BHARATHIDASAN UNIVERSITY

Program: M.Sc., Biomedical Science

Course Title : Neurobiology

Cerebro-spinal Fluid

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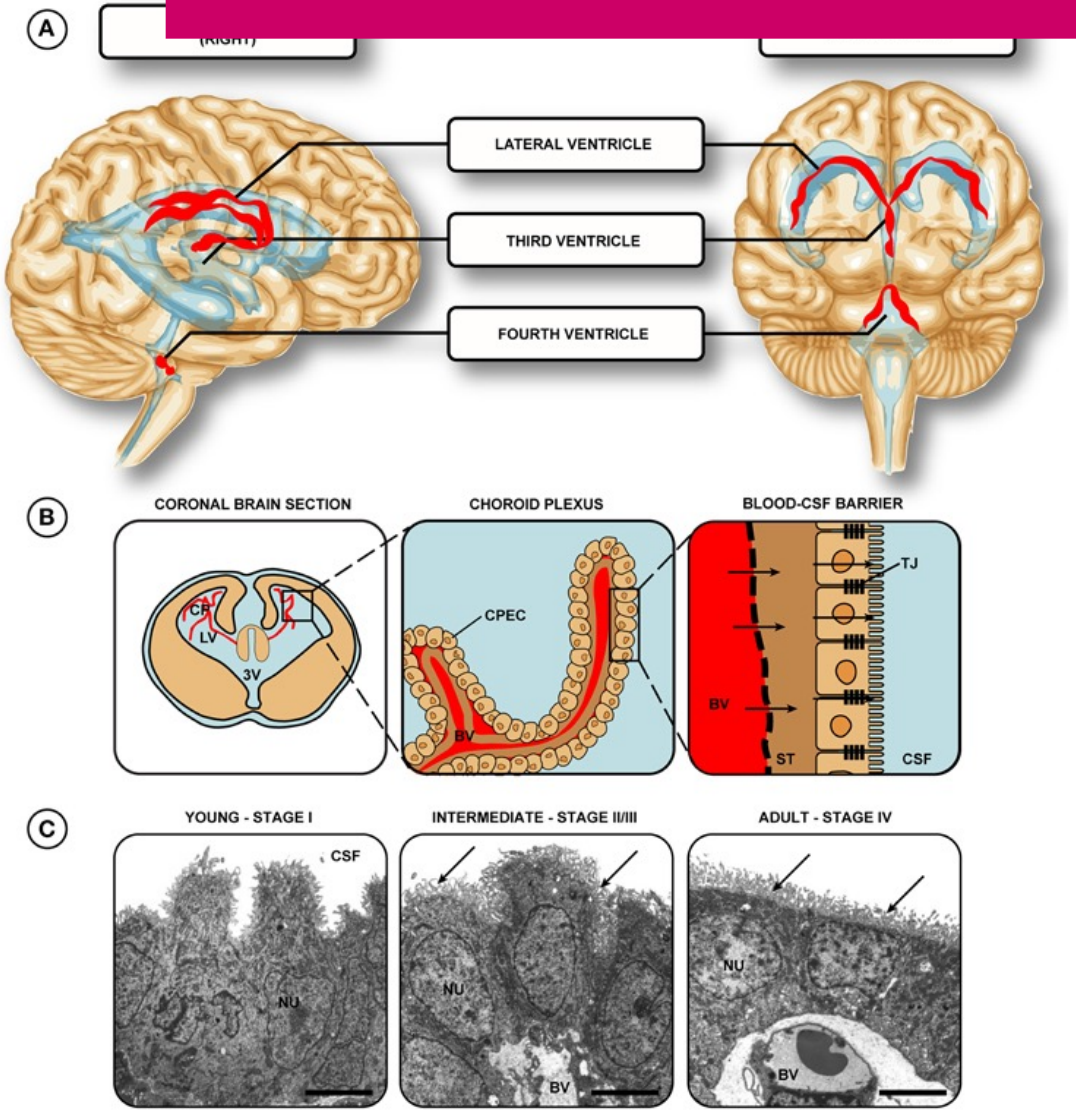
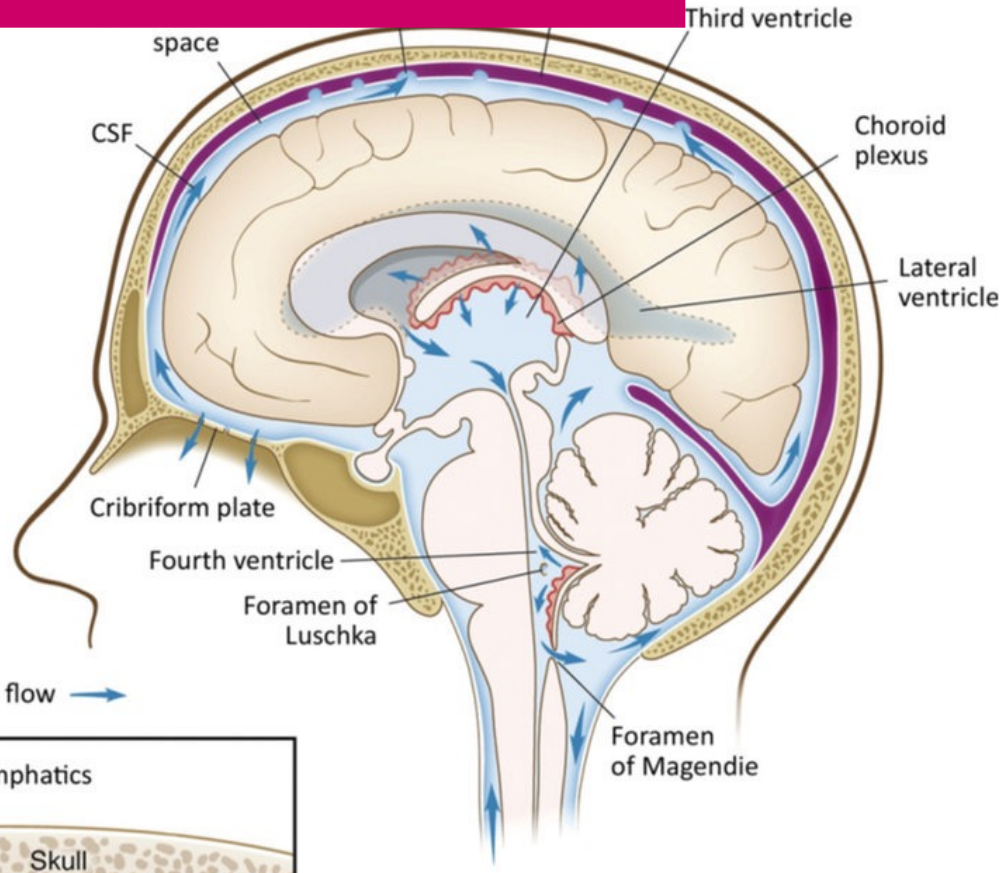
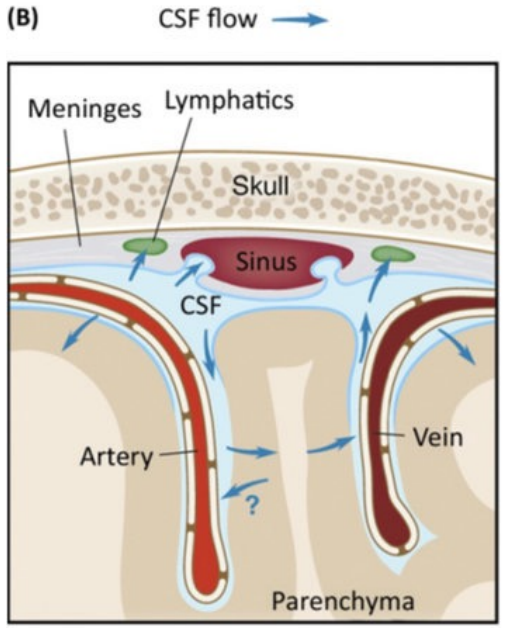
Cerebro-spinal Fluid (CSF)

