New Horizons for Chronic Fatigue

ME/CFS, Fibromyalgia, and Long COVID:
Osteopathic Medical Insights and Hands-On Healing

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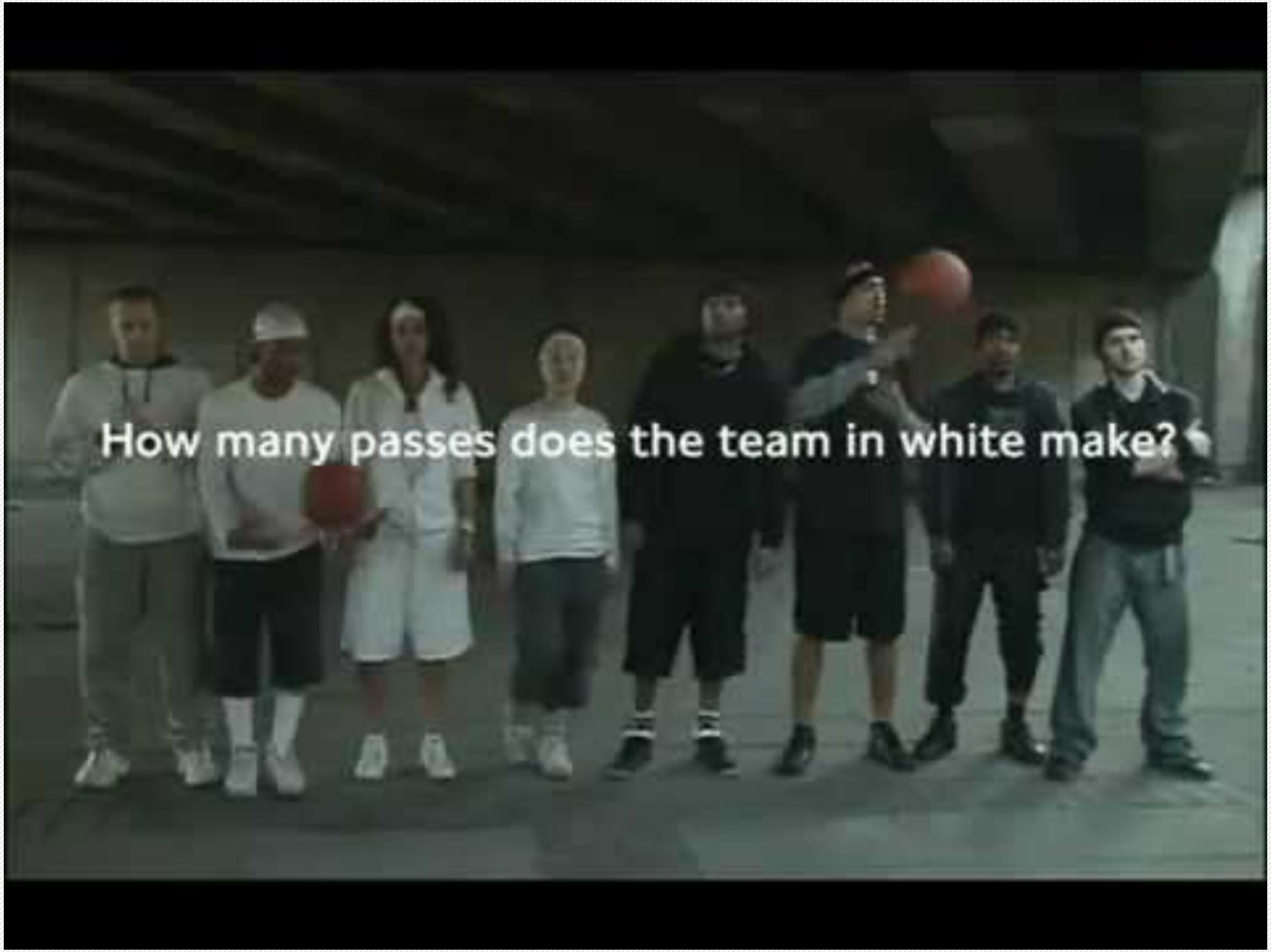
May 14, 2026 * Michigan Osteopathic Association Spring 2026


How many passes does the team in white make?

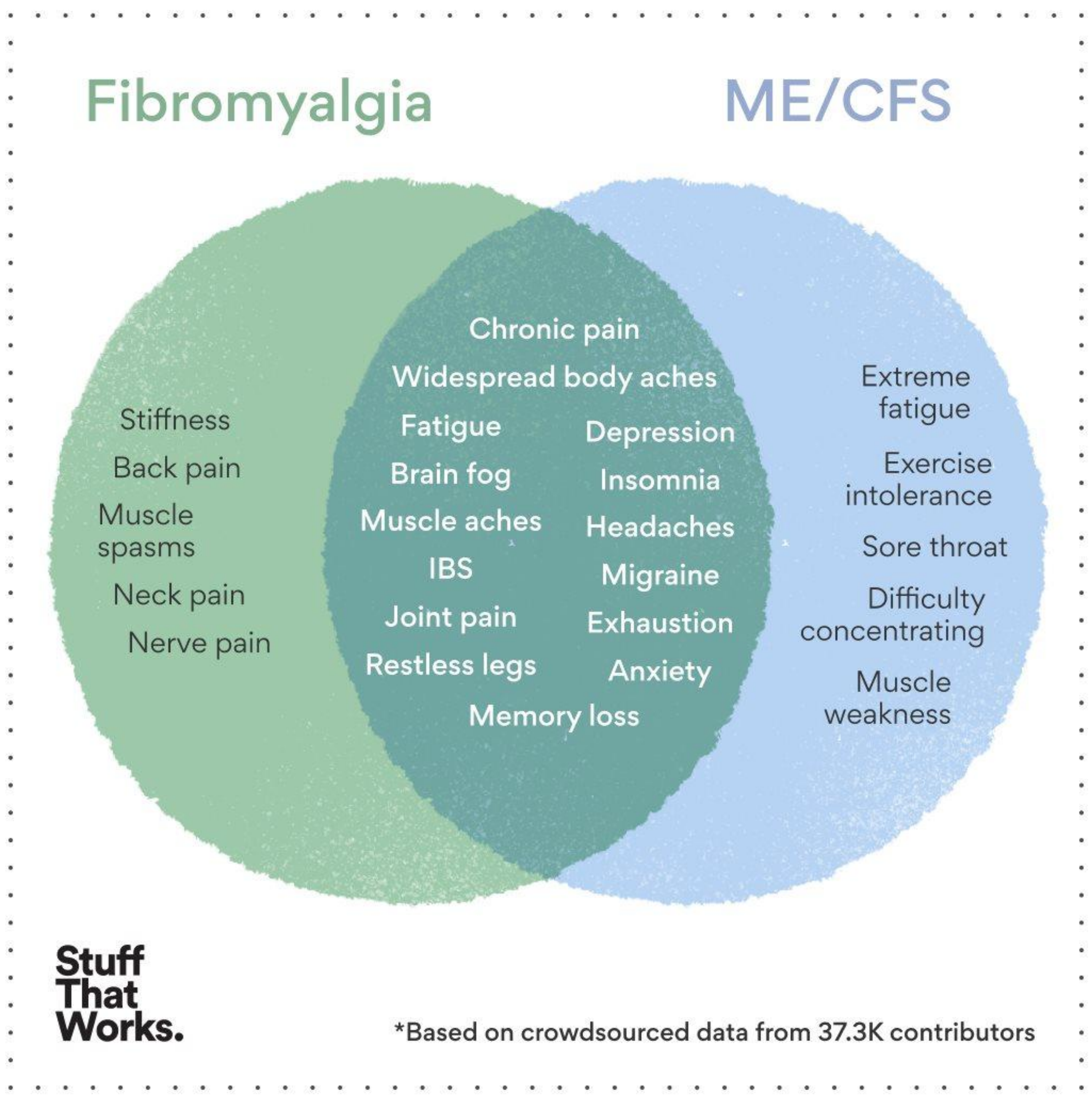
Learning Objectives

- Identify key osteopathic structural findings and autonomic/lymphatic patterns in ME/CFS (Myalgic Encephalomyelitis/Chronic Fatigue Syndrome, Fibromyalgia, and Long COVID.
- Demonstrate basic hands-on osteopathic techniques that support autonomic regulation and lymphatic flow.
- Enhance your clinical diagnostic accuracy for ME/CFS and Fibromyalgia
- Understand the glymphatic system and it’s role in health and disease

Fibromyalgia =

Pain in all 4 body quadrants

Pain Predominant



ME/CFS= Post-Exertional Malaise (PEM)

Delayed onset fatigue and extreme tiredness.

EXERCISE WORSENS PEM!

Fatigue predominant

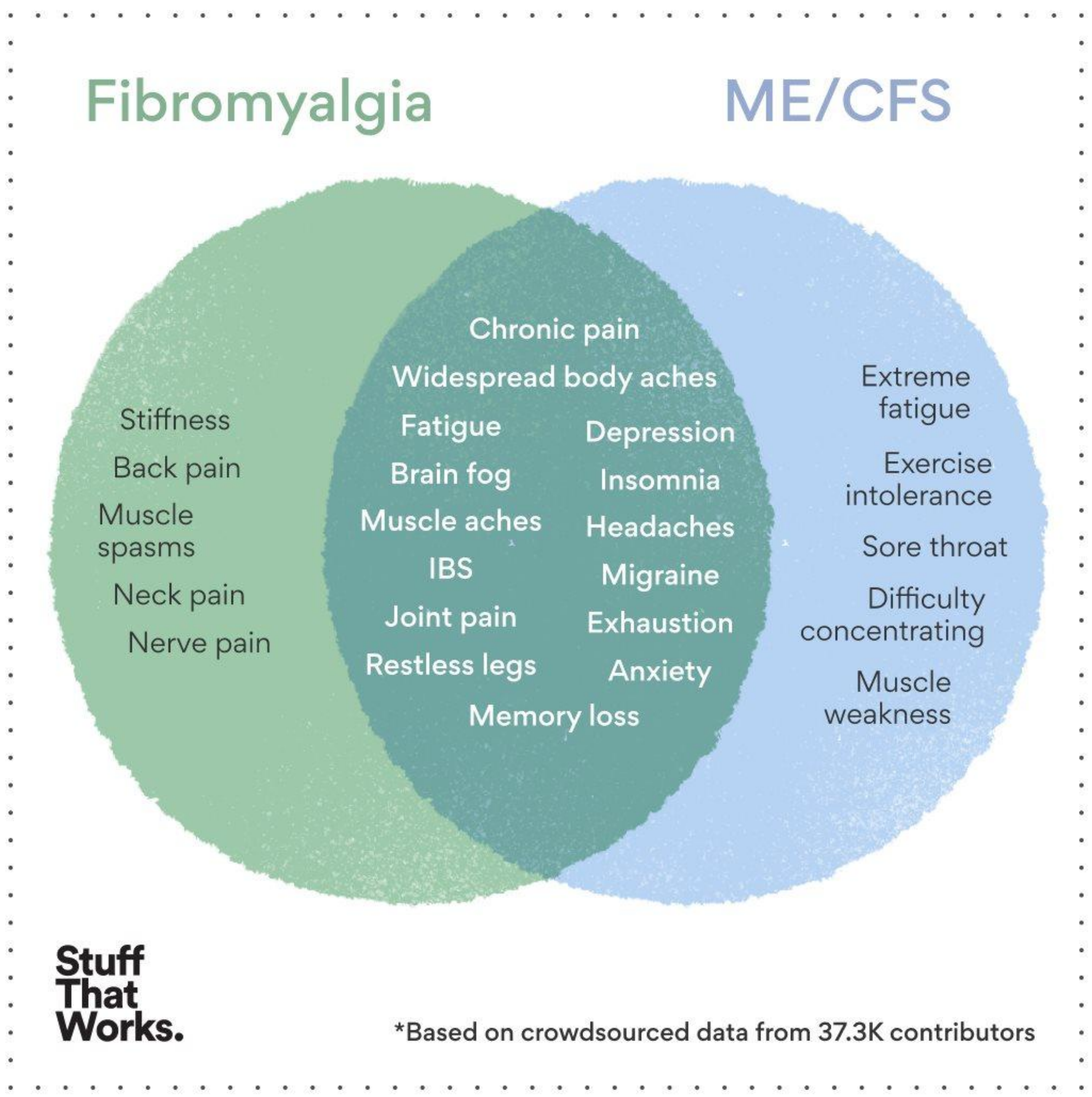
The Clinical Challenge

- **Overlapping Features + Diagnostic Challenge & Difficulty**
- Severe fatigue ± post-exertional malaise
- Widespread pain and tenderness
- “Brain fog,” unrefreshing sleep
- Autonomic symptoms (POTS, IBS, orthostatic intolerance)
- Associations with Trauma, Low SDOH, Lack of Support/Resources
- Lack of Belief that ME/CFS is a real disorder. “Fear of Physicians”
- Complex patients with many needs- and no prognosis or support more than duloxetine and therapy.

Fibromyalgia =

Pain in all 4 body quadrants

Pain Predominant



ME/CFS= Post-Exertional Malaise (PEM)

Delayed onset fatigue and extreme tiredness.

EXERCISE WORSENS PEM!

Fatigue predominant

The Clinical Challenge- Delayed Diagnosis

Condition	Core Criterion	Avg Delay to Diagnosis
ME/CFS	Fatigue + PEM ≥ 6 mo	1–3 yrs
Fibromyalgia	Widespread pain ≥ 3 mo	1–2 yrs
Long COVID	Symptoms ≥ 12 wk post-infection	Months

Factors associated with CFS/ME

- Infection
- Stressors
- Genetics

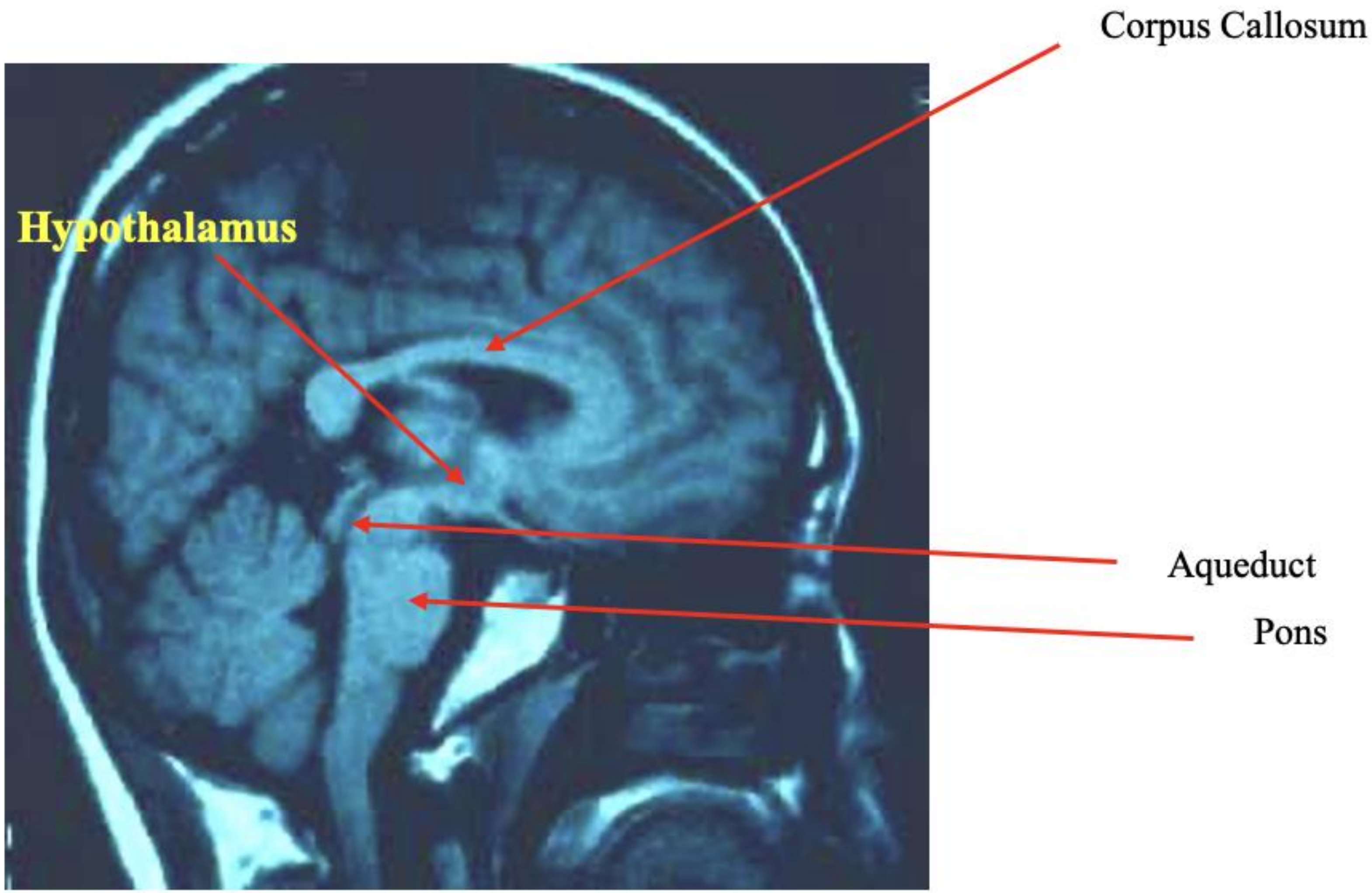


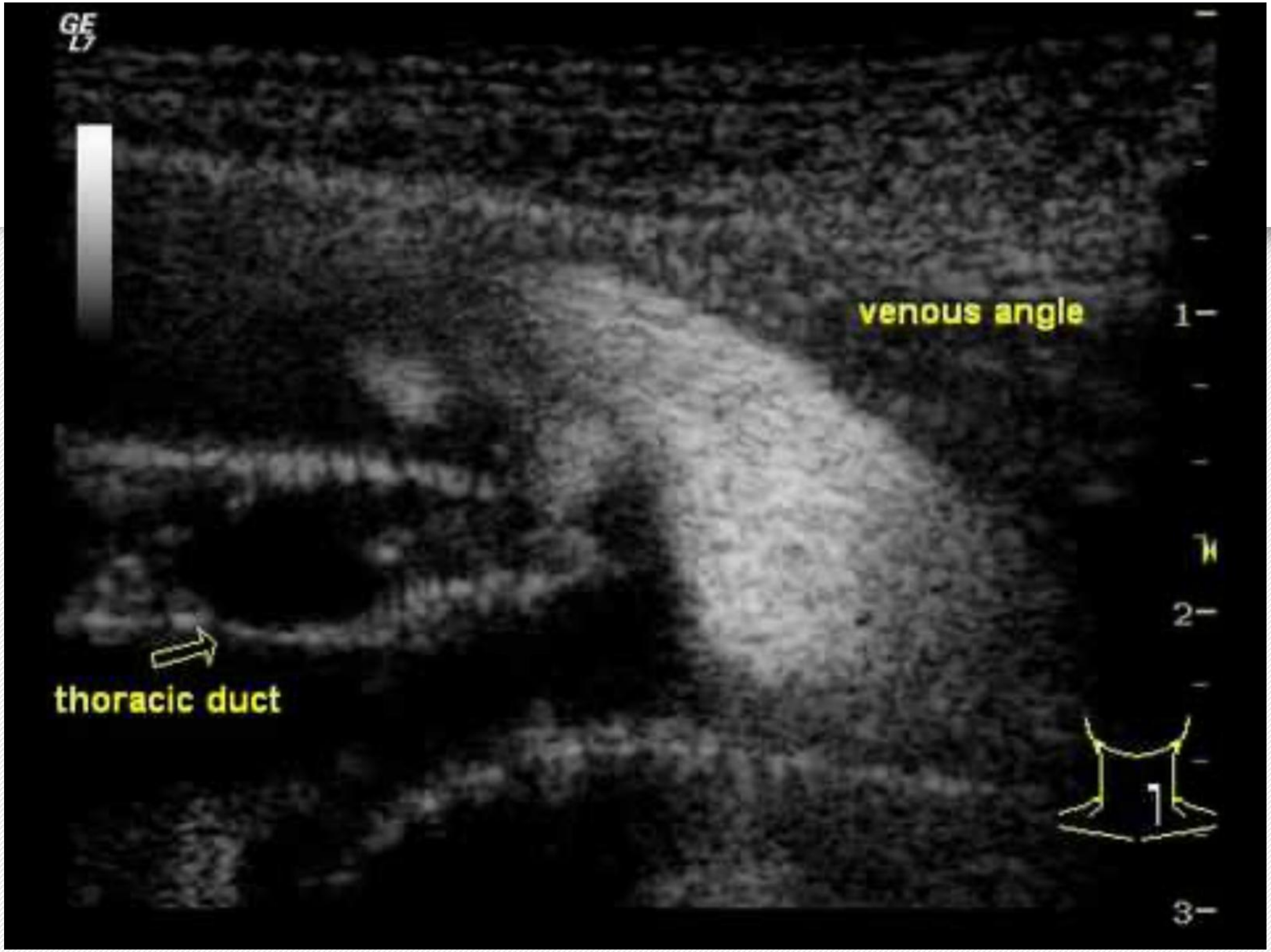
Figure 29 Sagittal view of brain showing position of the hypothalamus

