales das Gefäßrankenwerk der Laminae choroideae propriae in die beiden Seitenventrikel und den III. Ventrikel vorstößt und so den Plexus choroideus ventriculorum lateralium und den Plexus choroideus ventriculi III. bildet. Im Bereich des hinteren Marksegels verdickt sich die Pia mater encephali zu einem gefäßreichen Bindegewebslager, das als Tela choroidea rhombencephali an der Bildung der Adergeflechte des IV. Ventrikels teilhat”. [Under the fornix it [pia mater] thickens to become the richly vascularised tela choroidea prosencephali, from which the vascular tendrils of the laminae choroideae propriae protrude into both lateral

ventricles and the third ventricle, invaginating the laminae choroideae ependymales, thus forming the plexus choroideus ventriculorum lateralium and the plexus choroideus ventriculi tertii. In the area of the velum medullare caudale the pia mater encephali thickens into a richly vascularised mass of connective tissue, which as tela choroidea rhombenephali participates in forming the plexuses of the fourth ventricle].

Barone, 2004:

p. 12: “Elle [Lamina dorsalis] s’y réduit pratiquement au stratum ependymale et s’unit a la méninge interne ou pie-mère pour constituer avec elle, à chacun de ces niveaux, une toile choroïdienne (Tela choroidea), laquelle délègue dans la cavité neurale des plexus choroïdes (Plexus choroidei), formations sécrétoires qui seront décrites avec les segments auxquels elles appartiennent”. [It [lamina dorsalis] practically reduces itself to a stratum ependymale and unites itself with the inner meninx or pia mater to constitute with it, at each point, a tela choroidea, which descends into the neural cavity as plexus choroidei, secretory formations which are described within the brain parts to which they belong].

p. 25: “Quant a la paroi dorsale du myélencéphale, elle reste mince et produit lors de la formation du cervelet, avec la partie correspondante de la pie-mère, la toile choroïdienne du quatrième ventricule (Tela choroidea ventriculi quarti). Chaque angle latéral de ce dernier alors un étroit mais profond récessus latéral (Recessus lateralis) dans lequel s’invagine la toile choroïdienne pour produire un plexus choroïde (Plexus choroideus ventriculi quarti)» [As for the dorsal wall of the myelencephalon, it remains thin and produces together with the corresponding part of the pia mater the tela choroidea ventriculi quarti. The lateral angle of the ventricle later becomes a narrow yet deep recessus lateralis, into which the tela choroidea invaginates itself to form a choroid plexus (plexus choroideus ventriculi quarti)].

p. 31f: “Son plafond présente une partie médiane, dérivée de la lame dorsale, qui reste mince et forme la toile choroïdienne du troisième ventricule (Tela choroidea ventriculi tertii), avec des rudiments de plexus choroïdes [It’s ceiling presents a median part derived from the lamina dorsalis, which remains thin and forms the tela choroidea of the third ventricle with the primordium of the choroid plexus of the third ventricle].

p. 35: “A sa jonction avec la voûte diencéphalique, la paroi dorso-médiale de la vésicule se réduit au stratum ependymale et s’unit a la pie-mère au fond de la fissure transverse pour ébaucher de chaque cote un plexus choroïdes du ventricule latéral (Plexus choroideus ventriculi lateralis) qui prolonge celui du troisième ventricule au bord de la toile choroïdienne”. [On its junction with the diencephalic roof, the dorso-medial wall of the

vesicle reduces itself to a stratum ependymale and unites itself with the pia mater at the bottom of the transverse fissure to form on each side a choroid plexus of the lateral ventricle which then extends to the third ventricle along the border of the tela choroidea].

p. 179: “D’un côté a l’autre de cette attache [tenia du quatrième ventricule], la pie-mère forme la toile choroïdienne du quatrième ventricule (Tela choroidea ventriculi quarti) qui s’invagine dans la cavité de ce dernier pour produire le plexus choroïde du quatrième ventricule (Plexus choroideus ventriculi quarti)”. [From one side of its attachment to the other [tenia of the fourth ventricle] the pia mater forms the tela choroidea of the fourth ventricle, which invaginates itself into the cavity producing the choroid plexus of the fourth ventricle from the tela choroidea]

p. 621ff: “[…] la pie-mère s’invagine dans la cavité ventriculaire en s’unissant au revêtement épendymaire. Elle forme avec lui les toiles choroïdiennes dans lesquelles circulent les vaisseaux destines aux plexus choroïdes qui ourlent les bords. Chaque prolongement de la toile choroïdienne dans un ventricule est forme d’un pli de la pie-mère adossée a elle-même, tapisse sur ses deux faces par l’épendyme ; celui-ci est représenté par une seule assise de cellules cuboïdes. La lame centrale, qui résulte de l’union des deux lames epipiales, porte le réseau vasculaire qui caractérise la toile choroïdienne. Cette duplicité structurelle est bien visible lorsque la toile est arrachée […] Au bord oppose, libre, de ce prolongement de la toile choroïdienne, le conjonctif epipial devient plus abondant sous le revêtement épendymaire; toujours simple et cuboidal. Dans ce conjonctif les vaisseaux développent de fines anses capillaires irrégulièrement dilatées qui se pelotonnent par groupes en lobules saillants sous l'épendyme en autant de glomus choroïdiens (Glomi choroidea). Leur ensemble constitue le plexus choroïde, qui orle sa toile. Certaines substances telles que des colorants, injectées dans le réseau sanguin franchissent l'endothélium vasculaire at diffusent dans le conjonctif choroïdien. Mais ils sont bloqués par le revêtement épendymaire et ne passent pas dans le liquide cérébrospinal. Dans cet épithélium réside la barrière hemoméningée ou hémato-meningée qui assure au liquide cérébrospinal sa composition propre, bien différente de celle du sérum sanguin et contribue avec la barrière hemoneurale a maintenir le tissu nerveux dans un milieu rigoureusement constant [The pia mater invaginates into the ventricular cavity and unites itself with the ependymal coating. It [pia mater] forms with it [ependyma] the choroid plexuses which line their borders. Each extension of the tela choroidea into the ventricle is formed by a fold of pia mater, which, backed by itself, is covered on both sides with ependyma; this is represented by a single row of cuboid cells. The lamina centralis, the result of the union of two epipial laminae, carries the vascular network that is characteristic for the