1. Cerebro-Spinal Fluid is formed primarily by the choroid plexuses found in particular regions of the ventricles
2. choroid plexuses consist of richly vascularized, cauliflower-like masses of pia mater tissue that dip into pockets formed by ependymal cells.
3. Cerebro-spinal fluid forms as a result of selective transport mechanism across the membranes of the choroid plexuses.
4. The composition of CSF differs from that of blood.
5. CSF surrounds and cushions that brain and spinal cord.
6. CSF has about the same density as the brain itself, so the brain essentially floats or is suspended in this special fluid environment.
7. function of CSF is to serve as a shock-absorbing fluid to prevent the brain from bumping against the interior of the hard skull when the head is subjected to sudden, jarring movements. (mechanical trauma)







ST, stroma/basement
BV, blood vessel;
CP, choroid plexus;
CPEC, choroid plexus epithelial cell;

Trends in Neurosciences

CSF Composition

Composition	CSF	Blood Plasma
Na^+ (mM/L)	140 -145	135 - 147
K^+ (mM/L)	3	3.5 - 5
Cl^- (mM/L)	115-120	95 - 105
HCO_3^- (mM/L)	20	22 - 28
Glucose (mg/ml)	50-75	70 - 110
Protein (g/dL)	0.05 – 0.07	6 – 7.8
pH	7.3	7.35 – 7.45

8. plays an important role in the exchange of materials between the neural cells and the interstitial fluid surrounding the brains.
9. Only the brain interstitial fluid comes into direct contact with the neurons and glial cells but not the blood or CSF
10. Bçoz the brain interstitial fluid directly bathes the neural cells, its composition is critical.
11. The composition of the brain interstitial fluid is influenced by changes in the composition of the CSF than by alterations in the blood
12. Materials are exchanged freely between the CSF and brain interstitial fluid, whereas only limited exchange occurs between the blood and brain interstitial fluid.
13. Thus, the composition of the CSF must be carefully regulated.
14. For eg. CSF is lower in K and slightly higher in Na, making the brain interstitial fluid and ideal environment for movement of these ions down conc. gradients, a process essential for conduction of nerve impulses.
15. The biggest difference is the presence of plasma proteins in the blood but almost no proteins normally present in the CSF.

16. Plasma proteins cannot exit the brain capillaries to leave the blood during formation of CSF.
17. Once CSF is formed, it flows through the four interconnected ventricles of the brain and through the spinal cord's narrow central canal, which is continuous with the 4^{th} ventricle.
18. CSF also escapes through small openings from the fourth ventricle at the base of the brain to enter the subarachnoid space and subsequently flows between the meningeal layers over the entire surface of the brain and spinal cord
19. When the CSF reaches the upper regions of the brain, it is reabsorbed from the subarachnoid space into the venous blood through the arachnoid villi.
20. Flow of CSF through this system is facilitated by ciliary beating along with circulatory and postural factors that result in a CSF pressure of about 10mmHg.
21. Reduction of this pressure by removal of even a few ml of CSF during a spinal tap for lab analysis may produce severe headaches.

22. Through the ongoing processes of formation, circulation, and reabsorption, the entire CSF volume of about 125-150 ml is replaced more than three times a day.
23. If any one of these processes is defective so that excess CSF accumulates causing hydrocephalus occurs.
24. The resulting increase in CSF pressure can lead to brain damage and mental retardation if untreated. Treatment consists of surgically shunting the excess CSF to veins elsewhere in the body.