This MR image shows just how small the hypothalamus is in relation to the entire brain. The scan also reveals the central location of the hypothalamus close to the important pons, frontal lobe, just below the limbic system and in the heart of the ventricular system.

Raymond Perrin DO PHD & Ryan Christensen DO

The Perrin Technique™
Licensed Practitioner

What is Lymph?



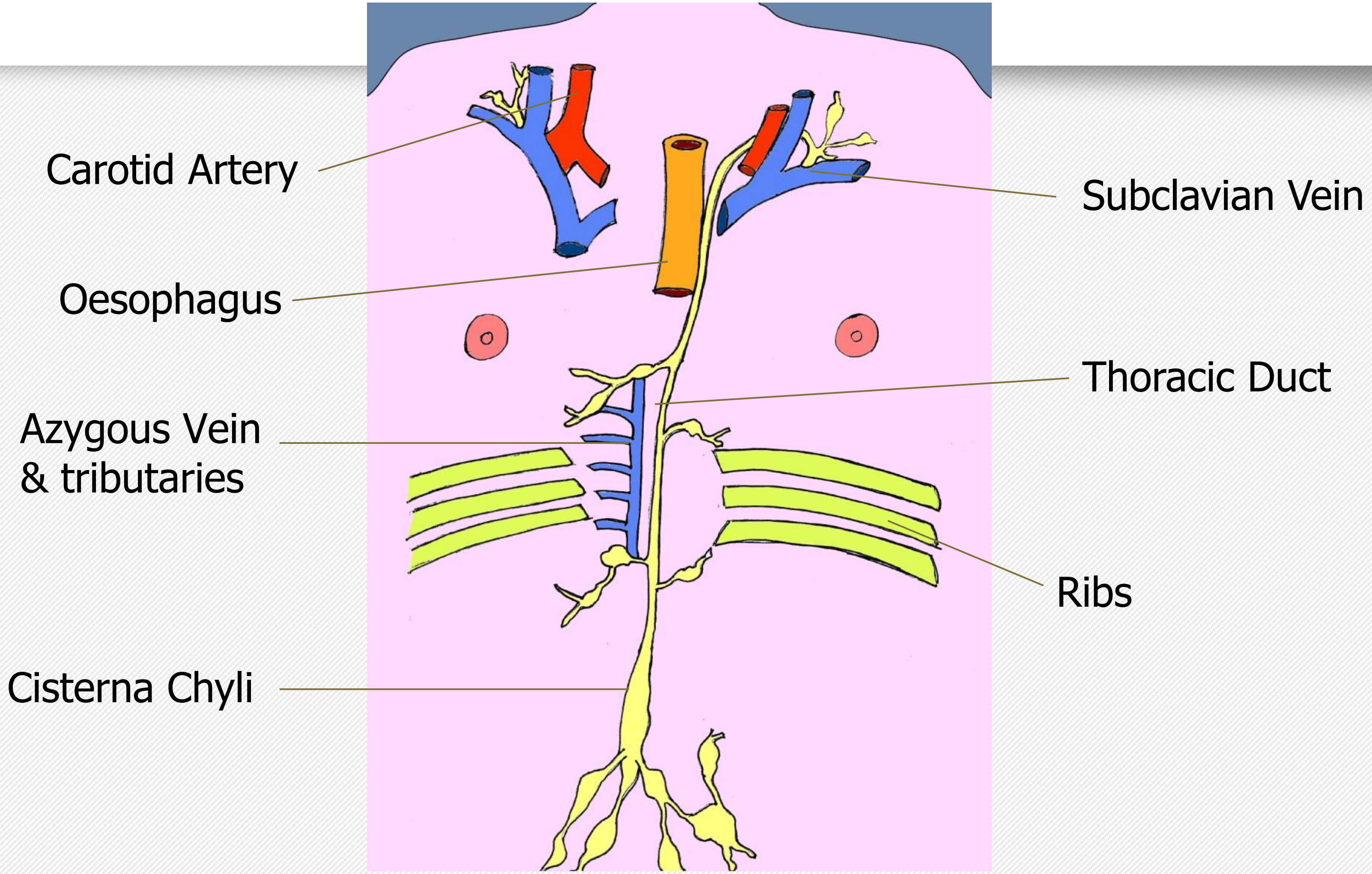
FUNCTIONS OF THE LYMPHATIC SYSTEM

- **Lymphocyte development, and the immune response.**

- **Reabsorbs excess interstitial fluid:**
  - returns it to the venous circulation
  - maintain blood volume levels
  - prevent interstitial fluid levels from rising out of control.

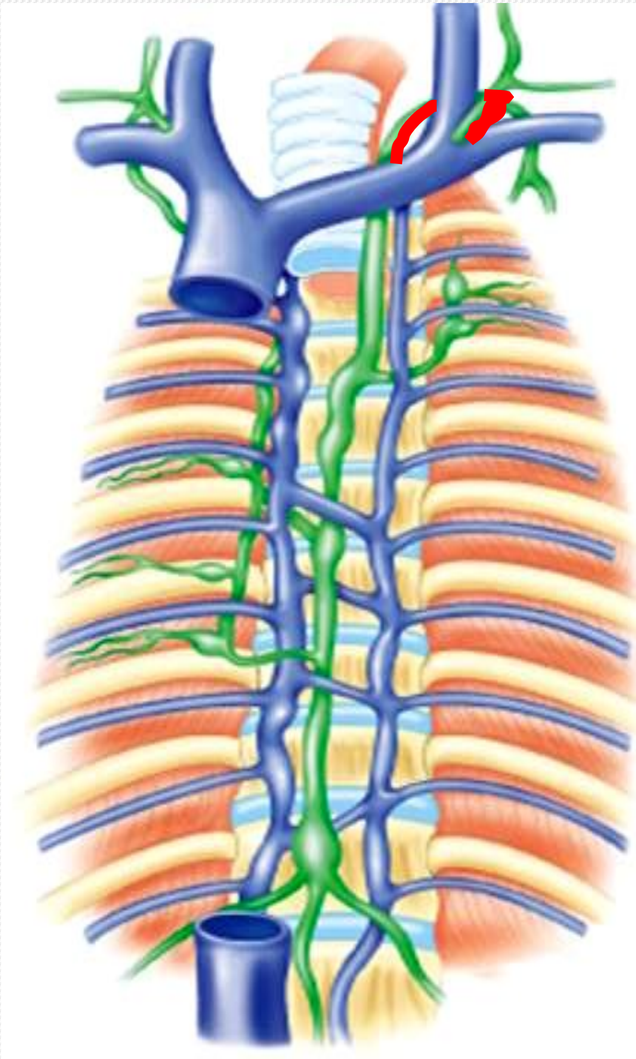
- **Transport dietary lipids:**
  - transported through lacteals
  - drain into larger lymphatic vessels
  - eventually into the bloodstream.

The Thoracic Duct



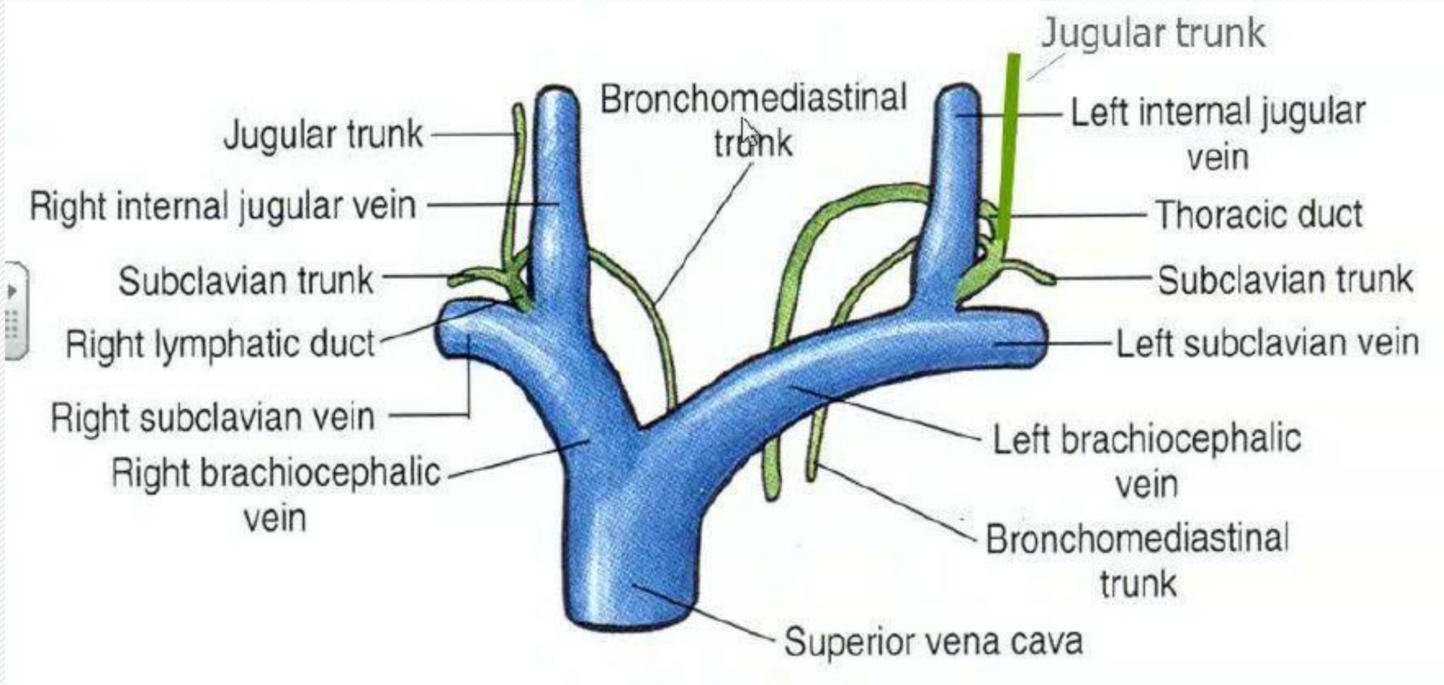
THORACIC DUCT…..

- At the root of the neck, it turns laterally
- arches forwards and descends to enter the left venous angle
- before termination, it receives the left jugular, Subclavian and broncho-mediastinal trunk

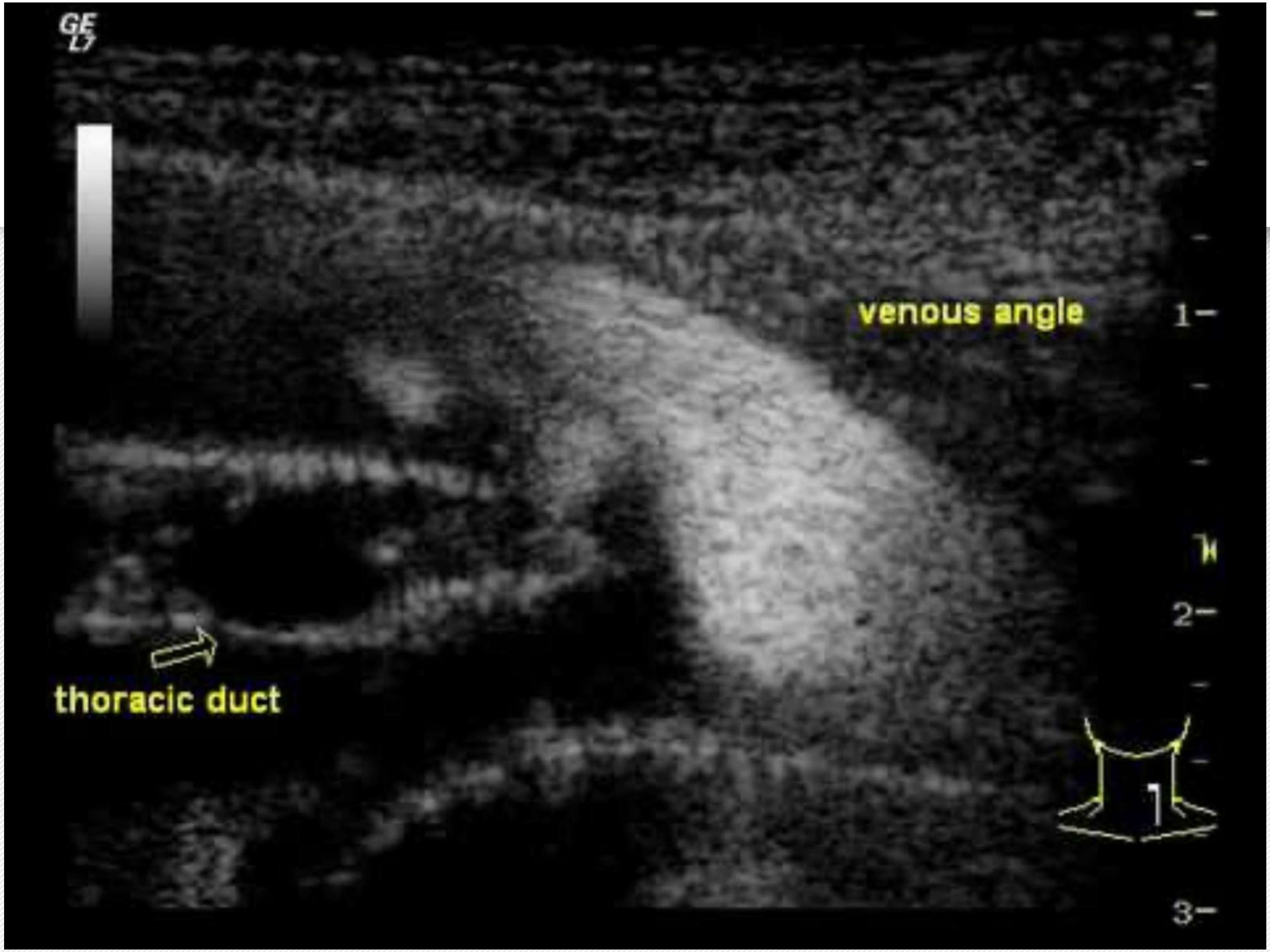


The Thoracic Duct

Anastomosis of the Thoracic Duct and the Venous Drainage



What is Lymph?