tela choroidea. This duplicate structure is well visible when the tela is torn off [..].. At the opposite, free edge of this extension of the tela choroidea, the epipial connective tissue becomes more abundant under the ependymal cover, which remains a simple cuboidal epithelium. In the connective tissue the vessels form fine capillary loops, which are irregularly dilated, curl up in groups and form protruding lobules under the ependyma, the choroid plexus glomera. Together they constitute the choroid plexus, which is attached to the tela choroidea. Certain substances such as colorants cross the endothelium when injected into the vascular network and diffuse into the connective tissue. Yet they are blocked by the ependymal cover and do not enter into the cerebrospinal fluid. The hemomeningeal or hemato-meningeal barrier is formed by the epithelium, assuring the proper composition of cerebrospinal fluid which differs considerably from that of blood serum and by forming the haemato-encephalic barrier, it contributes to maintaining the nerval tissue in a strictly constant environment].

Bossy, 2005:

p. 74: “les plexus choroïdes, qui sont à la origine de la production du liquide cérébro-spinal, peuvent être considères comme des systèmes capillaires spéciaux annexes aux toiles choroïdiennes des ventricules cérébraux”. [The choroid plexuses, which are the origin of the production of cerebrospinal fluid, can be considered as a special capillary system attached to the telae choroideae of the cerebral ventricles].

p. 132: “Au niveau de chaque dilatation ventriculaire, la paroi dorsale s’amincit formant une membrana tectoria comprenant trois couches: interne épendymaire, externe piale et intermédiaire neurogliale. Cette organisation persiste dans les voiles médullaires et les ténias, la seule différence étant une couche intermédiaire gliale sans élément nerveux. Les toiles choroïdiennes se réalisent lorsque que disparait la couche intermédiaire ; a ce moment, les vaisseaux de la couche piale prennent de l’importance, ou même prolifèrent pour réaliser les plexus choroïdes. Pour les toiles et les plexus choroïdes, les formations piales sont en contact avec l’épithélium épendymaire”. [At the locations of ventricle formation, the dorsal wall becomes thinner forming a membrana tectoria, which consists of three layers: an internal ependymal, external pial and intermediate neuroglial. This organization persists through the medullary vela and the teniae, the only difference is an intermediate glial layer without nervous elements. The telae choroideae form where the intermediate layer disappears; at this moment the blood vessels of the pial layer gain importance, they proliferate to form the choroid plexuses. For the telae and plexus choroidei, the pial formations are in contact with the ependymal epithelium].

p. 246: “Au niveau des membranes obturatrices, la pie-mère s’épaissit pour former une « toile choroïdienne ». On appelle membrana tectoria la cloison faite de la superposition de l’épendyme et de la couche choroïdienne. Cette différenciation peut aboutir à la formation des plexus choroïdes, amas de tissu choroïdien très vascularise, qui repoussent l’épendyme, en s’invaginant à l’intérieur de la cavité ventriculaire. […] Les plexus choroïdes d’aspect granuleux, grumeleux, correspondent donc à de multiples villosités de pie-mère dont chacune est centrée par une artère choroïdienne. Ces villosités se groupent en bouquets, en pelotons dont la couleur rougeâtre vient de leur importante vascularisation. La surface de ces villosités est à son tour faite de microvillosités”. [At the level of the roof of the fourth ventricle, the pia mater thickens to form a tela choroidea. We call the septum formed by superposition of the ependyma and the choroid layer the membrana tectoria. This differentiation can lead to the formation of the choroid plexuses, clumps of highly vascularized choroid tissue, which displace the ependyma while invaginating into the lumen of the ventricles. […] The choroid plexuses, which are granular and lumpy in appearance, represent multiple villosities of the pia mater, each with a central choroid artery. These villus bundles form bouquets or small balls, whose red colour originate from their rich vascularization. The surface of these villosities itself is covered withf microvilli].

p. 333: “La pie-mère s’invagine au niveau de chacun des ventricules pour réaliser les formations choroïdiennes. C’est le cas en particulier pour les ventricules latéraux ou, dans la fissure choroïdienne, elle donne les plexus choroïdes”. [The pia mater invaginates into each ventricle to form choroid structures. This is particularly the case in the lateral ventricles where, within the choroid fissure they form the choroid plexuses].

