Atlas of Science
another view on science
http://atlasofscience.org

The choroid plexus: a new player in the (microbiome-)gut-brain axis

The healthy human gut microbiome contains 100 trillion bacteria, outnumbering the amount of human cells by a factor of 10. These bacteria are important in several crucial processes in our body. Hence, changes in the composition, caused by a variety of factors, have been linked to health problems, including neurological disorders. Bidirectional communication between the gut and brain, called the gut-brain axis, is achieved via hormonal, neural, endocrine, immune and metabolic pathways. The gut microbiome can modulate these pathways and thus plays an important role in the gut-brain axis, referred to as the microbiome-gut-brain axis. There are two natural barriers to signalling within the microbiome-gut-brain axis: the gastrointestinal barrier and the brain barrier. The gastrointestinal barrier is characterized by a monolayer of epithelial cells interconnected by tight junctions, and a mucus layer. The two most important brain barriers are the blood-brain barrier (consisting of tightly connected brain endothelial cells lining blood vessels, astrocytic endfeet and a basement membrane) at the brain parenchyma and the blood-cerebrospinal fluid (CSF) barrier (consisting of tightly connected epithelial cells) at the choroid plexus (Fig. 1). Previously, we showed that both peripheral and central inflammation affects the functioning of the choroid plexus.

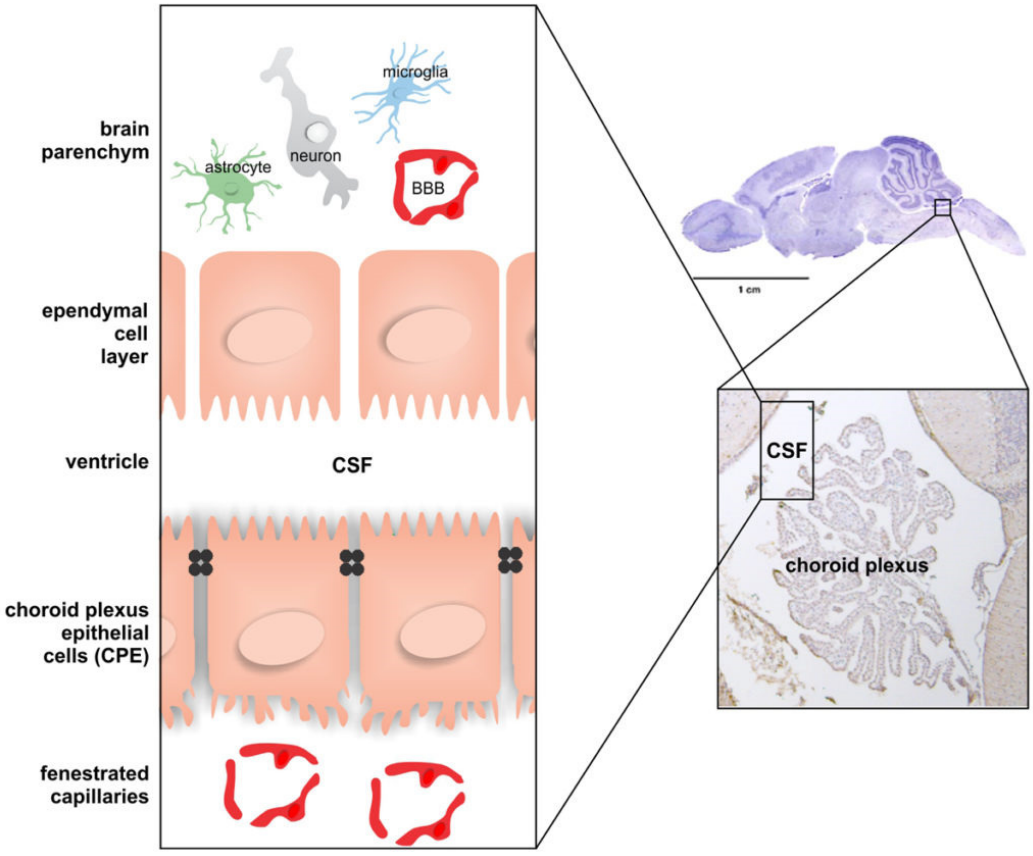

Fig. 1. The choroid plexus is a small structure hanging in the cerebrospinal fluid (CSF-) filled ventricles of the brain. The choroid plexus epithelial (CPE) cells are tightly connected due to the presence of tight junctions and form the blood-CSF barrier. (BBB, blood-brain barrier; CPE, choroid plexus epithelial cells; CSF, cerebrospinal fluid).

Helicobacter pylori (*H. pylori*) is a Gram-negative bacterium that chronically infects more than 50% of the human population. Several studies have shown that *H. pylori* infection is associated with the development and progression of neurological diseases. *H. suis*, a non-pylori *Helicobacter*, is the second most prevalent *Helicobacter* species in the stomach of humans suffering from gastric disease. Strikingly, significantly higher frequency of *H. suis* was found in patients with idiopathic parkinsonism compared to control patients. In our current study, we aimed to investigate whether the presence of *H. suis* has an impact on brain homeostasis.

One month after *H. suis* infection of C57/Bl6 mice, we found increased gastrointestinal inflammation associated with increased leakiness of the gastrointestinal barrier, causing low-grade systemic inflammation and the presence of toll like receptor 4 (TLR4) ligands in the blood of *H. suis* infected mice. Additionally, we observed brain inflammation, characterized by microgliosis and behavioural changes. When studying the brain barriers, no functional changes at the blood-brain barrier could be found, while we did observe significant loss of blood-CSF barrier integrity upon gastric *H. suis* infection. Indeed, *H. suis* infection induced an increase in choroid plexus inflammation and changed both the expression and localisation of tight junction proteins. In conclusion, our data suggest that the choroid plexus is a new player a role in the microbiome-gut-brain axis due to its unique position between blood and brain. Further research is needed to find out whether this also holds true for other gut(microbiome) changes and whether these neurological changes are associated with increased risk to develop neurological pathologies such as Parkinson's disease and Alzheimer's disease.

Gorlé N, Vandenbroucke RE
VIB Center for Inflammation Research, Ghent, Belgium, VIB, B-9052 Ghent, Belgium
Department of Biomedical Molecular Biology, Ghent University, B-9052 Ghent, Belgium

Publication

The choroid plexus epithelium as a novel player in the stomach-brain axis during Helicobacter infection.
Gorlé N, Blaecher C, Bauwens E, Vandendriessche C, Balusu S, Vandewalle J, Van Cauwenberghe C, Van Wonterghem E, Van Imschoot G, Liu C, Ducatelle R, Libert C, Haesebrouck F, Smet A, Vandenbroucke RE
Brain Behav Immun. 2018 Mar