Lymph Nodes

@ 450- 800 in adult human body

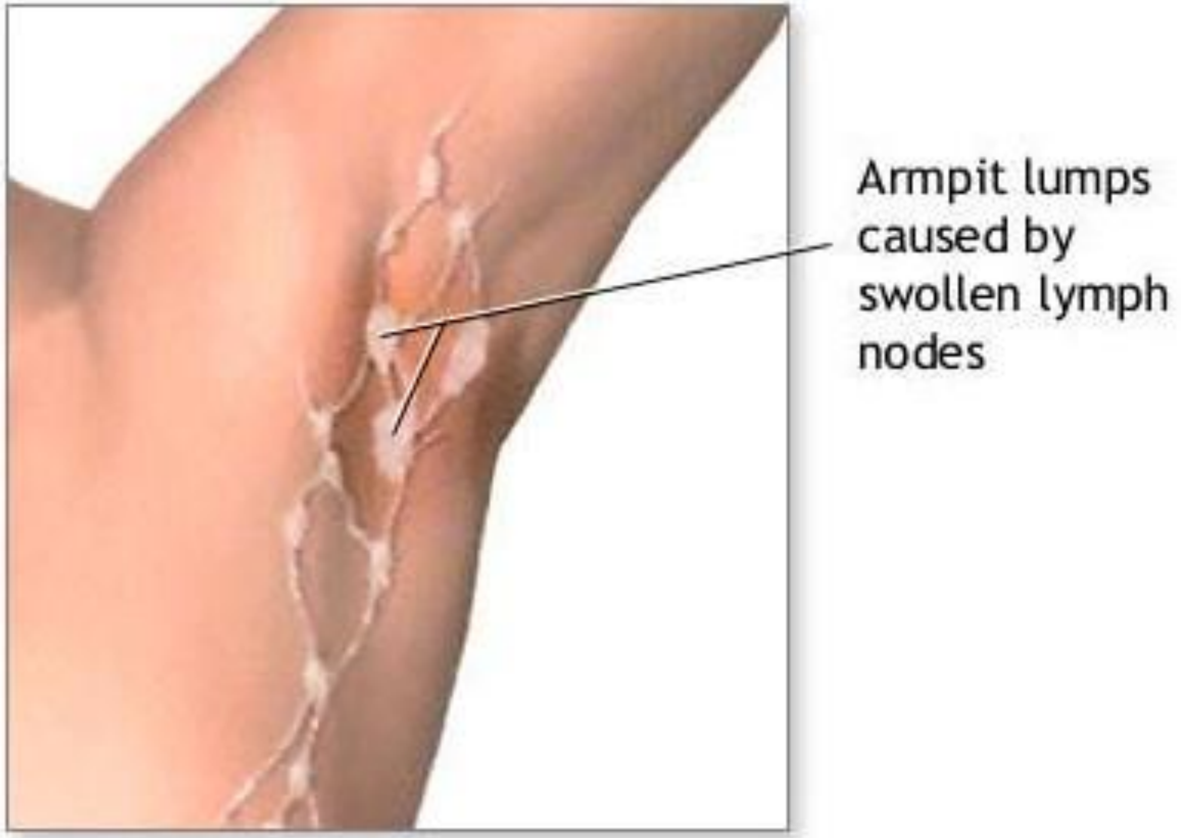
Cervical @ 300

Axillary @ 20-30

Mesenteric @ 100-150

Inguinal @ 4-20

Popliteal @ 2-9



Dynamics of moving fluid into the lymphatic vessel is not passive drainage

- ECM (extracellular matrix) pumps fluid into the lymphatic vessel
- Contractile actomyosin filaments attached to the terminal lymphatics rhythmically push the lymph into the lymphangion
- Lymphangion is the "little heart" of the lymphatic system due to the peristaltic motion it produces and the role that the T-type Ca^{2+} channels play in lymphatic pacemaking
- The ANS, body temperature, caffeine, and hormones affect contractions, too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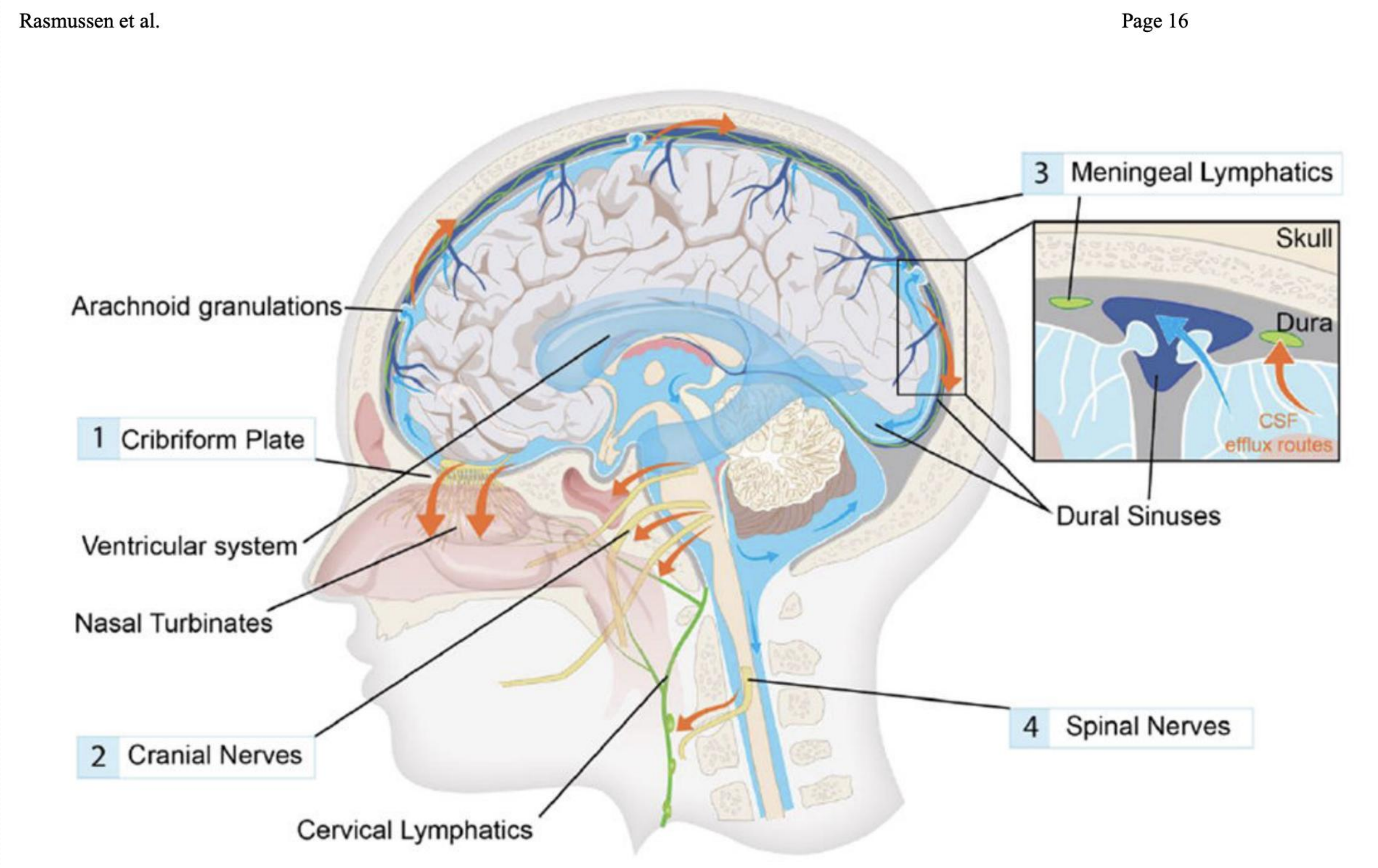
Lymphatic drainage of the Brain



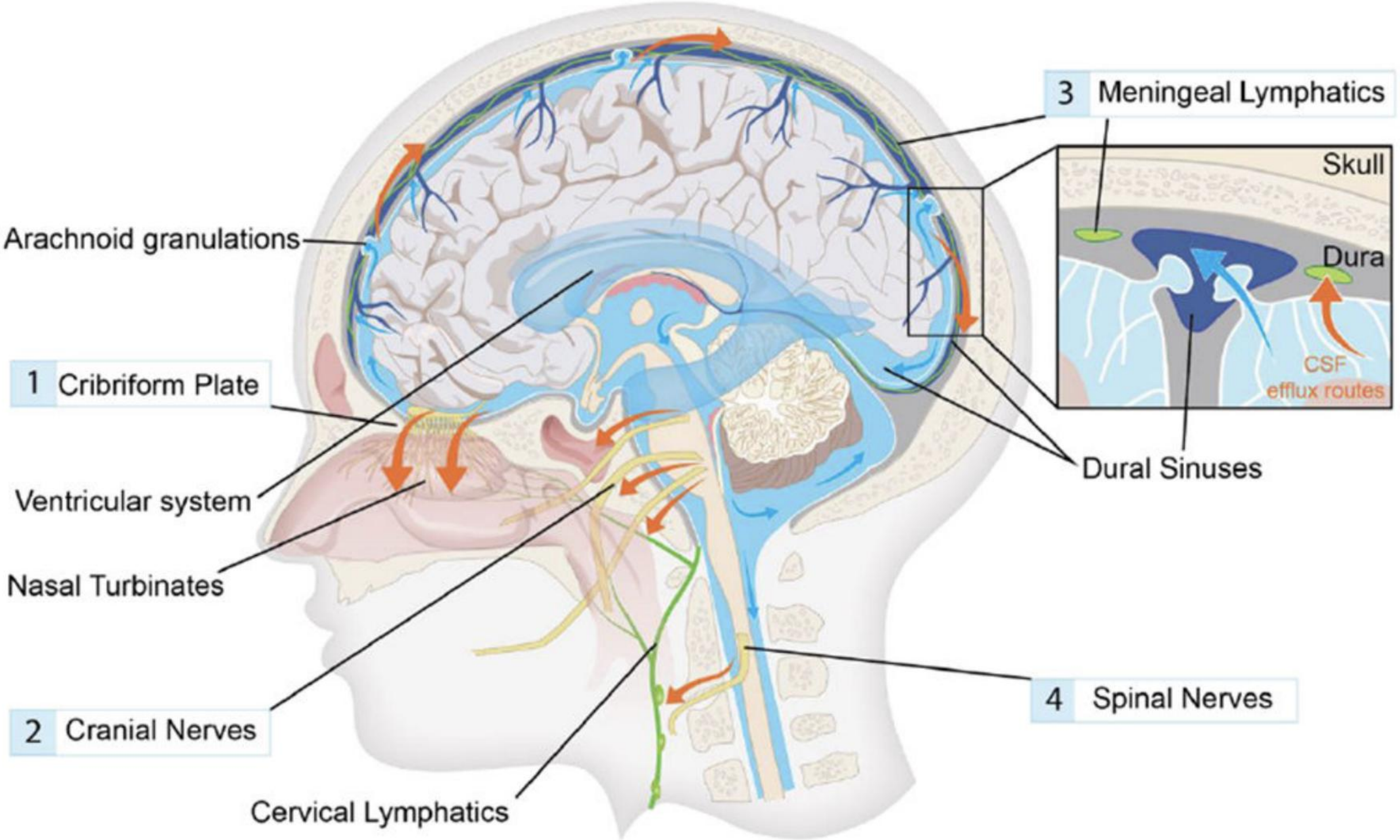
The glymphatic pathway in neurological disorders.

Martin Kaag Rasmussen#1, Humberto Mestre#2,3, and Maiken Nedergaard1,2,3,* 1Center for Translational Neuromedicine, Faculty of Health and Medical Sciences, University of Copenhagen, 2200, Copenhagen, Denmark 2Center for Translational Neuromedicine, Department of Neurosurgery, University of Rochester Medical Center, Rochester, NY 14642, USA 3Department of Neuroscience, University of Rochester Medical Center, Rochester, NY 14642, USA

https://pmc.ncbi.nlm.nih.gov/articles/PMC6261373/pdf/nihms-995539.pdf

Figure 2. Cerebrospinal fluid efflux in humans.

Cerebrospinal fluid (CSF) produced in the choroid plexus flows from the ventricles to the subarachnoid space of the brain and spinal cord. CSF contained in the subarachnoid space keeps the central nervous system buoyant and serves as a fluid source for glymphatic influx. Egress sites of cranial cerebrospinal fluid (red arrows) fall into three functionally distinct categories, namely the perineural sheaths surrounding cranial and spinal nerves,[20,24] dural lymphatic vessels,[18,19,] and arachnoid granulations.[1] The contribution and significance of each egress pathway is still a matter of debate. A main perineural egress site in both rodents and human is along the olfactory nerve through the cribriform plate (1) towards lymphatic vessels of the nasal mucosa.[16,20] From here the CSF is drained to the cervical lymph nodes.[43] Other significant perineural efflux pathways in rodents are the trigeminal, the glossopharyngeal, vagal, and spinal accessory nerves (2).[20] Dural lymphatic vessels have also been shown to carry CSF towards the cervical lymphatic system (3). In rodents, these vessels exit the skull along the pterygopalatine artery, the veins that drain the sigmoid sinus and retroglenoid vein, and the foramina of the cranial nerves.[18,19] In humans, meningeal lymphatic vessels have been visualized with MRI and were located around the dural sinuses, middle meningeal artery and cribiform plate.[25] Arachnoid granulations are protrusions of the arachnoid membrane where CSF flows into the sagittal sinus, and constitute the only known egress site that drains directly to the blood stream.[1] Traditionally, this site was thought to be the main cerebrospinal fluid egress site, but evidence suggests that under physiological intracranial pressure virtually no CSF leaves to the blood stream.[1] The main egress site of CSF in the spinal cord is along the spinal nerves (4).



3 Meningeal Lymphatics
Skull
Dura
CSF
efflux routes
Arachnoid granulations
1 Cribriform Plate
Ventricular system
Nasal Turbinates
Dural Sinuses
4 Spinal Nerves
2 Cranial Nerves
Cervical Lymphatics

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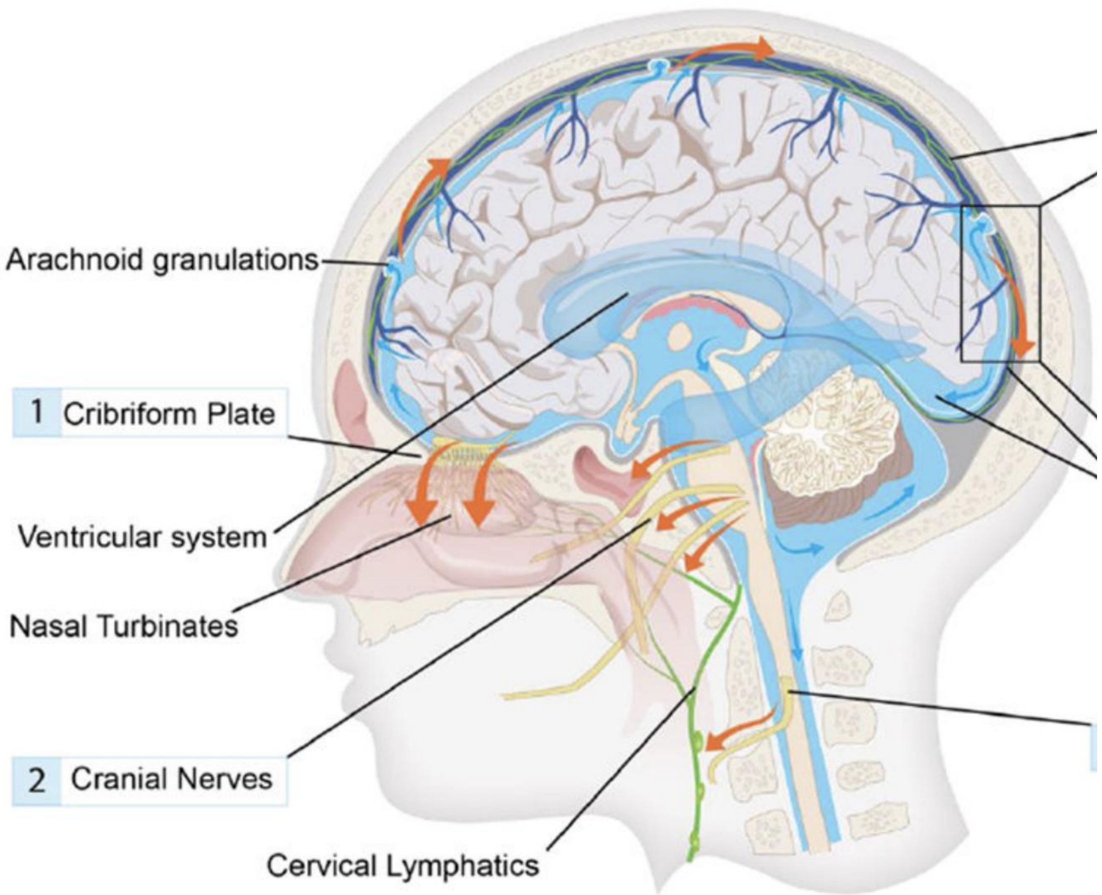