Anastasi, 2006:

p. 17: “In alcune aree specifiche si trovano gruppi di cellule ependimali che non presentano ciglia, ma un ampio numero di microvilli (ependima dei plessi corioidei); in queste aree, situate in prossimità del III ventricolo, le cellule ependimali contraggono un rapporto molto stretto con i vasi costituendo in tal modo un dispositivo, il plesso corioideo, che rappresenta la base anatomica per la produzione del liquor”. [In some specific areas, groups of ependymal cells are found, which do not exhibit cilia, but a large number of microvilli (ependyma of the choroid plexuses); in these areas, which are situated near the third ventricle, the ependymal cells are in close contact with blood vessels, thus forming a structure, the choroid plexuses, which represent the anatomical basis for liquor production].

p. 90: “Il velo midollare posteriore (valvola di Tarin) è una lamina di ependima che viene raddoppiata e prolungata a chiudere lo spazio tra i peduncoli cerebellari inferiori da una lamina di pia madre chiamata membrana tectoria; quest’ultima accoglie in sé la tela coriodea del IV ventricolo”. [The posterior medullary velum is an ependymal lamina which becomes doubled and elongated to close the space between the inferior cerebellar peduncles by a sheet of pia mater called membrana tectoria; this contains the tela choroidea of the fourth ventricle].
p. 184: “[…] mentre il metencefalo da origine al cervelletto, il mielencefalo si atrofizza, rimanendo solo l'ependima che si accolla alla pia madre per formare la tela corioidea. […] In alcuni punti della tela corioidea l'ependima s'invagina all'interno della cavita ventricolare sospinto dalla pia madre e da un ciuffo di vasi piali (arteriole, capillare e venule); queste formazioni costituiscono il plesso corioideo”. [while the [roof of the] metencephalon gives rise to the cerebellum, [that of] the myelencephalon atrophies, only leaving the ependyma which adheres to the pia mater to form the tela choroidea. […] In some places of the tela choroidea the ependyma invaginates into the ventricular cavity pushed by the pia mater and a tuft of pial vessels (arterioles, capillaries and venoles); these formations constitute the choroid plexus].
p. 191: “la pia madre […] si pone in diretto contatto con l'ependima, partecipando alla formazione delle tele e die plessi corioidei” [the pia mater gets into direct contact with the ependyma, participating in the formation of the telae and plexus choroidei].

Nieuwenhuys, 2008:
Labelled figures only, citation/translation not applicable

Dyce et al, 2010:
p. 265: “Much of the medial wall of each hemisphere remains particularly thin, and in fetal life a part rolls inward, invaginating the pia mater and blood vessels covered by the ependymal lining into the ventricle, where it develops into the choroid plexus associated with this cavity”.
p.296: “The choroid plexuses are tufts of capillaries covered with ependyma that invaginate into the ventricles at specific locations throughout the brain. […] The plexuses of each of the lateral ventricles and of the third ventricle, which merge within the interventricular foramen, develop within a fold of pia mater that becomes entrapped between the expanding telencephalic vesicles and the roof of the diencephalon. The plexuses of the fourth ventricle

develop separately within the pia over the caudal medullary velum. […] Ependymal cells of the choroid plexuses are joined together with tight junctions”

Esposito, 2010:

p. 104: “La lamina ependimale, e la pia che la riveste, costituiscono, riunite assieme, la tela coroidea o membrana otturatrice del quarto ventricolo”. [The ependymal lamina, and the pia which it covers, constitute together the tela choroidea or membrana obturatoria of the fourth ventricle].

p. 342: “I margini laterali della tela corrispondono a quel solco coriodeo del talamo, di là dal quale la tela, arricchendosi di vasi, forma i plessi coroidei dei ventricoli laterali”. [The lateral margins of the tela correspond with the sulcus choroideus of the thalamus, between which the tela, enriched by vessels, forms the choroid plexuses of the lateral ventricles].

p. 343: “La struttura dei plessi coroidei può essere ben apprezzata considerando, per esempio la organizzazione del terzo ventricolo. La parete e semplicemente costituita di uno strato di cellule ependimali ricoperte di uno strato di pia madre. Lo strato piale si affaccia verso lo spazio subaracnoideo dove si trova la rete vascolare cerebrale. Lo strato ependimale e fatto di cellule cubiche contenenti gocce di lipide, glicogeno, lipofuscine e concrementi di calcio. Le cellule fittamente addensate sono intermesse mediante giunzioni di tipo occludente e poggiano tutte su una membrana basale”. [The structure of the choroid plexuses can be easily recognised considering for example the organization of the third ventricle. The lining is simply constituted by a layer of ependymal cells covered by a layer of pia mater. The pial layer faces the subarachnoid space where the cerebral vascular networks are located. The ependymal layer consists of cuboidal cells containing droplets of lipids, glycogens, lipofuscins and concrements of calcium. The densely packed cells are connected by tight junctions type and rest on a basement membrane].