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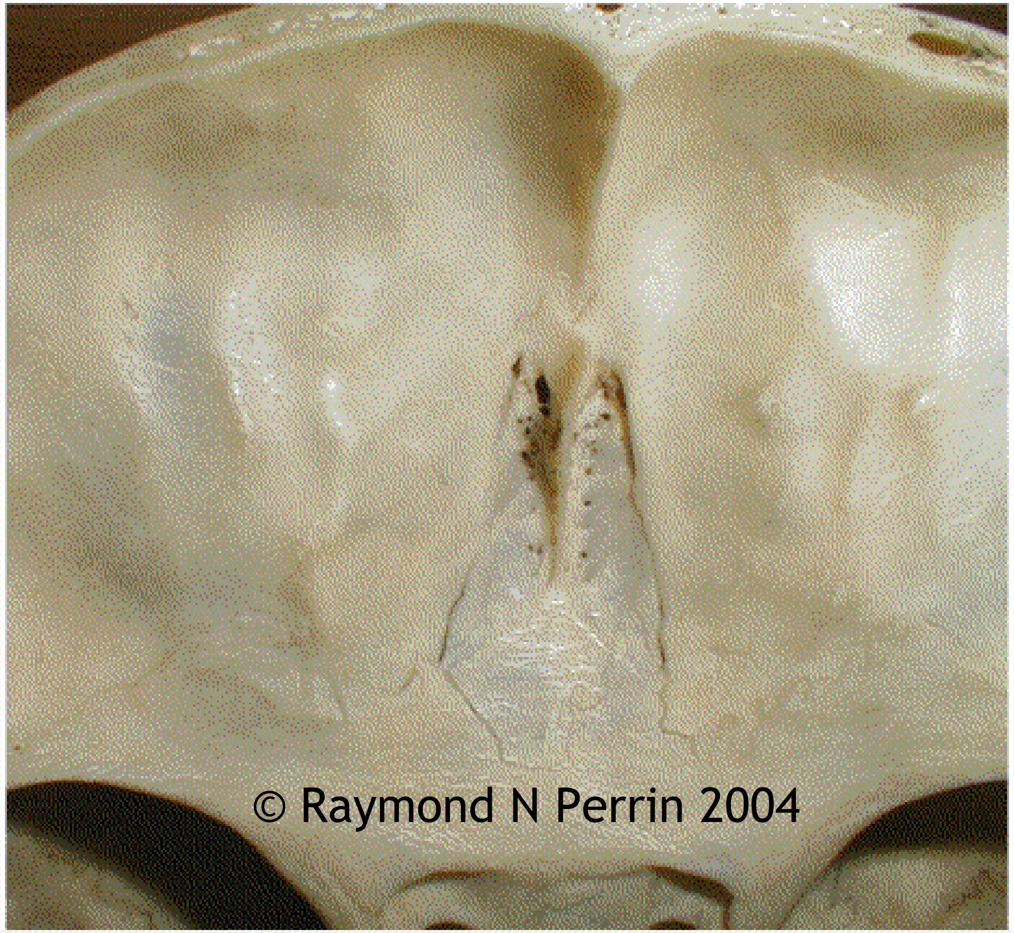
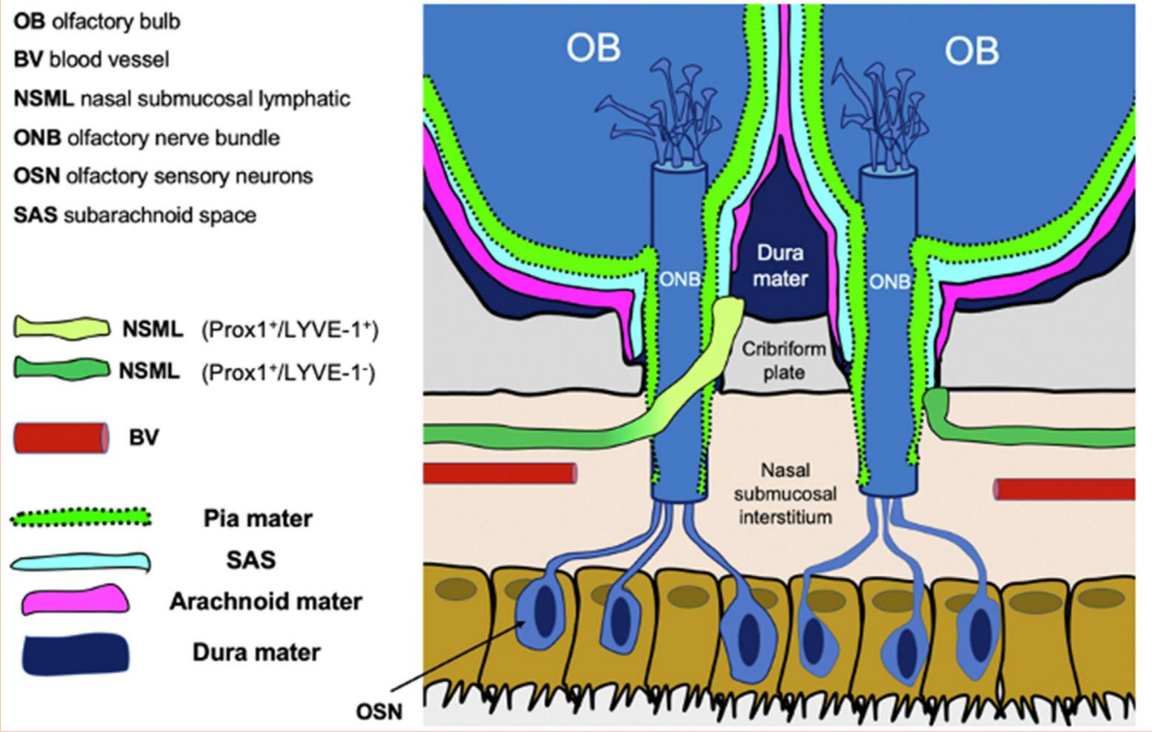
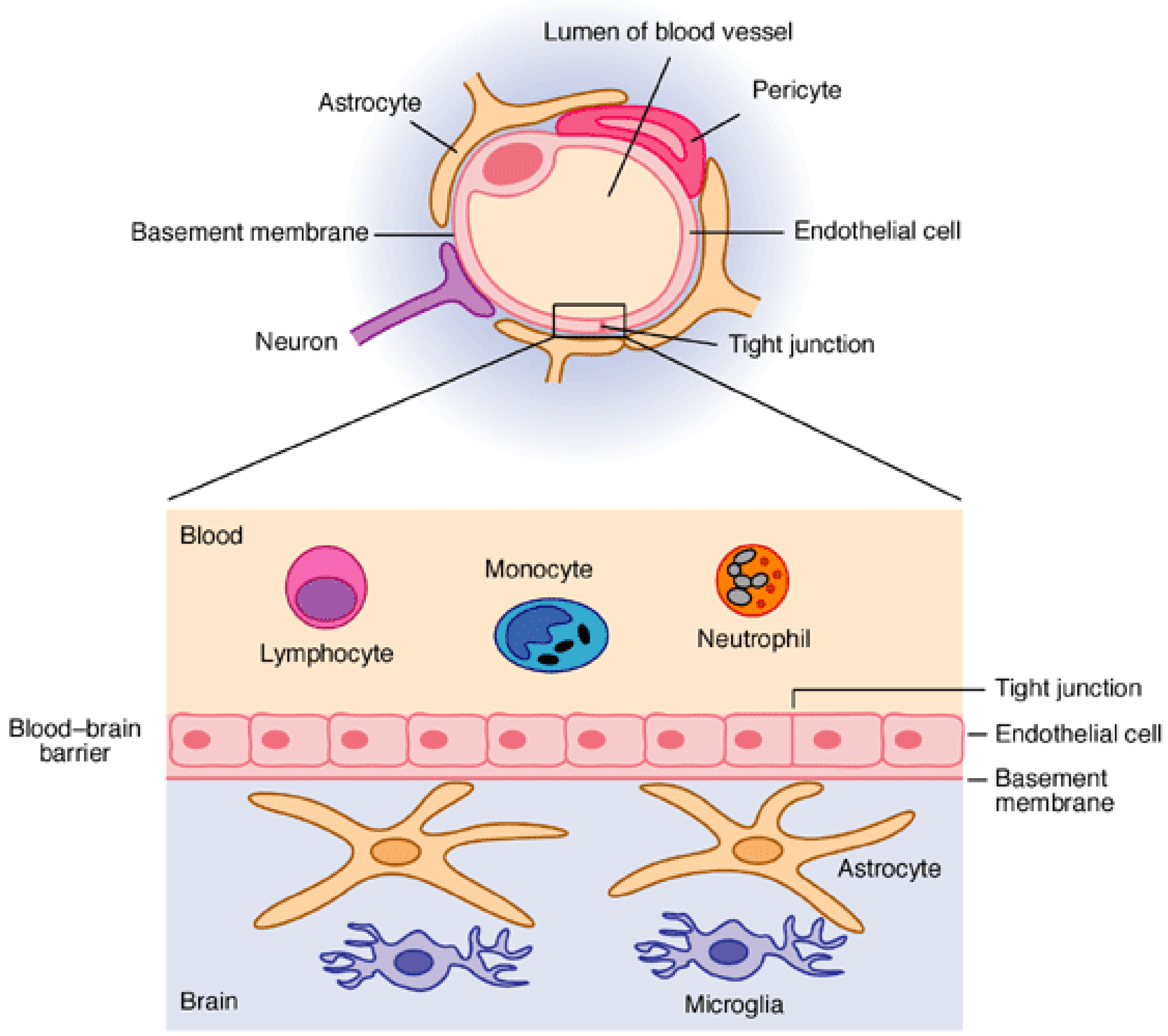
CRIBIFORM PLATE AND CSF DRAINAGE



SPERA IN 2023 VIA IMMUNOFLUORESCENT PROBES INITIALLY IN MICE AND NOW IN HUMANS





The blood–brain barrier (BBB)

CSF tracer (Green) moves along the paravascular space around an arteriole in the brain.

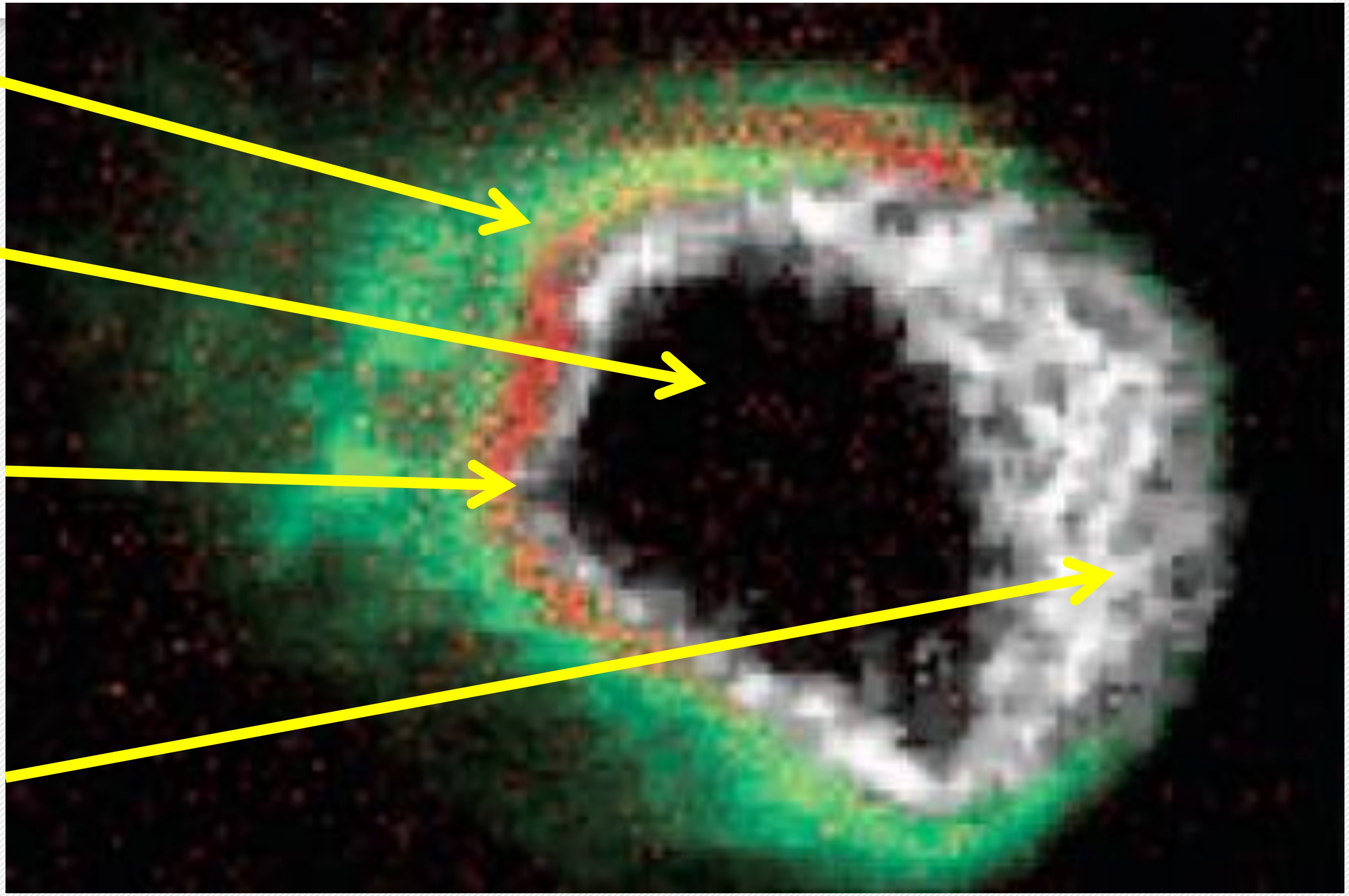
Iliff J et al. August 2012

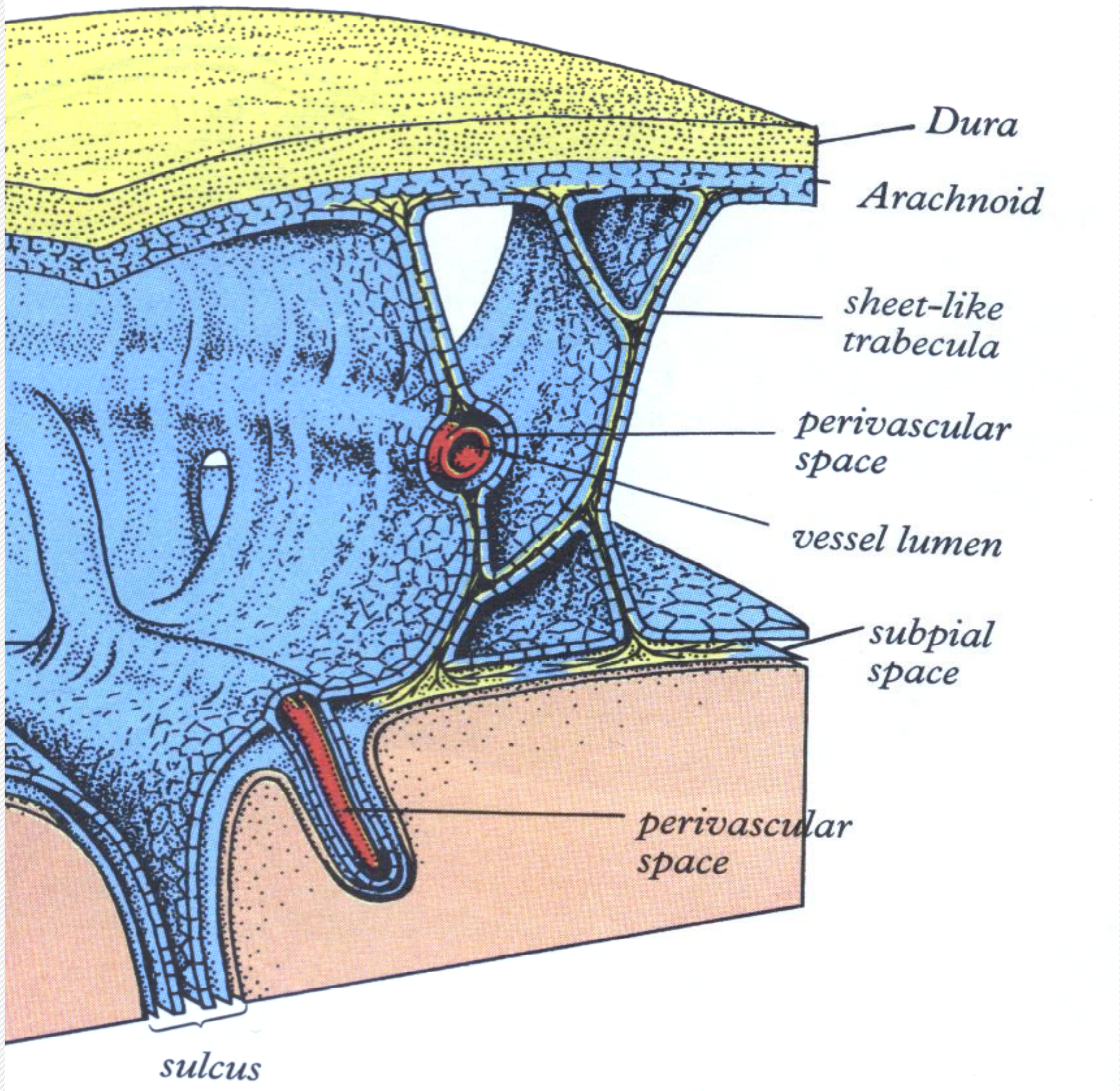
CSF

Blood

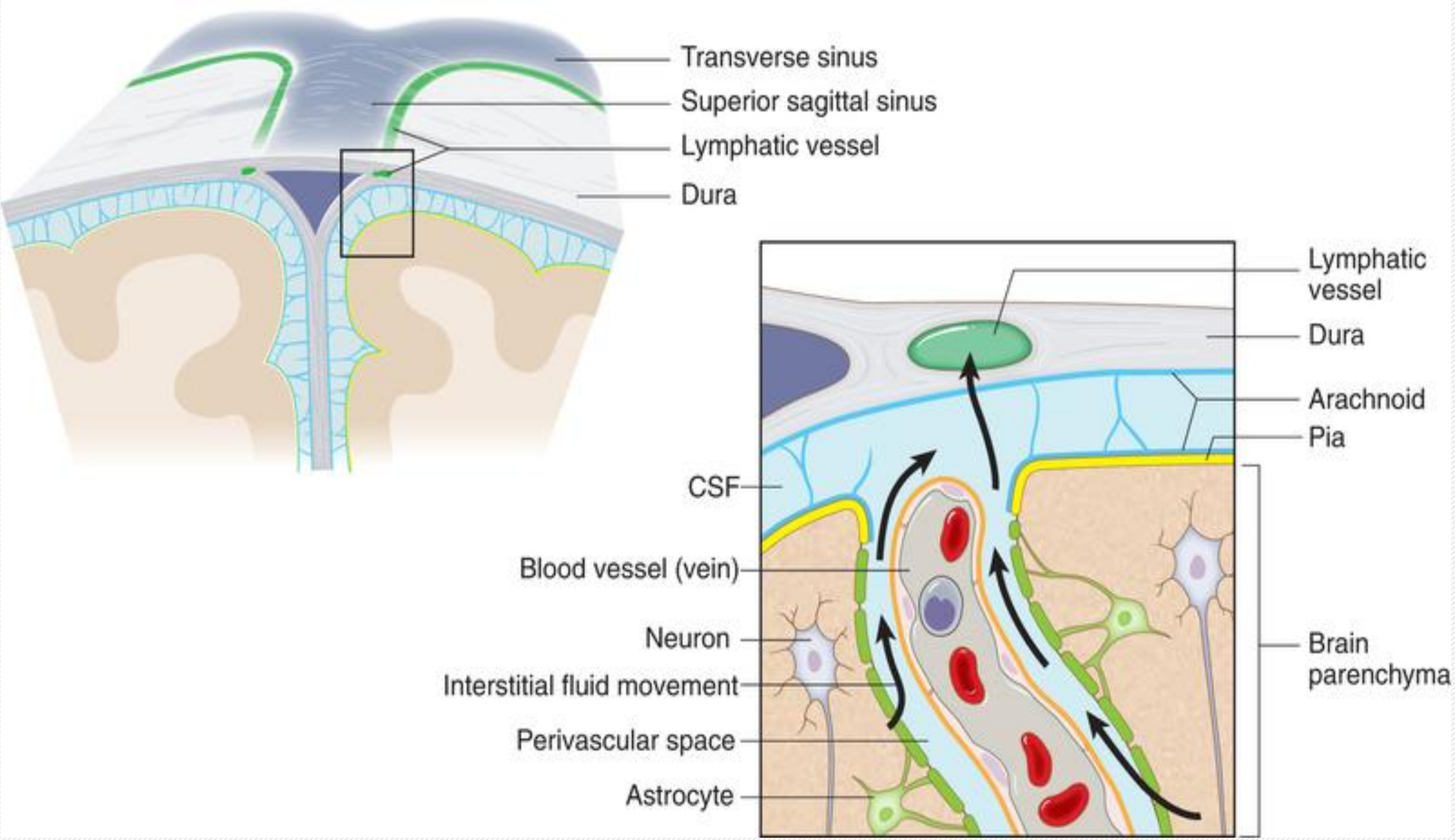
Smooth Muscle

Endothelium (astrocytic Endfeet)





Section of the meninges illustrating perivascular spaces
(Illustration from Gray's Anatomy 38th Edition p.1213, Zhang *et al.*, 1990)