Stoffel, 2011:

p. 36: “An jenen Stellen, an denen die Wand des Neuralrohrs so dünn bleibt, dass der Ventrikelraum lediglich durch das Ependym von den Hirnhäuten getrennt wird, differenziert sich diese Lamina epithelialis zum Plexus choroideus-Epithel”. [In those areas, where the wall of the neural tube remains very thin, so that the ventricular space is separated from the meninges solely by ependyma, the lamina epithelialis differentiates into the choroid plexus epithelium].

p. 37: “Auch das Ependym, das Plexus-choroideus-Epithel, die Pituizyten und die Pinealozyten gelten als spezialisierte Gliazellen”. [Also the ependyma, the choroid plexus epithelium, the pituicytes and pinealocytes are considered specialized glia cells].

p. 51: “Im Velum medullare caudale treffen Pia mater (Tela choroidea) und die ependymale Lamina epithelialis aufeinander, aus denen der Plexus choroideus ventriculi quarti entsteht”. [In the caudal medullary velum pia mater (tela choroidea) and the ependymal lamina epithelialis come together to form the plexus choroideus ventriculi quarti]

p. 53: “Die Lamina epithelialis rhombencephali wird durch das gefäßreiche Mesenchym der Pia mater eingestülpt. Dadurch entsteht ein Plexus choroideus, welcher Hirn-Rückenmarksflüssigkeit in den IV. Ventrikel absondert”. [The lamina epithelialis rhombencephali is invaginated by the richly vascularised mesenchyme of the pia mater. Thus develops a choroid plexus which secretes cerebrospinal fluid into the fourth ventricle].

p. 67: “Die Wand der Hemisphärenbläschen ist nicht gleichmäßig dick. Am ausgeprägtesten ist die Reduktion der Wandstärke im Bereich der Lamina epithelialis prosencephali. Wie im Dach des IV. Ventrikels ist die Wand des Neuralrohrs dorsal am Diencephalon sowie ventromedial an den Hemisphärenbläschen bis auf das Ependym reduziert. Analog zur Lamina epithelialis rhombencephali gehen aus der Lamina epithelialis prosencephali die Plexus choroidei der Seitenventrikel I und II sowie des unpaaren III. Ventrikels hervor”. [The wall of the hemispheric vesicles is not uniformly thick. The reduction of wall thickness is most pronounced in the area of the lamina epithelialis prosencepahli. Like in the roof of the fourth ventricle, the dorsal wall of the neural tube of the diencephalon as well as the ventromedial wall of the hemispheric vesicles is reduced to the ependyma. Similar to the lamina epithelialis rhombencephali, the choroid plexuses of the lateral ventricles and the unpaired third ventricle arise from the lamina epithelialis prosencephali].

p. 106: “Die Zellen dieses einschichtig kubischen Epithels tragen Microvilli und Zilien. Da es sich um spezialisierte Gliazellen handelt, fehlt zwischen Ependym und subependymalem Nervengewebe eine Basalmembran. […] Aufgrund ihrer gemeinsamen Entstehung aus der Lamina epithelialis prosencephali stehen die Plexus choroidei der Seitenventrikel und des III. Ventrikels durch das Foramen interventriculare hindurch miteinander in Verbindung”. [The cells of this simple cuboidal epithelium carry microvilli and cilia. Since they are specialized glia cells, a basement membrane between ependyma and subependymal nervous tissue is missing. […] Because of their joint origin from the lamina epithelialis prosencephali, the choroid plexuses of the lateral ventricles and third ventricle are connected via the foramen interventriculare].

p. 109: “Die Plexus choroidei stellen die Bildungsstätten des Liquor cerebrospinalis dar. […] Die Ventrikulärschicht differenziert sich zum Plexus-choroideus-Epithel, die Pia mater wird zur Tela choroidea. Die Tela choroidea besteht aus lockerem, gefäßreichem Bindegewebe. Das Endothel dieses dichten Kapillarnetzes ist fenestriert, wobei die Fenestrae durch Diaphragmen verschlossen sind. Die zytologischen Besonderheiten des einschichtig kubischen Plexus-choroideus-Epithels sind apikale Mikrovilli und vereinzelte Zilien, Zonulae occludentes sowie ein basales Faltenlabyrinth. Da dieses Epithel an das piale Bindegewebe grenzt, wird es von einer Basalmembran unterlagert. […] Damit stellt das Plexus-choroideus-Epithel das morphologische Äquivalent der Blut-Liquor-Schranke dar”. [The choroid plexuses represent the production site of the liquor cerebrospinalis […] The ventricular layer differentiates into the choroid plexus epithelium, the pia mater into the tela choroidea. The tela choroidea consists of loose, richly vascularised connective tissue. The endothelium of this dense capillary network is fenestrated, the fenestrae are closed by diaphragms. The cytological characteristics of the simple cuboidal epithelium of the choroid plexus are apical microvilli and sporadic cilia, zonulae occludentes and a basal labyrinth. Since this epithelium borders the pial connective tissue, it is supported by a basement membrane […] Thus the choroid plexus epithelium represents the morphological equivalent to the blood-liquor-barrier].

Anderhuber et al, 2012:

p. 955: “Nach kranial ist er [III. Ventrikel] nur von einer dünnen Ependymschicht und mesodermalen Zellen bedeckt, die sich als Plexus choroideus in den dritten Ventrikel einstülpen”. [Cranially it [the third ventricle] is covered by a thin ependymal layer and mesodermal cells, which invaginate into the third ventricle as the choroid plexus].

p. 1026: “Das dünne epitheliale Dach, die Tela choroidea ventriculi tertii, spannt sich zwischen den Striae medullares der beiden Thalami aus. Aus der auf ihr liegenden Schicht weicher Hirnhaut stülpen Blutkapillaren die dünne Epithellage gegen den Ventrikel vor und bilden so den Plexus choroideus ventriculi tertii”. [The thin epithelial roof, the tela choroidea ventriculi tertii, spans between the striae medullares of both thalami. From the leptomeningeal layer covering the tela choroidea, blood capillaries invaginate the thin epithelial layer into the ventricle and thus form the plexus choroideus ventriculi tertii].