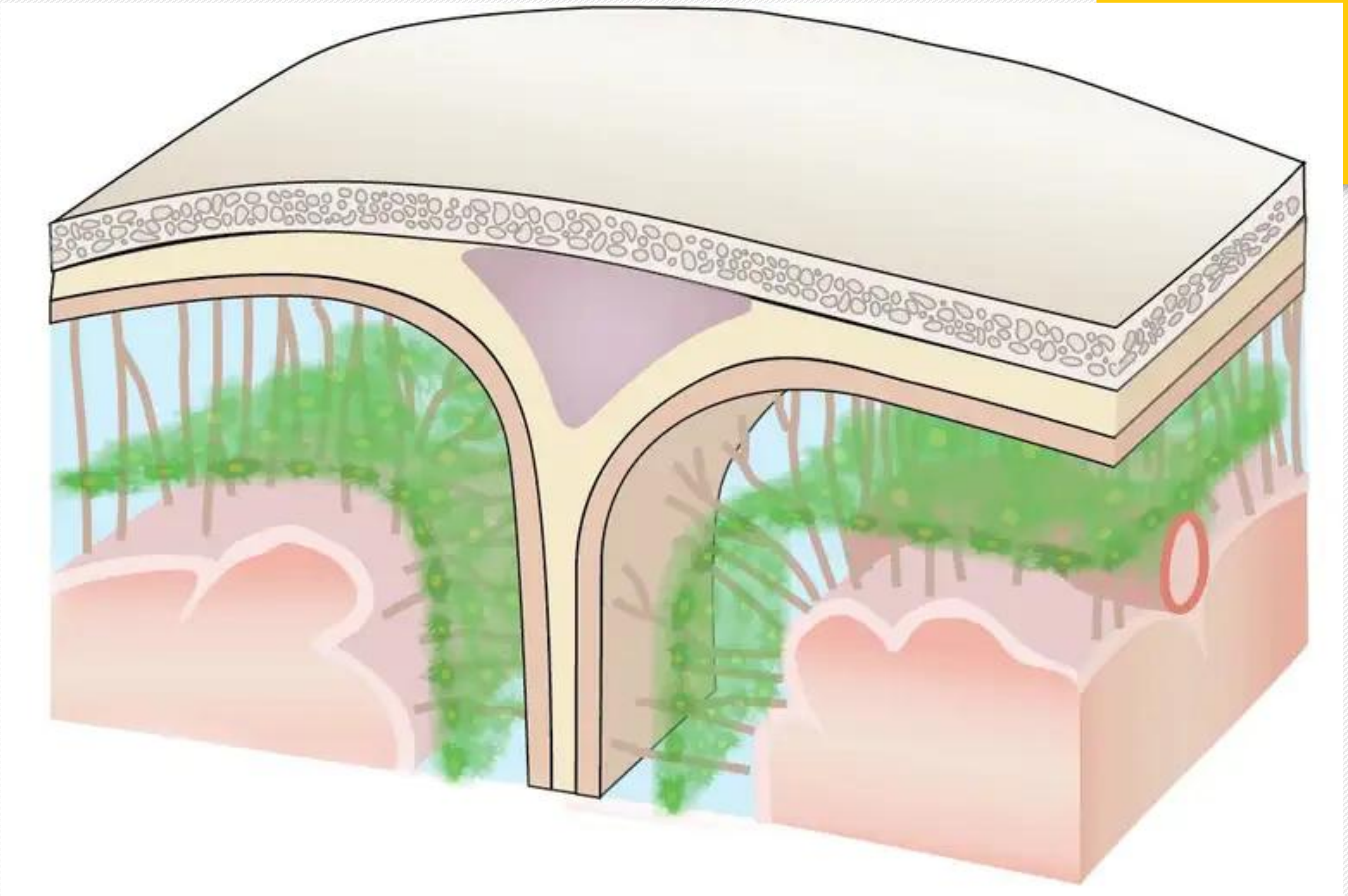


Antoine Louveau et al. **Structural and functional features of central nervous system lymphatic vessels**. *Nature*, 2015; DOI: 10.1038/nature14432

The SLYM (Subarachnoid Lymphatic-Like Membrane)

Cross section of the skull (top) and outer layer of the brain, showing the subarachnoid lymphatic-like membrane in green
A cross-section of the skull (top) and the outer layer of the brain, showing the subarachnoid lymphatic-like membrane in green

University of Copenhagen



The Glymphatic System

- An extra layer lines the brain The traditional view is that the brain is surrounded by three layers, the dura, arachnoid, and pia mater.
- Møllgård et al. found a fourth meningeal layer called the subarachnoid lymphatic-like membrane (SLYM).
- SLYM is immunophenotypically distinct from the other meningeal layers in the human and mouse brain and represents a tight barrier for solutes of more than 3 kilodaltons, effectively subdividing the subarachnoid space into two different compartments.
- SLYM is the host for a large population of myeloid cells, the number of which increases in response to inflammation and aging, so this layer represents an innate immune niche ideally positioned to surveil the cerebrospinal fluid

Reference:

Møllgård K, Beinlich F , Kusk P et al.
A mesothelium divides the subarachnoid space into functional compartments.
Science
2023 Jan 6;379(6627):84-88. doi:10.1126/science.adc8810. Epub 2023 Jan 5.

It is extremely thin, with a width of just a few cells or, in places, even one cell. The SLYM hadn’t been noticed before, partly because the membrane disintegrates when the brain is removed from the skull in post-mortems, says Maiken Nedergaard at the University of Rochester Medical Center in New York.

Functionally, the closeness of SLYM with the endothelial lining of the meningeal venous sinus permits direct exchange of small solutes between cerebrospinal fluid and venous blood, The functional characterization of SLYM provides fundamental insights into brain immune barriers and fluid transport.

Current CSF Drainage Understanding (BEFORE)

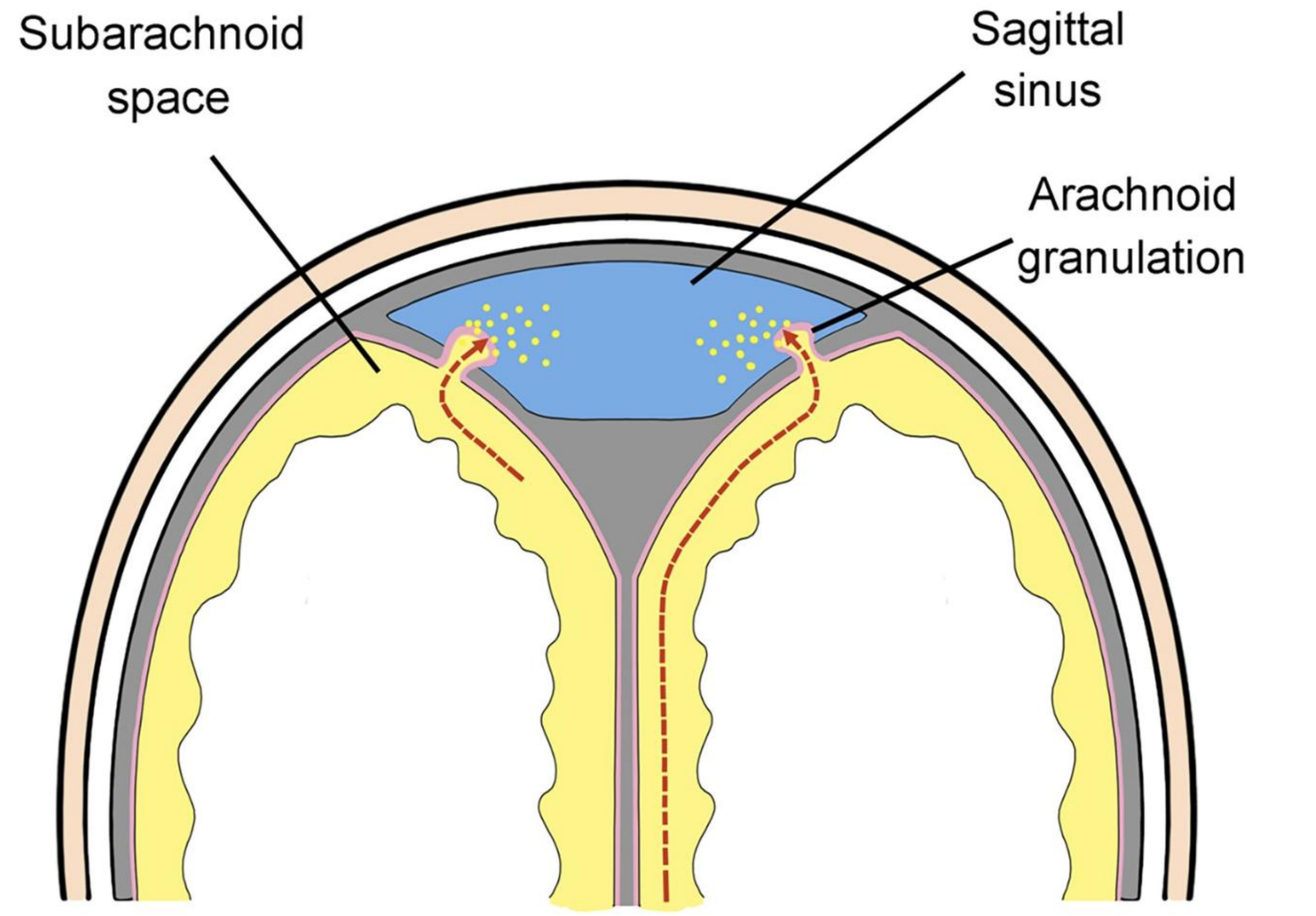


Fig 1. Cross-section diagram of the accepted model of CSF drainage in humans. CSF (yellow) in the subarachnoid space is thought to diffuse through protrusions of the arachnoid meninges (arachnoid granulations) into the sagittal sinus vein (blue).

https://doi.org/10.1371/journal.pone.0285269.g001

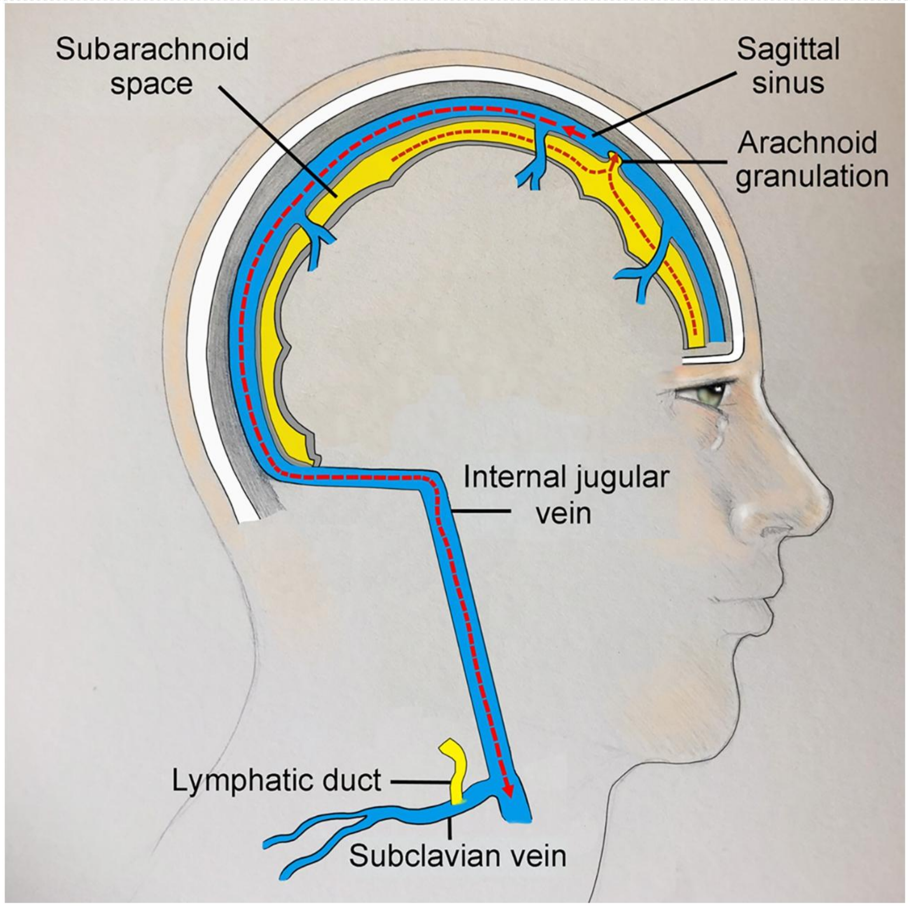


Fig 2. Sagittal view of the current model of CSF drainage. CSF (yellow) drains from the subarachnoid space through arachnoid granulations into the sagittal sinus vein (blue). Sagittal sinus venous blood exits the cranium through the jugular foramen to enter the internal jugular vein.

https://doi.org/10.1371/journal.pone.0285269.g002

RESEARCH ARTICLE

Identification of a novel path for cerebrospinal fluid (CSF) drainage of the human brain

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Abstract

How cerebrospinal fluid (CSF) drains from the human brain is of paramount importance to cerebral health and physiology. Obstructed CSF drainage results in increased intra-cranial pressure and a predictable cascade of events including dilated cerebral ventricles and ultimately cell death. The current and accepted model of CSF drainage in humans suggests CSF drains from the subarachnoid space into the sagittal sinus vein. Here we identify a new structure in the sagittal sinus of the human brain by anatomic cadaver dissection. *The CSF canalicular system* is a series of channels on either side of the sagittal sinus vein that communicate with subarachnoid cerebrospinal fluid via Virchow-Robin spaces. Fluorescent injection confirms that these channels are patent and that flow occurs independent of the venous system. Fluoroscopy identified flow from the sagittal sinus to the cranial base. We verify our previous identification of CSF channels in the neck that travel from the cranial base to the subclavian vein. Together, this information suggests a novel path for CSF drainage of the human brain that may represent the primary route for CSF recirculation. These findings have implications for basic anatomy, surgery, and neuroscience, and highlight the continued importance of gross anatomy to medical research and discovery.

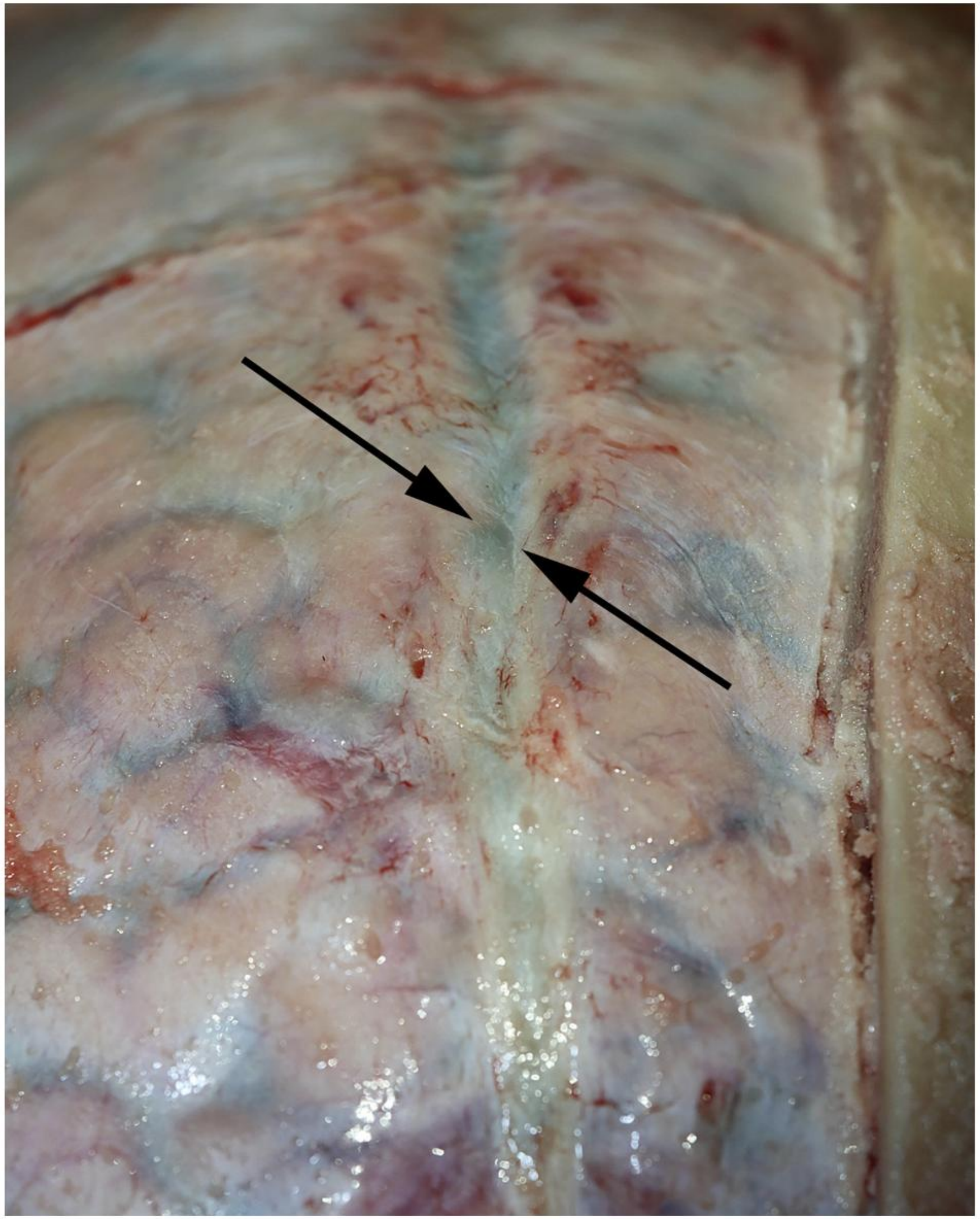


Fig 3. Demonstration of the venous sagittal sinus. The sagittal sinus is a midline venous structure (between arrows) in the dura. CSF channels travel on either side of this venous sinus.

https://doi.org/10.1371/journal.pone.0285269.g003

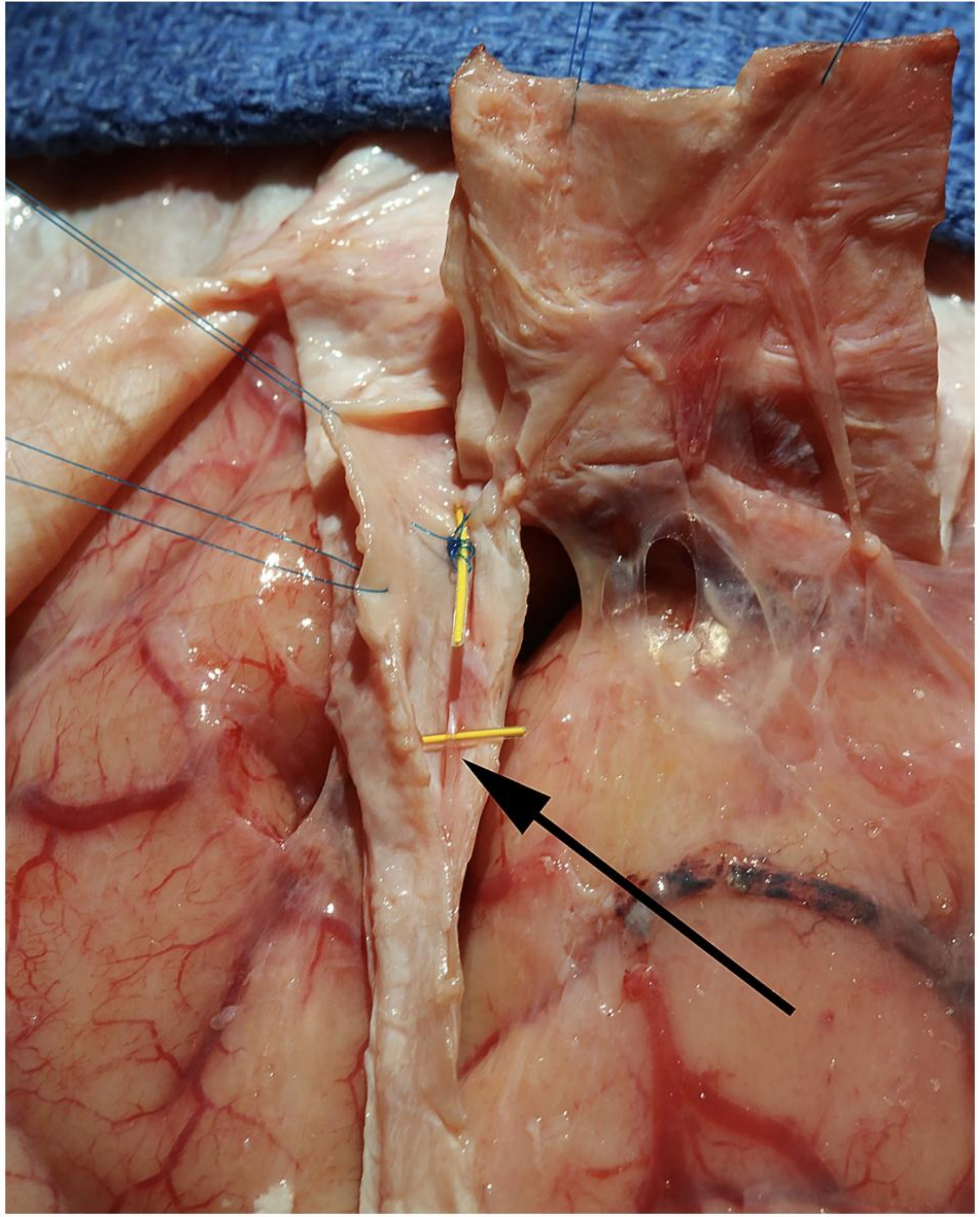


Fig 4. CSF channels in the sagittal sinus. Blood was evacuated from the venous sagittal sinus and is held open with blue sutures. The right CSF channel system (arrow) is identified over the yellow marker in a 90's year-old female specimen.

https://doi.org/10.1371/journal.pone.0285269.g004

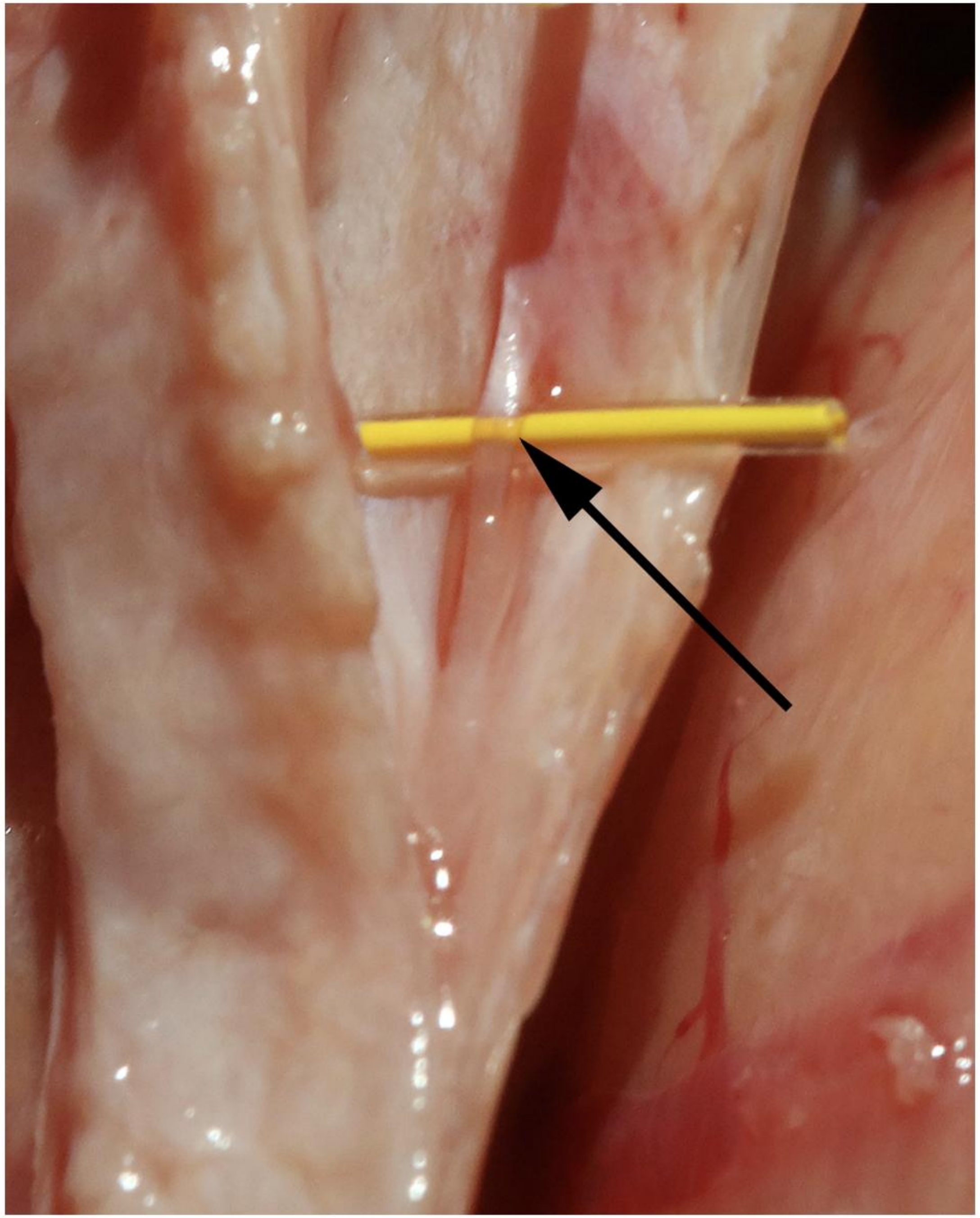


Fig 5. CSF channels in the sagittal sinus. This is a macro view of CSF channels (arrow) in the sagittal sinus.

https://doi.org/10.1371/journal.pone.0285269.g005

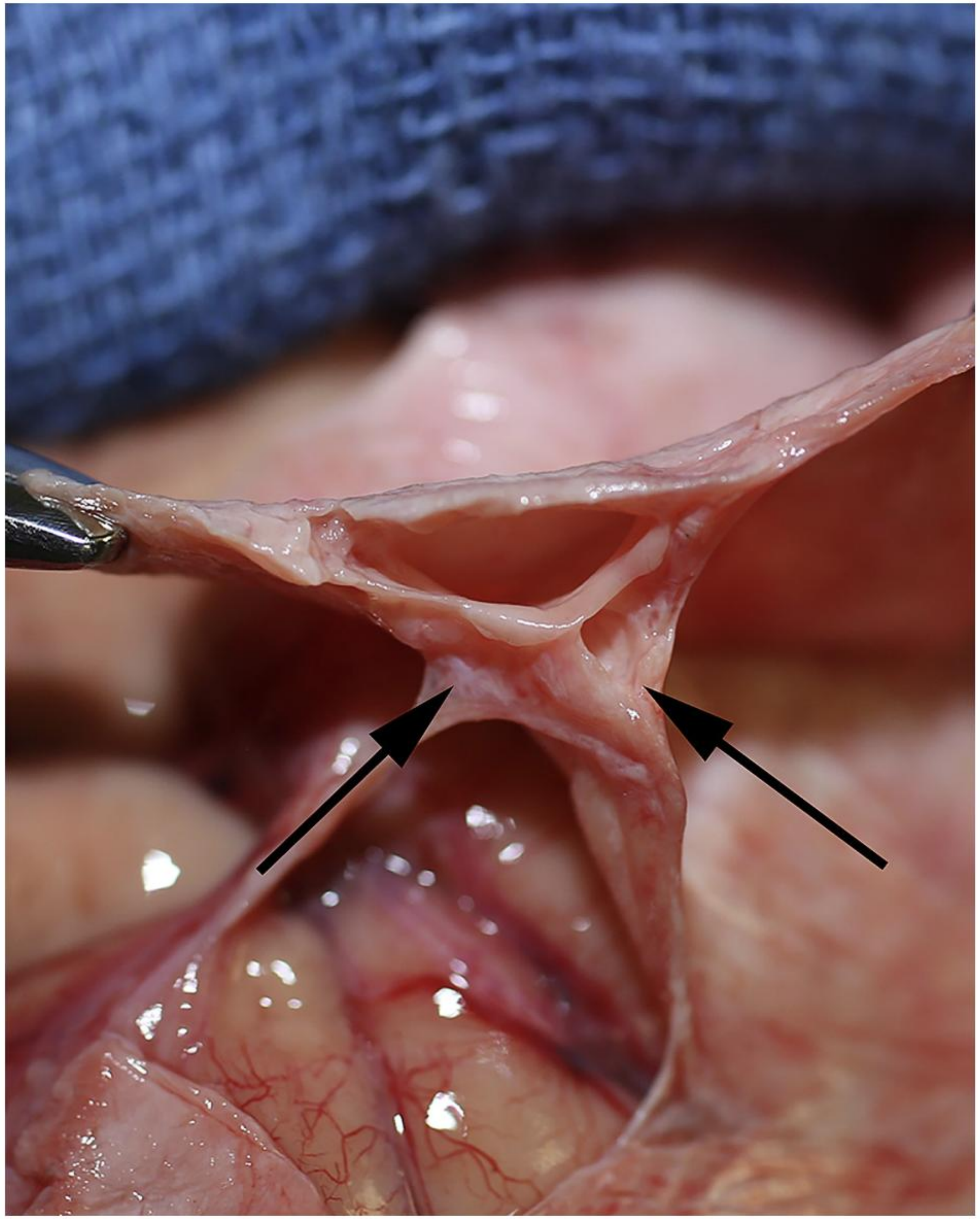


Fig 7. CSF channels in the sagittal sinus. Clamps suspend dura and show the empty venous sinus and bilateral CSF channels (arrows). The right side is widely patent, whereas the left has been obliterated by infiltrating carcinoma. The arachnoid meninges travel to these CSF channels.

https://doi.org/10.1371/journal.pone.0285269.g007

Table 1. Characterization of the CSF canalicular system. The CSF canalicular system provides an anatomic route for CSF drainage directly from the arachnoid meninges to the subclavian vein, and is independent of the venous sagittal sinus.

Privileged	Does not involve intermediary lymphatics or blood vessels
Direct route	From arachnoid meninges to the subclavian vein
May be primary path	Secondary path to scalp lymphatics and lymph nodes
Drains to subclavian vein	CSF recycled into the vascular circulation
Analogous to nerves	Terminal CSF drainage of both brain and nerves is subclavian vein
Canalicular structure	Channels are embedded in surrounding tissue
Plexiform	Travel as a group of channels
Lack valves / muscular wall	Usually single-cell layer thickness

https://doi.org/10.1371/journal.pone.0285269.t001

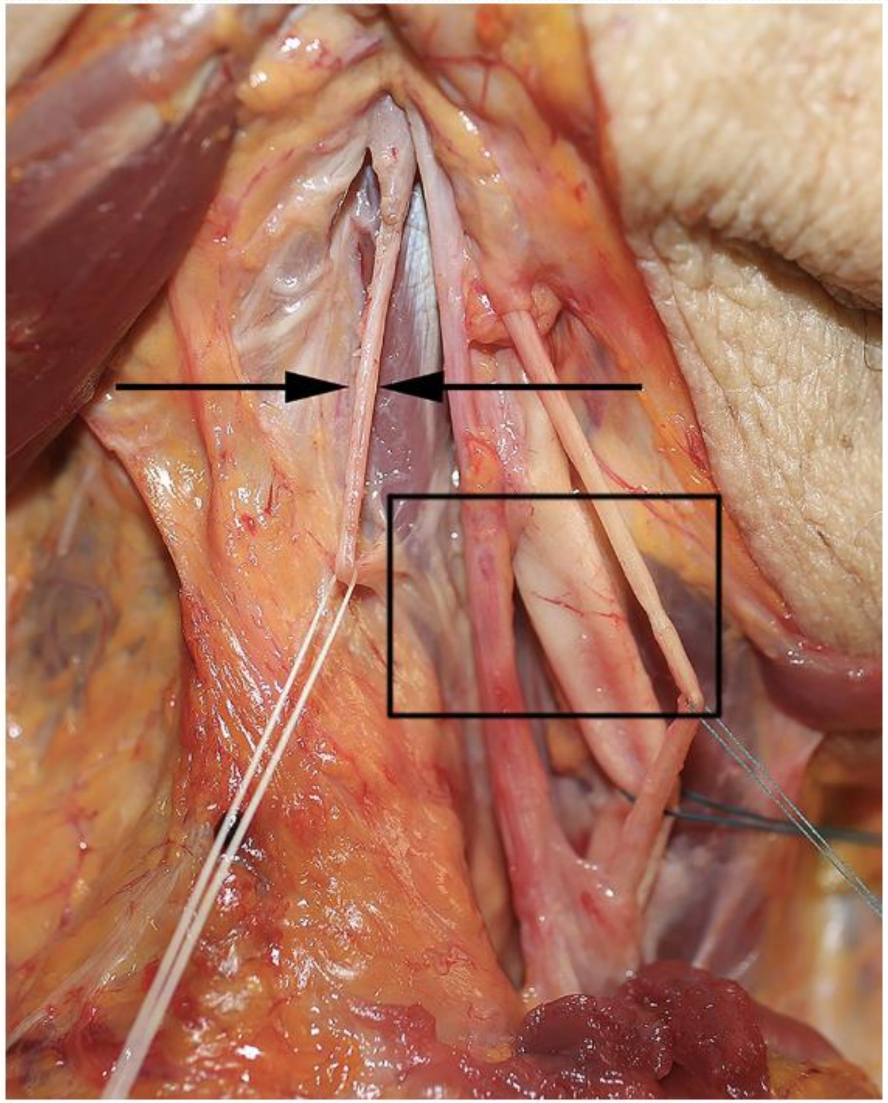


Fig 18. Cervical CSF system. Neck dissection in an 80's year-old female specimen verifies the terminal CSF drainage system in the neck (arrow). The structures of the carotid sheath are seen in the rectangle and include (from left to right) the internal jugular vein, carotid artery, and vagus nerve.

https://doi.org/10.1371/journal.pone.0285269.g018

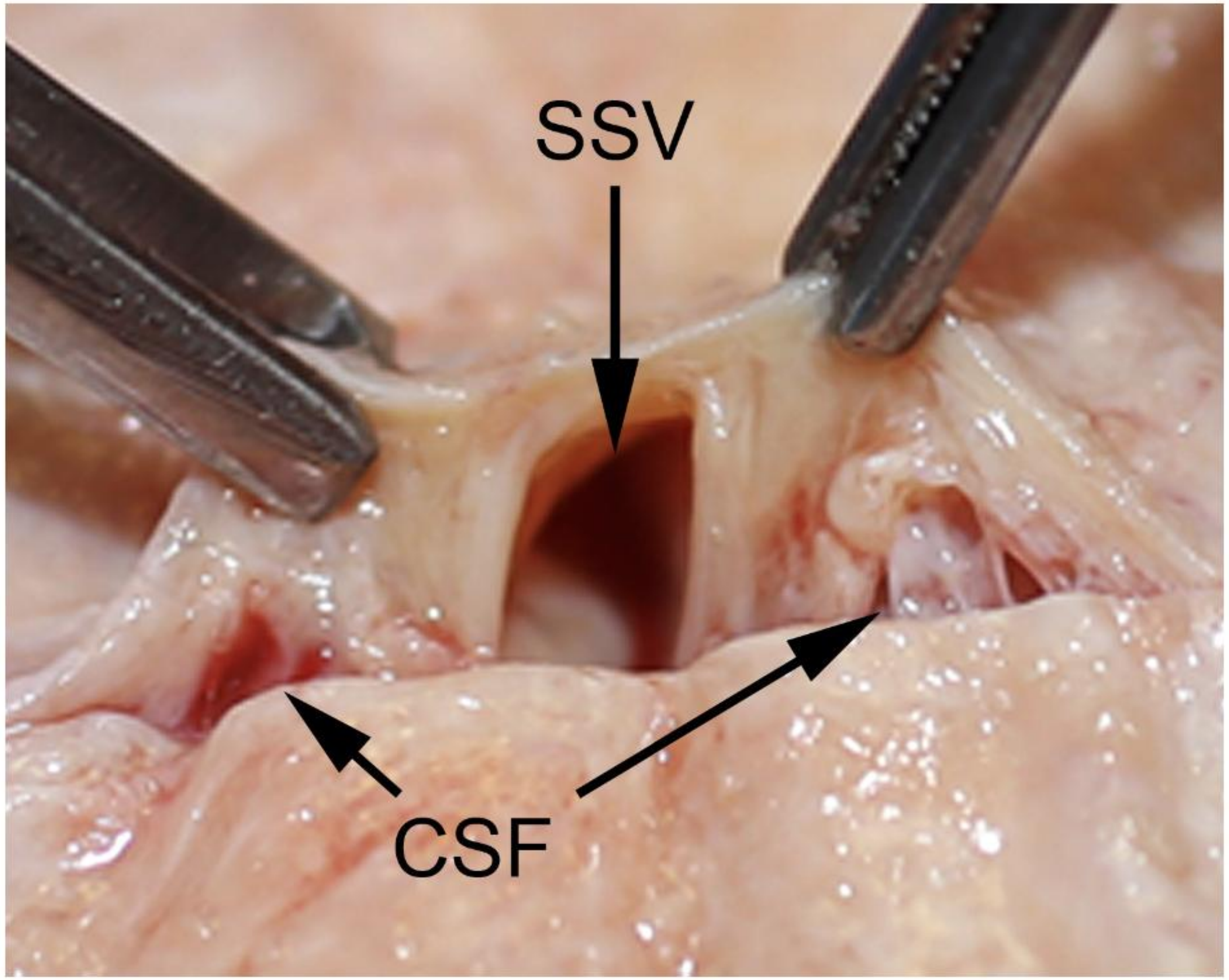


Fig 22. The location of CSF canalicular system relative to the venous sagittal sinus. Macro view shows the centrally-located sagittal sinus vein (SSV) accompanied by CSF channels (CSF) located on either side.