Cihak, 2016:

p. 238: “Na velum medullare inferius dále kaudálně navazuje […] kaudální konec stropu IV. komory [a] vytváří tela choroidea ventriculi quarti – vazivová ploténka pokryta ependymem zevnitř komory a s pia mater na povrchu, ve které je vrostla cévní pleten – plexus choroideus ventriculi quarti. Tela choroidea je důležitým zdrojem mozkomíšního moku, který produkuje do IV. komory”. [To the velum medullare inferius connects caudally the caudal end of the roof of the fourth ventricle, forming the tela choroidea ventriculi quarti. This is a plate of connective tissue covered from the ventricle side by ependyma and on its outer surface by pia mater, into which grows a network of blood vessels – the plexus choroideus ventriculi quarti. The tela choroidea is an important source for the cerebrospinal fluid, which is produced into the fourth ventricle].

Paulsen, Waschke, 2017:

p. 265: “Der Plexus choroideus geht für beide Seitenventrikel und den III. Ventrikel aus der Deckplatte hervor”. [For both the lateral ventricles and the third ventricle the choroid plexus originates from the roof plate].

Lanz, Wachsmuth, 2019:

p. 283: “Die Tela choroidea ventriculi quarti besteht aus einer zweischichtigen Lage von Pia mater, die sich zwischen Unterfläche des Cerebellum und Dachabschnitt des Ventriculus IV einschiebt. Zwischen die Piablätter reicht eine kleine Zisterne mit Gefäßen bis zum Velum medullare caudale”. [The tela choroidea ventriculi quarti consists of a two-layered pia mater sheet, which invaginates between the bottom surface of the cerebellum and the roof part of the fourth ventricle. Between the pia sheets, a small cistern with blood vessels reaches the velum medullare caudale]

<u>Original quotes from the articles:</u>

Herring, 1927:

p. 130: “The fringes of the plexus hang freely in the cerebrospinal fluid of the ventricle. The blood-vessels are capillaries, and the circulation in the plexus is not of the sinusoidal variety which MINOT described as characteristic of the paraphysal gland. The plexus is covered by a single layer of epithelial cells, which show somewhat different histological characteristics in different species of animals”.

Argenta, Merigliano, 1958:

p. 647: “Plessi del III ventricolo: l'osservazione portata sull'ependima e la sottostante sostanza bianca lasciava vedere un epitelio perfettamente normale nella sua continuità e nei suoi rapporti [..]. Alcuni [plessi coroidei] presentavano una vivace iperplasia stromale per lo più in preda a degenerazione jalina” [Plexuses of the third ventricle: the observation of the ependyma and the underlying white matter presented an epithelium, which was perfectly normal regarding its continuity and relationships […] Other choroid plexuses presented a large stromal hyperplasia that was mostly in a state of hyaline degradation”

Avgeropolous, Henson, 1958:

p. 632: “In addition to a meningeal origin, intracranial leiomyosarcoma could also potentially arise from components of the choroid plexus stroma or tela choroidea”.

Strong, 1964:

p. 59: “The vessels only with their pia we shall call the choroid plexus; the ependyma, the lamina choroidea epithelialis or just ependyma; and the combination of the two, tela choroidea”.

Allen, 1975:

p.197: “The latter studies confirmed that the basic structure of the choroid plexus consisted of a single layer of cuboidal epithelial cells, microvilli, cilia and a layer of interposed connective tissue”.

Maillot, Koritke, 1975:

p. 171: “Ces plexus choroïdes sont formes par la prolifération des vaisseaux piemeriens ayant refoule la membrane tectoriale”. [These choroid plexuses are formed by proliferation of pial blood vessels who have pushed back the tectorial membrane].

Dermetziel, 1976:

p. 461f: “Betrachtet man unter dieser Voraussetzung den Aufbau der choroidalen Plexus, so lassen sich mindestens drei Grenzschichten definieren, an denen solche Diffusionsbarrieren lokalisiert sein können: I. Das Ependym als Grenzfläche zwischen Liquorraum und Plexusinterstitium. II. Das interstitielle Gewebe einschließlich der Tela choroidea zwischen der perivaskulären Zone und dem Ependym. III. Das Gefäßendothel als primäre Grenzzone zwischen Blutraum und dem interstitiellen Kompartiment”. [Looking at the configuration of

the choroid plexuses under these circumstances, at least 3 layers can be identified, where these diffusion barriers can be located: I. The epithelium as an interface between liquor space and plexus interstitium, II. the interstitial tissue including the tela choroidea between the perivascular zone and the ependyma, and III. the vessel endothelium as a primary boundary between blood space and the interstitial compartment].

p. 465: “Zwischen der ependymalen Zellschicht und dem Gefäßgeflecht breiten sich die Zellen des Plexusinterstitiums aus, die nach allgemeiner Ansicht leptomeningealen Ursprungs sein sollen. Sie bilden ein weitverzweigtes Netz von schlanken und spindelförmigen Ausläufern, die sich im Bereich größerer Kapillaren zu perivaskulären Scheiden und an der Basis der Plexus zur Tela choroidea anordnen”. [The cells of the plexus interstitium, which are commonly considered of leptomeningeal origin, spread between the ependymal cell layer and the network of blood vessels. They form a highly branched net of thin and fusiform processes, which form perivascular sheaths near larger capillaries and arrange themselves as a tela choroidea at the base of the plexuses].

Lametschwandtner, 1978:

p. 229: “Anatomical studies employing light microscopy, transmission electron microscopy and scanning electron microscopy have been performed upon the choroidal epithelium. In addition, light and transmission electron microscopic and freeze fracture studies have been executed on the choroidal plexus capillaries”.

Maillot, Koritke, 1978:

p. 22: “Le plexus choroïde est constitué par la prolifération des vaisseaux piemeriens en regard de la partie bulbaire du plancher du quatrième ventricule et du récessus latéral. Ces vaisseaux refoulent ainsi la membrane tectoriale, représente par une simple assise de cellules épendymaires”. [the choroid plexus is formed by the proliferation of pial vessels along the bulbar part of the floor of the fourth ventricle and of the lateral recessus. Thus, these vessels push back the tectorial membrane represented by a simple layer of ependymal cells]

Britt et al, 1980:

p. 247: “A poorly preserved epithelial layer in a papillary configuration suggestive of choroid plexus was present. Vascular malformations arising primarily in the choroid plexus are extremely rare. The first documented angioma of the choroid plexus was probably that reported by Guerard in 1833”.

p. 249: “Butler, et al. postulated that angiomas of the choroid plexus most likely develop at approximately the 30-mm embryonic stage, where large crossing arterial and venous endothelial tubes are most evident near the relatively enormous choroid plexus. Padget postulated that fistulas develop in areas where the primitive vessels cross when they are separated by only a double layer of endothelial cells. Choroid plexus angiomas predominate in the glomus, although malformed vessels may extend into the villi. Shuangshoti and Netsky showed that the glomus is the most heavily vascularized portion of the choroid plexus, both in fetal life and in later years, and hence is the most likely to contain abnormal collections of vessels from developmental errors. The interesting encapsulation of the lesion presented here likely resulted from hemorrhage into the stroma of the choroid plexus without escape of significant blood in the cerebrospinal fluid”.

Gotow, Hashimoto, 1980:

p. 303: “The cytological features of the cyst cell and its junctional relationship to neighboring cells imply that cyst cells are derived from ependymal and choroid epithelial cells. The cyst cells usually contact directly the perivascular spaces of postremal, choroidal or pial capillaries, where the cytoplasm is often considerably attenuated”.

p. 306: “Fig. 4. Two ependymal cells with cystic lumina (L) in the tela chorioidea of the fourth ventricle”.

Michaels, Tornheim, 1980:

p. 449: “The lateral areas of the rhombencephalic tela of the bullfrog contain long, irregular islands of ependymal cells that are similar in fine structure to the epithelium of the rhombencephalic choroid plexus. […] The posterior tela is a delicate membrane that includes a ventral ependymal layer and a dorsal layer of leptomeningeal cells, generally referred to as pia mater in Amphibia”.

Jones, Jopling, 1983:

p. 121: “From embryonic stage 22-25 there is progressive differentiation into choroid plexus and posterior tela ependymal cells”.

p. 124: “All embryos sectioned have loosely arranged elongated cells with thin processes which overlie the posterior tela dorsally: these are assumed to be developing pial and arachnoid cells”.

Wolfram-Gabel et al, 1984:

p. 31: “Le réseau capillaire qui forme le plexus choroïde contraste beaucoup avec le réseau vélique par dimension, sa complexité et sa grande importance fonctionnelle. En effet, le plexus choroïde est forme par al prolifération de vaisseaux piemeriens accompagnes, en direction ventriculaire, par la membrane épendymaire qui les recouvre en totalité. La prolifération de ces vaisseaux, tres irrégulière, donne naissance a des touffes vasculaires ou villosités choroïdiennes. Chaque villosité peut elle-même etre formée par la juxtaposition de plusieurs lobules choroïdiennes; un lobule choroïdien représentant en quelque sorte l'unité structurale et fonctionnelle du plexus choroïde”. [The capillary network that form the choroid plexus contrasts greatly with the networks of the velum in dimension, complexity and its great functional importance. Effectively, the choroid plexuses are formed by proliferation of the pial vessels accompanied, towards the ventricle, by the ependymal membrane which covers them entirely. The very irregular proliferation of these vessels gives rise to vascular tufts or groups of choroid villi. Each group of villi can form choroid lobules by juxtaposition with several others. A choroid lobule represents in a way the structural and functional unit of the choroid plexus].

Harbut, Johanson, 1985:

p. 137: “Rodriguez's review of CSF as a pathway in neuroendocrine integration stressed the need for delineation of transport/ absorption capacities of the respective CP epithelia”.

Kotwica et al, 1985:

p. 201: “Meningiomas of the lateral ventricle are supposed to originate from the tela choroidea of the ventricle”.

Kato et al, 1986:

p. 232: “However, the tela choroidea, which consists of a single layer of ependymal cells of the roof plate and is the structural forerunner of the choroid plexus, is recognizable in the dorsal wall of the fourth ventricle of the fetal brain on the 11th day of gestation. […] The choroid plexuses appear in the ventricles between the 13th and 15th days of gestation [4]. As shown in Fig. 5a, some portions of the tela choroidea begin to differentiate morphologically (to form plexus) during the 14th day of gestation”.