https://doi.org/10.1371/journal.pone.0285269.g022

PESSA CSF CANALICULAR SYSTEM INCLUDED (AFTER)
NEW GROSS ANATOMY SYSTEM FOUND 2023

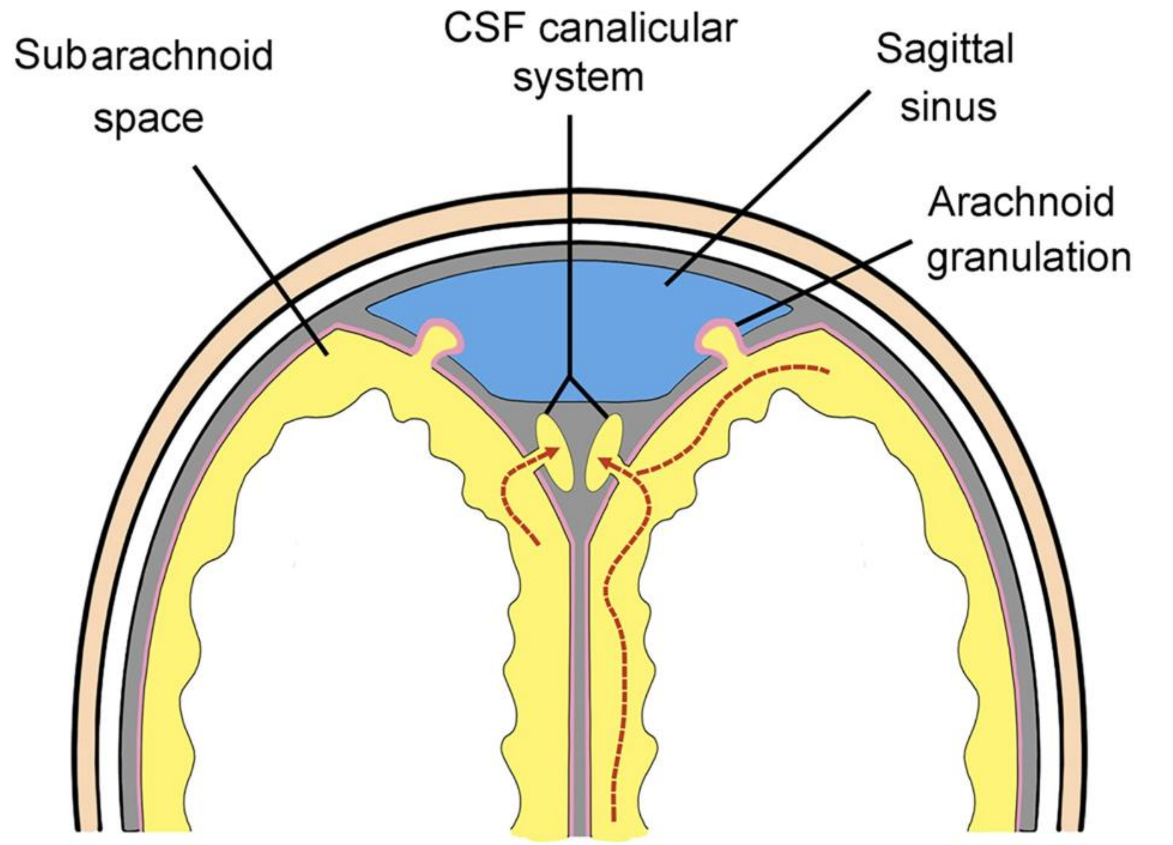


Fig 19. A cross-section diagram of the CSF canalicular system. The CSF canalicular system is located on either side of the venous sagittal sinus. CSF (yellow) flows from the subarachnoid space into CSF channels.

https://doi.org/10.1371/journal.pone.0285269.g019

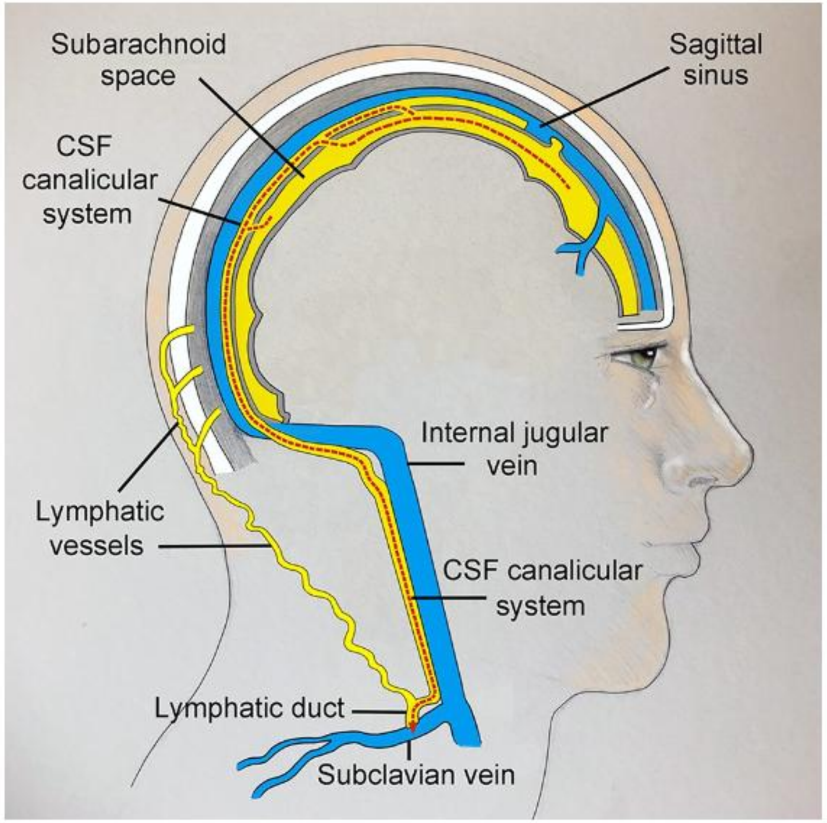
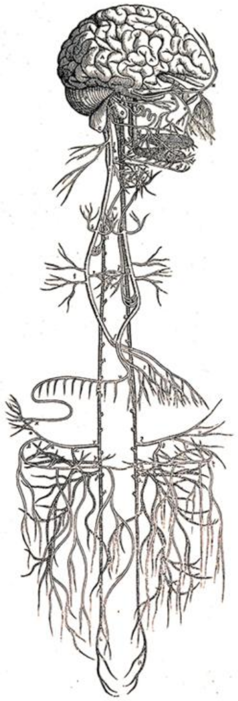
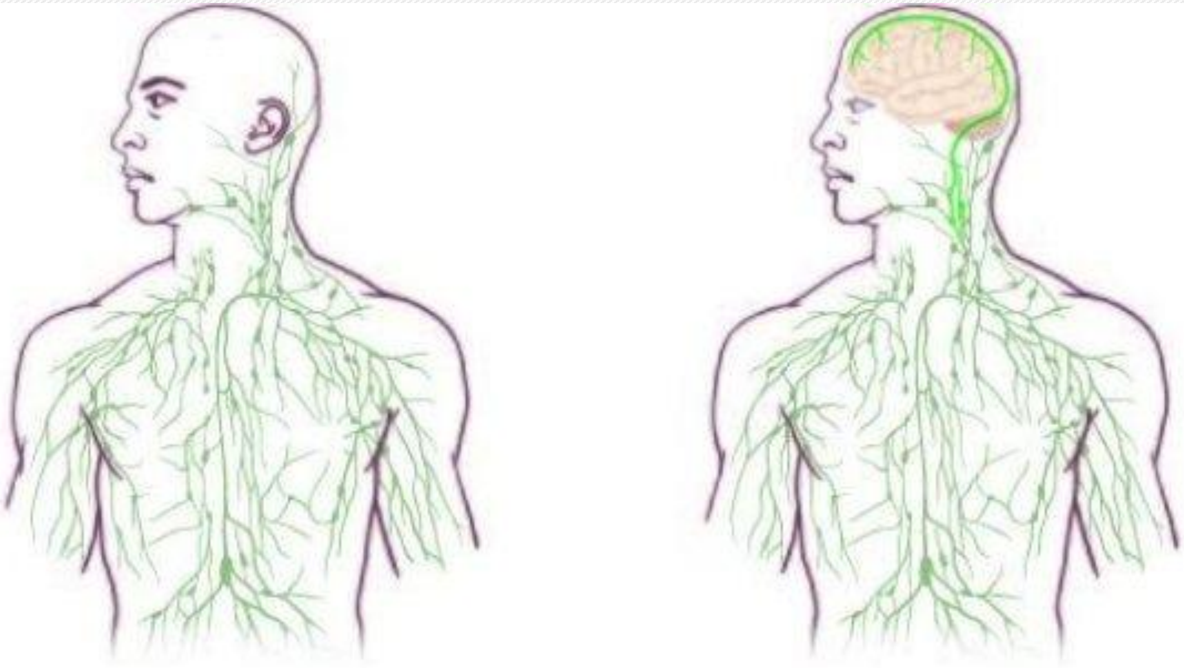


Fig 20. Sagittal view of the CSF canalicular system. The CSF canalicular system provides an anatomic CSF (yellow) to drain from the subarachnoid space directly to the subclavian vein.

https://doi.org/10.1371/journal.pone.0285269.g020





Human and nonhuman primate meninges harbor lymphatic vessels that can be visualized noninvasively by MRI

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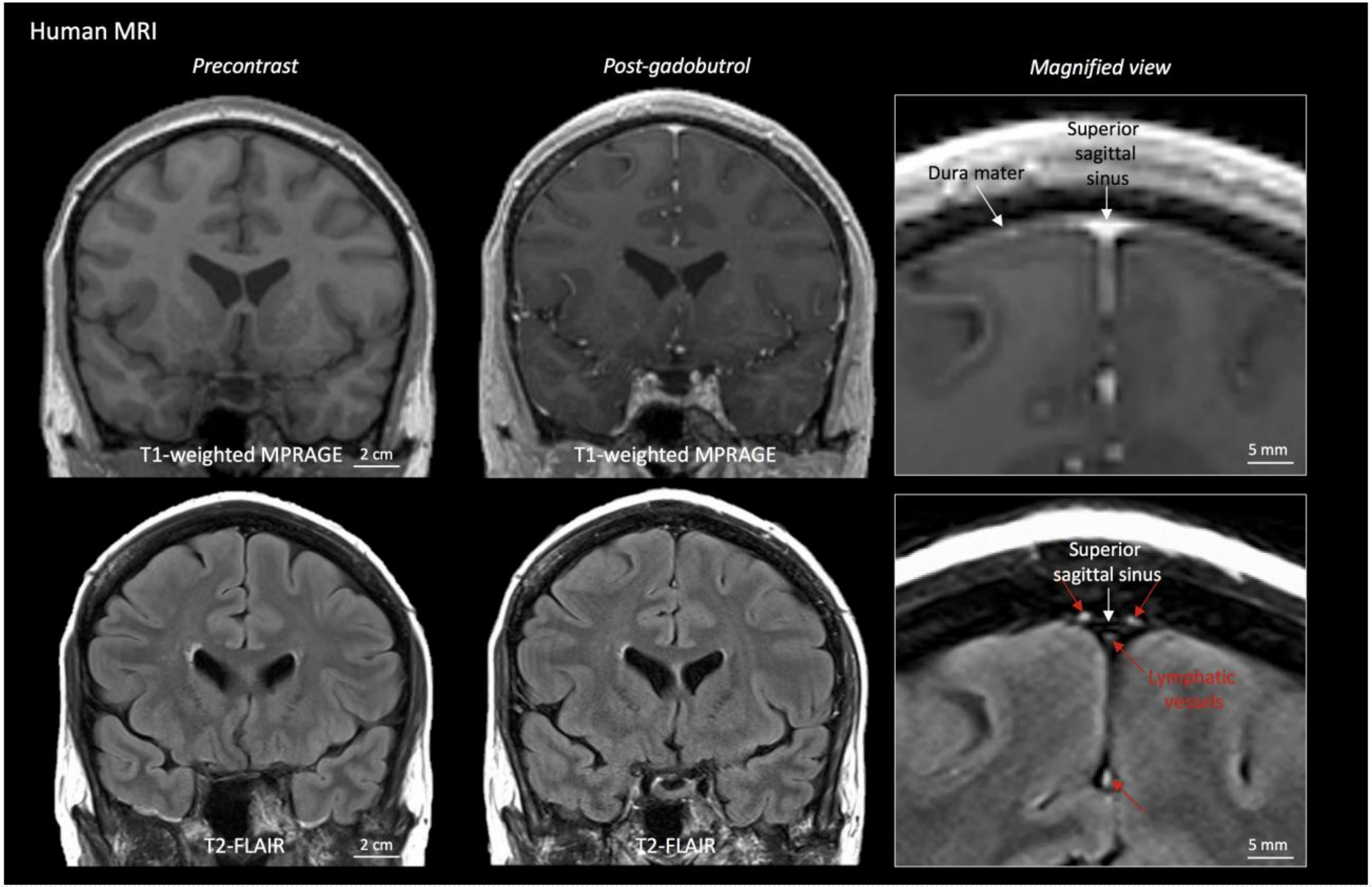
Abstract Here, we report the existence of meningeal lymphatic vessels in human and nonhuman primates (common marmoset monkeys) and the feasibility of noninvasively imaging and mapping them in vivo with high-resolution, clinical MRI. On T2-FLAIR and T1-weighted black-blood imaging, lymphatic vessels enhance with gadobutrol, a gadolinium-based contrast agent with high propensity to extravasate across a permeable capillary endothelial barrier, but not with gadofosveset, a blood-pool contrast agent. The topography of these vessels, running alongside dural venous sinuses, recapitulates the meningeal lymphatic system of rodents. In primates, meningeal lymphatics display a typical panel of lymphatic endothelial markers by immunohistochemistry. This discovery holds promise for better understanding the normal physiology of lymphatic drainage from the central nervous system and potential aberrations in neurological diseases.

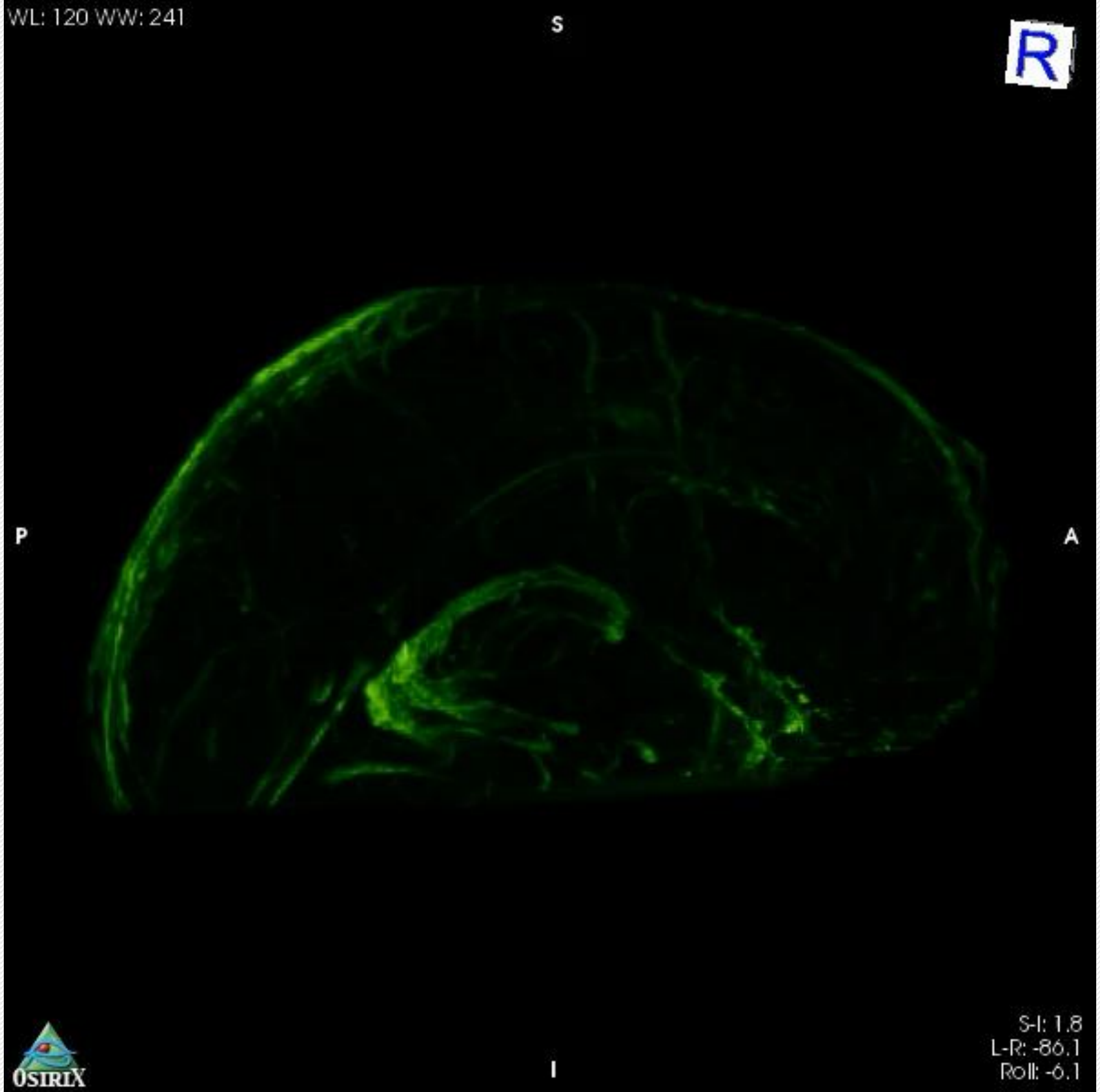
DOI: https://doi.org/10.7554/eLife.29738.001