Altman, Bayer, 1987:

p. 478: “Instead, a membrane, the medullary velum, part of which becomes the tela choroidea, spreads over the enlarged rhomboid cavity, the fourth ventricle”.

p. 478: “The dorsal (surface or alar) plates fail to fuse medially in this region. Instead, a membrane, the medullary velum, part of which becomes the tela choroidea, spreads over the enlarged rhomboid cavity, the fourth ventricle. This membrane initially forms a simple canopy over the fourth ventricle and interconnects the edges of the caudal and rostral portion of the classical dorsal rhombencephalon. The tela choroidea then invaginates to form the primitive choroid plexus, and neural tissue spreads along the edges of its folding surface. The choroid plexus and the neuroepithelial tissue associated with it give rise to recesses of the fourth ventricle”.

p. 482: “The rostral secondary precerebellar neuroepithelium is associated here with the medial portion of the choroid plexus”

Maurizi, 1987:

p. 62: “Tela choroidae are delicate membranes made up of ependymal cells and pia mater […] However, substrate supplied from the blood vessels of the choroid plexus would still be available for CSF secretion”.

Kondziolka, Bilbao, 1989:

p. 91: “Specifically, theories were offered to explain these cysts as products of invagination or evagination of the neuroepithelial surface as it underwent folding in the embryo to form the tela choroidea. […] These findings were then correlated to an analysis of neighboring structures such as ependyma and choroid plexus epithelium to identify similarities and differences”.

Makover et al, 1989:

p. 19: “However, the tela choroidea, which consists of a single layer of ependymal cells of the roof plate and is the structural forerunner of the choroid plexus, is recognizable in the dorsal wall of the fourth ventricle of the fetal brain on the 11th day of gestation”.

Ho, Garcia, 1992:

p. 605: “The histogenesis of colloid cyst of the third ventricle remains unsettled. Ultrastructural and immunohistochemical analyses have suggested the following possible

origins: (a) neuroepithelium, including paraphysis, ependyma, choroid plexus and tela chorioidea; and (b) endoderm, including respiratory and enteric epithelium".

Berry, Rice, 1994:

p. 134: "The choroid plexus in the lateral ventricles was not present anteriorly, but fragments of chorid plexus could be seen farther back in the region of the trigone. […] Fresh red blood cells were present around the fronds of the choroid plexus".

p. 135: "One rather rare cause of intraventricular hemorrhage is rupture of a vascular malformation in the choroid plexus".

p. 136: "The choroid plexus is a villous vascular structure whose epithelial lining is formed of modified ependymal cells and whose stroma is extremely vascular. During the course of embryological development, the modified ependymal cells of the roof plate of the neural tube, covered by the vascular pia mater, invaginate into the ventricle along the choroidal fissure. […] The tela choroidea, which is the membranous attachment of the choroid plexus to the choroidal fissure, is also a site whereby arteries supplying and veins draining the choroid plexus pass".

Bendon et al, 1996:

p. 303: "Microscopically, a portion of the cyst showed an ependymal lining with tufts resembling choroid plexus".

p. 312: "All had ependymal/choroid plexus epithelium facing into the cyst. This was always over the roof of the third ventricle as if evaginated from the tela choroidea. Microscopically, this epithelium resembled the normal morphology of the tela choroidea".

Wen et al, 1998:

p. 2: "The choroid plexus in the body of the lateral ventricle originates from the tela choroidea of the roof of the third ventricle".

p. 12: "The second layer [of the roof of the third ventricle] is the superior membrane of the tela choroidea. The third layer is the vascular layer, which consists primarily of the internal cerebral veins and the medial posterior choroidal artery and branches; it is located between the superior and inferior membranes of the tela choroidea, in a space known as the velum interpositum. The fourth layer is therefore the inferior membrane of the tela choroidea".

p. 20: “Histologically, the choroid plexus has a villous structure with a stroma (leptomeningeal cells, connective tissue, and blood vessels) covered by an epithelium derived from ependyma”.

Colleti et al, 2000:

p. 38: “After the choroid plexus was partially removed and the tela choroidea divided and deflected, the floor of the lateral recess of the fourth ventricle and the convolution of the dorsal cochlear nucleus became visible”.

Maurizi, 2000:

p. 420: “The basal membrane of choroid plexus ependyma is in contact with the pia mater of the tela choroideae”

Cummings et al, 2001:

p. 349: “Fibroblasts of the dural border cell layer are attached to the underlying arachnoid, and their inclusion with arachnoidal stromal elements and pial-based tela choroidea during formation of choroid plexus interstitium may account for intraventricular SFTs”.

Colleti et al, 2002:

p. 84: “The choroid plexus was then partially removed and the tela choroidea divided and bent back”.

Gore et al, 2006:

p. 486: “A transcallosal microsurgical approach to the body of the lateral ventricle was performed combined with a simultaneous endoscopic approach via a left temporal bur hole to resect the choroid plexus papilloma”.

Huh et al, 2007:

p. 119: “Through the choroidal fissure, the two membranes of the tela choroidea of the third ventricle proceed to the body of the lateral ventricle to originate the choroid plexus. Histologically, the choroid plexus has a villous structure with a stroma (leptomeningeal cells, connective tissue and blood vessels) covered by an epithelium derived from ependyma”.

García-Lecea et al, 2008:

p. 1: “The choroid plexus (ChP) represents a thin outgrowth of the dorsal midline ependyma into the brain ventricles”.
p. 2: “At 29hpf a group of GFP-positive cells appeared at the roof of the fourth ventricle (not shown) and as the GFP expression and number of cells increased, at 36hpf these cells formed a sheet close to the midline (Fig. 1B), which probably represents the ChP primordium - tela choroidea (TC)”.
p. 11: “Final transformation of the tela choroidea into the ChP proper by means of the coalescence of cells in the dorsal midline”.

Tubbs et al, 2008:
p. 131: “The VI extended laterally over the thalami to become continuous with the choroid plexus of the lateral ventricles. At a point along the thalami where the choroid plexus was found, the VI became "tacked" down and thus continuous with the choroid plexus subependymally. No specimen exhibited a separate choroid plexus of the third ventricle. In each, the choroid plexus of the lateral and third ventricle were the same tissue layer, all arising from the VI. [..]. The supratentorial choroid plexus is simply a vascular extension of the VI”.
p. 132: “The VI [Velum interpositum] has been scantly and classically described as composed of two layers of tela choroidea or a fold of pia, which together with the body and crura of the fornices forms the roof of the third ventricle. Rhoton described this tela as a thin, arachnoid-like membrane”.

Lucy et al, 2009:
p. 241: “By 40 days of gestation, the roof plate of diencephalon was converted into the tela choroidea and along with the growing blood vessels formed the choroid plexus of the third ventricle”.

Ciotkowski et al, 2011:
p. 87: “The more medially we move, the more the nervous tissue of the inferior medullary velum disappears and we notice semi-translucent pial-ependymal choroid membrane”.

Jolly et al, 2011:
p. 416: “At the depths of the choroidal fissure, staining of the meningeal/ependymal membrane giving rise to the lateral choroid plexus appeared to be directly associated with similar staining of underlying ependymal cells”.

Ramraje et al, 2012:

p. 126: “They arise from the arachnoid cells embedded in the choroid plexus”

p. 128: “Third ventricle tumours arise from the tela of the velum interpositum, which is the space between the two layers of tela in the roof of the third ventricle that contains the posterior medial choroidal arteries and internal cerebral veins”.

Azab et al, 2014:

p. 3: “The embryonic roof plate, which is the primordium of the tela choroidea (or AMA and PMA), is invaginated by developing vascular structures to form the choroid plexus”.

Chibbaro et al, 2014:

p. 239: “The authors believe that it is not justified to try to be radical in the resection in case the cyst is strongly adhering to the roof of the third ventricle and tela choroidea as it is very important to avoid excessive traction of the choroid plexus with its related venous system”.

Iacoangeli et al, 2014:

p. 1471: “The choroidal fissure is the thinnest site in the wall of the lateral ventricle that represents a “safe corridor” to the velum interpositum and roof of the third ventricle because there is no neuronal tissue interposed between the ependyma of the lateral ventricle and the tela choroidea of the third ventricle”.

p. 1472: “In this way the choroid plexus was lateralized and the choroid fissure opened”.

p. 1473: “The gradual insufflation of the Fogarty catheter or the alternating opening and closing of the forceps was used to gently separate the choroid plexus from the fornix, thus expanding the surgical corridor. At this point, the superior membrane of the tela choroidea was opened and the contents of the velum interpositum (medial posterior choroidal arteries and internal cerebral veins) were seen. […] Once the inferior membrane of the tela choroidea was opened, the posterior portion of the cyst and its attachment to the tela choroidea were fully exposed, allowing the safe detachment of the capsule from the roof of the third ventricle (Fig. 1C and D)”.

Gabel et al, 2015:

p. 1: “The tela choroidea is a connective tissue layer that separates the pia mater from the ependymal lining of the ventricular system. During embryologic development, ependymal

cells of the lateral, third, and fourth ventricles invaginate to form longitudinal folds; the tela choroidea invaginates along with these cells and acts as a richly vascularized lamina propria. These ependymal cells eventually differentiate into the choroid plexus of the ventricular system".

Hadzic et al, 2020:

p. 2: "The CP is a highly vascularized tissue that is located in the cerebral ventricles. […] P-CSF system is crucial for the maintenance and function of the CNS […]. The CP is located in the cerebral ventricles, along the rim ("limbus") of the hemisphere where the cerebral cortex abuts on the diencephalon, and similarly where the cerebellar cortex abuts on the rhombencephalon. Here, the neural tube does not develop neuroblasts and remains as the originally single layer of cuboid neuroectodermal cells (final ependyma), resting on mesenchymal connective tissue, which carries blood vessels (final pia mater). Proliferation of the vascular mesenchyme invaginates the ependyma lined ventricle lumen, forming the CP. […] The third ventricle has a roof, a floor, and four walls. The roof, which makes a gentle upward arch, consist of four layers: one layer of neural tissue (formed by the fornix), two layers of tela choroidea (formed by meningeal pia mater and ependymal cells) interconnected by trabeculae, and one layer of cerebral vasculature in the velum interpositum (the space between the two layers of tela choroidea) [14,15]. The tela choroidea of the third ventricle gives further rise to the CP, which extends into the lateral ventricles".

D'Gama et al, 2021:

p. 2: "tela choroidea, which is the epithelial layer located above the dorsal telencephalon and the forbrain choroid plexus and co-existed with monociliated cells"

p. 14: "In fact, the TC is a fold of the pia mater that gives rise to the ChP prior to the formation of the plexus with the blood vasculature".

Sato et al, 2021

p. 219: "Studies have suggested that LVMs originate from the remains of arachnoid cap cells in the stroma of the choroid plexus, and the choroid plexus is covered by an ependymal cell monolayer".