Martina Absinta, Seung-Kwon Ha, Govind Nair, Pascal Sati, Nicholas J Luciano, Maryknoll Palisoc, Antoine Louveau, Kareem A Zaghloul, Stefania Pittaluga, Jonathan Kipnis, Daniel S Reich (2017) Human and nonhuman primate meninges harbor lymphatic vessels that can be visualized noninvasively by MRI

https://doi.org/10.7554/eLife 6:e29738


Human MRI
Precontrast
Post-gadobutrol
Magnified view
T1-weighted MPRAGE
2 cm
T1-weighted MPRAGE
Superior
sagittal
sinus
Dura mater
5 mm
T2-FLAIR
2 cm
T2-FLAIR
Superior
sagittal sinus
Lymphatic
vessels
5 mm

3D-rendering of dural lymphatics (green) in a 47 year old woman from skull-stripped subtraction T1-black-blood images (horizontal view, 180 degrees, 7 frames/minute). https://doi.org/10.7554/eLife.29738.014

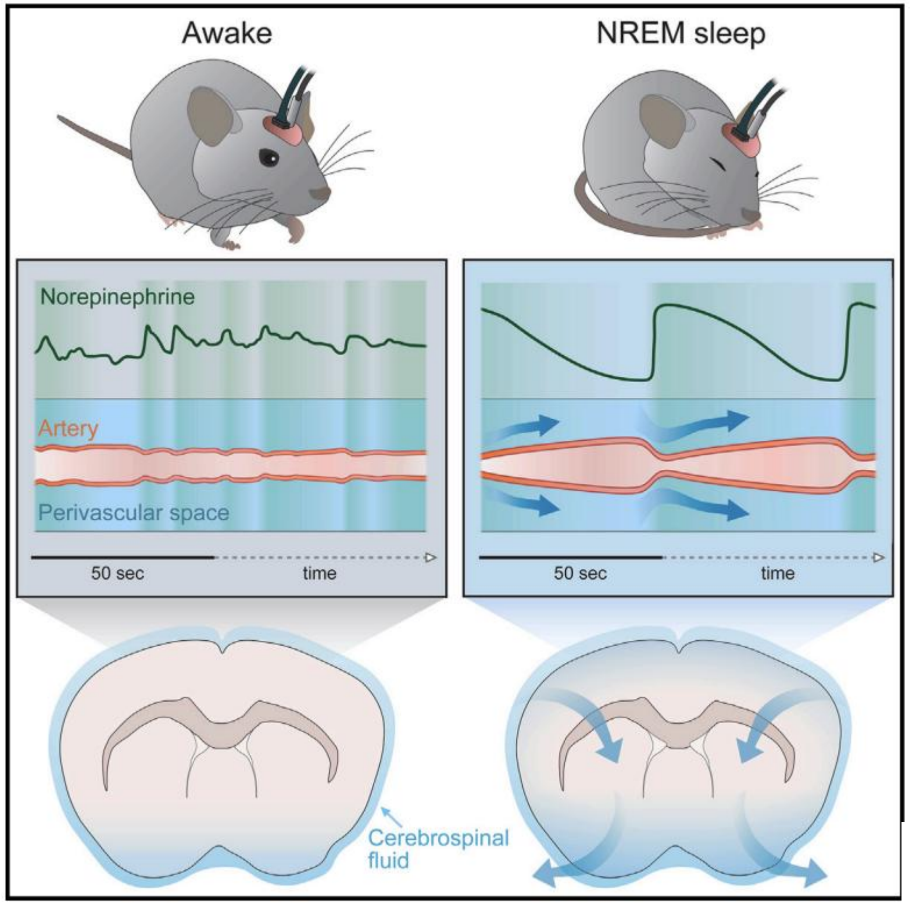


Cell

Article

Norepinephrine-mediated slow vasomotion drives glymphatic clearance during sleep

Graphical abstract



Authors

Natalie L. Hauglund, Mie Andersen, Klaudia Tokarska, ..., Pia Weikop, Hajime Hirase, Maiken Nedergaard

Correspondence

nedergaard@sund.ku.dk

In brief

Norepinephrine oscillations during NREM sleep drive synchronized changes in cerebral blood volume and cerebrospinal fluid, promoting glymphatic clearance. Optogenetic and pharmacological manipulations confirm that vasomotion, regulated by norepinephrine, acts as a pump for brain fluid transport.

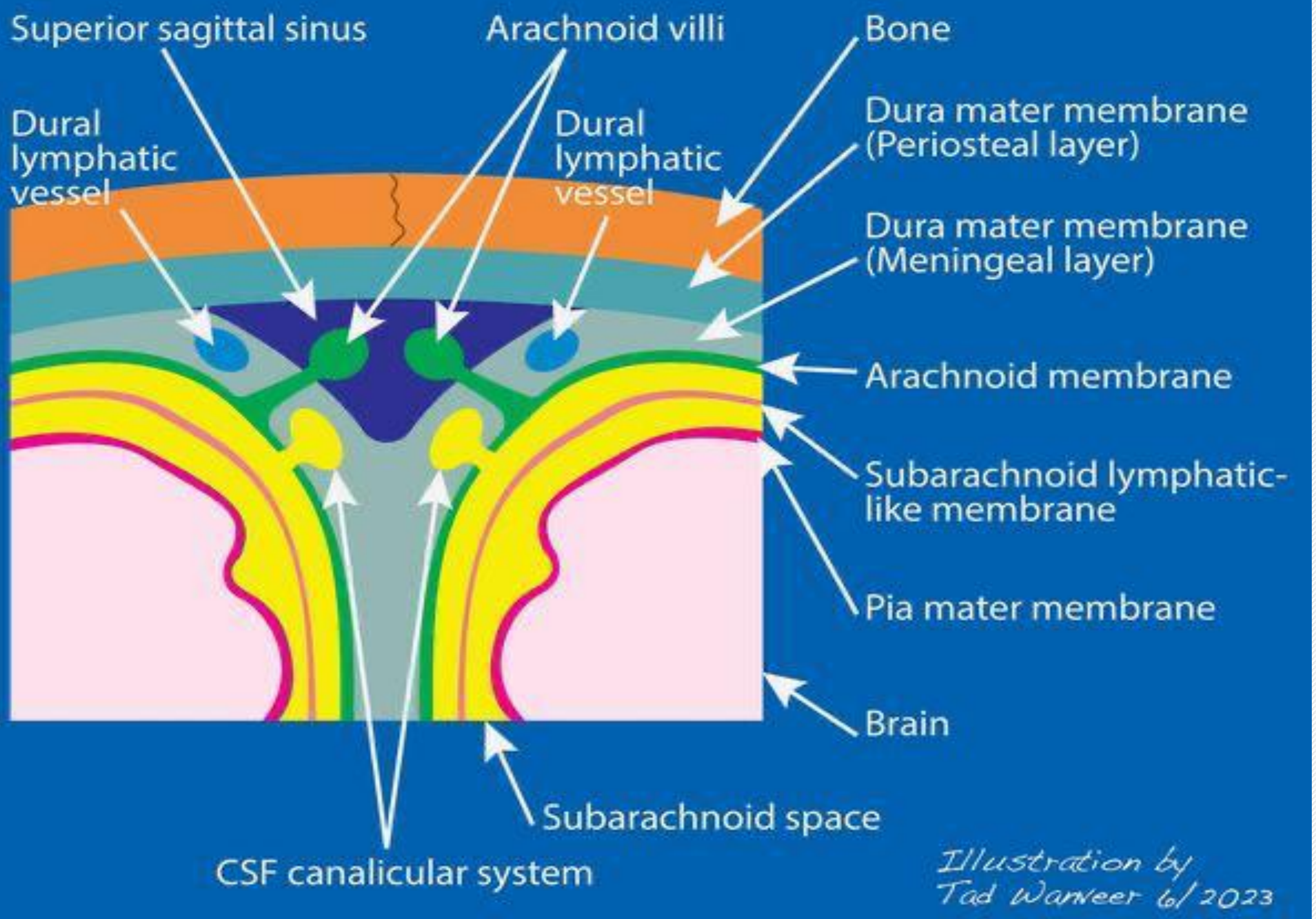
Highlights

- Norepinephrine release from the locus coeruleus drives slow vasomotion in NREM sleep
- Infraslow norepinephrine oscillations control opposing changes in blood and CSF volumes
- Norepinephrine oscillation frequency during NREM sleep predicts glymphatic clearance
- The sleep aid zolpidem suppresses norepinephrine oscillations and glymphatic flow

Hauglund et al., 2025, Cell *188*, 606–622
February 6, 2025
https://doi.org/10.1016/j.cell.2024.11.027

CellPress

Cross Section of the Superior Sagittal Sinus, Arachnoid Villi, Dural Lymphatic Vessels & CSF Canalicular System



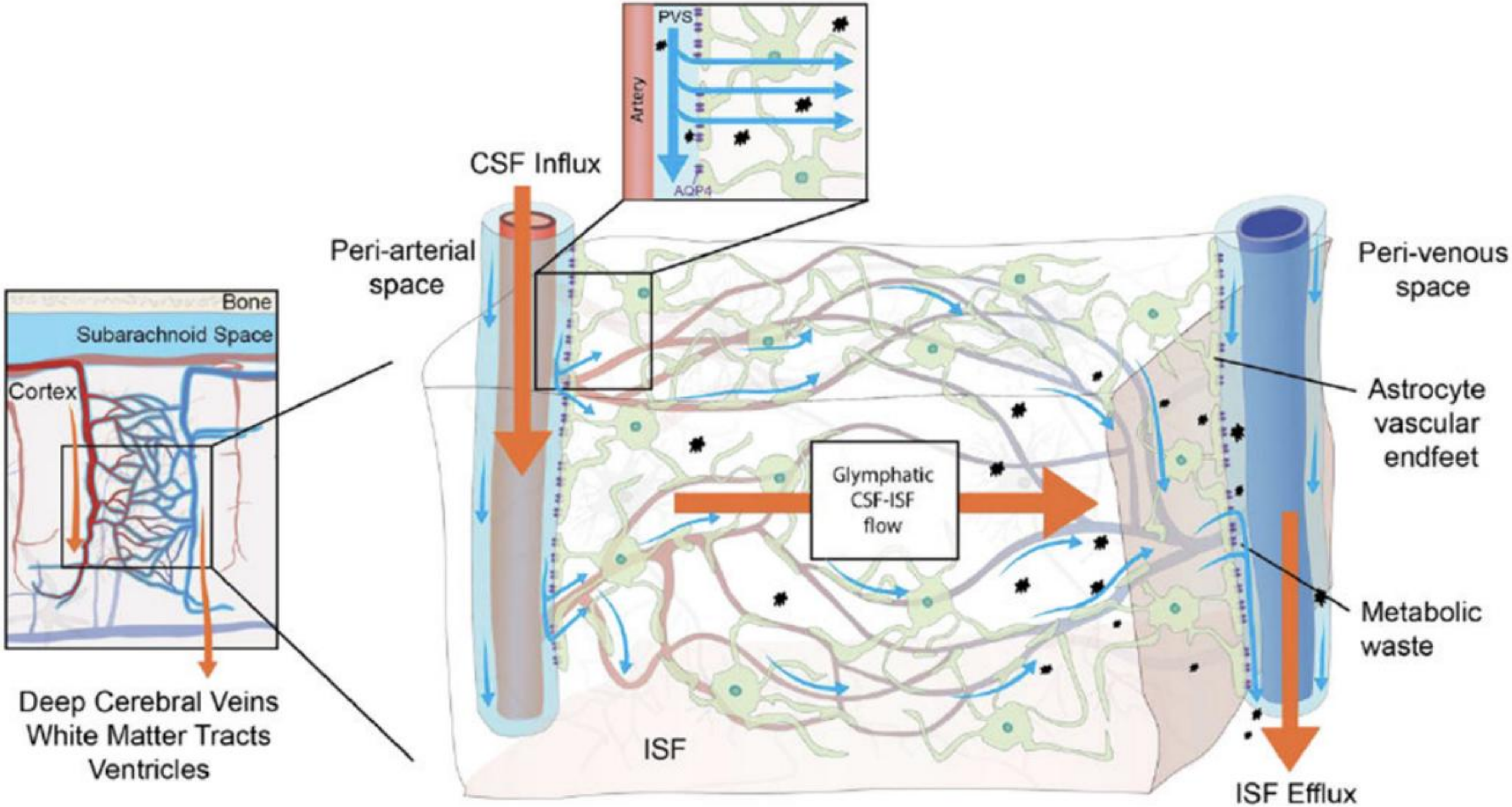
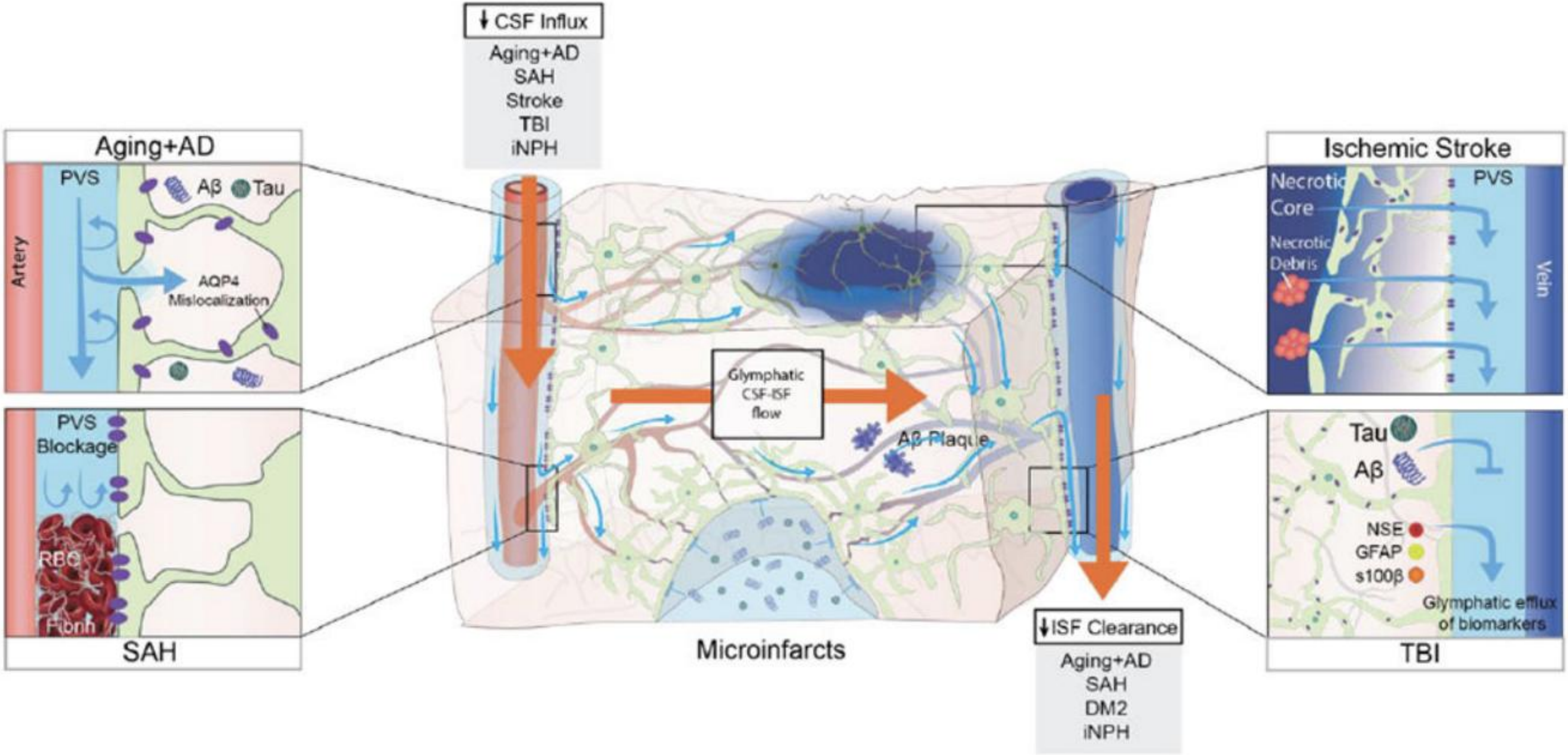

PVS
Artery
AQP4
CSF Influx
Peri-arterial space
Bone
Subarachnoid Space
Cortex
Deep Cerebral Veins
White Matter Tracts
Ventricles
Glymphatic CSF-ISF flow
ISF
Peri-venous space
Astrocyte vascular endfeet
Metabolic waste
ISF Efflux

Figure 1. The glymphatic pathway.

Rodent studies have shown that CSF from the subarachnoid space is driven into the perivascular space of major cerebral arteries on the brain surface from where it flows along the artery as it branches into penetrating arteries.[12,13,22,39] A similar pattern of CSF flow has been shown in patients undergoing MRI in combination with intrathecal contrast agent.[15,46] In these patients it was observed that the CSF contrast agent flows along the large leptomeningeal cerebral arteries in an anterograde fashion, and that presence of contrast agent in the subarachnoid space precedes parenchymal uptake in adjacent brain regions.[15] The microscopic details of CSF flow within the brain thus far all stem from animal research. These studies have shown that the perivascular space runs along the entire penetrating artery, known as the Virchow-Robin space, and continues to follow the vessel as it branches into arterioles and capillaries.[12,13,21] In the murine brain, CSF influx into the extracellular space happens at every level of the perivascular space after entry to the brain parenchyma and is facilitated by a polarized expression of the AQP4 water channel towards the astrocytic end-feet that line the perivascular space.[12] Whether a similar parenchymal CSF flow occurs in human brain has not yet been proven, but humans also harbor intracerebral perivascular spaces and polarized AQP4 expression towards astrocytic end-feet.[55,58] The basis of fluid movement within the interstitium is still a matter of debate. Bulk flow clearance of ISF is a long-standing observation, which could be driven by multiple factors such as CSF inflow, arterial pulsatility, hydrostatic pressure gradients between the arterial and venous perivascular spaces, and osmotic gradients.[8] Rodent studies show that ISF and its solutes move towards the venous perivascular space, where the fluid is taken up and drained by convection out of the brain parenchyma.[12] This directional flow removes solutes from the brain parenchyma accumulated during neural activity.[12]


↓CSF Influx
Aging+AD
SAH
Stroke
TBI
iNPH
Aging+AD
PVS
Aβ
Tau
Artery
AQP4
Mislocalization
PVS
Blockage
RBC
Fibrin
SAH
Glymphatic
CSF-ISF
flow
Aβ Plaque
Microinfarcts
↓ISF Clearance
Aging+AD
SAH
DM2
iNPH
Ischemic Stroke
Necrotic
Core
Necrotic
Debris
PVS
Vein
Tau
Aβ
NSE
GFAP
s100β
Glymphatic efflux
of biomarkers
TBI

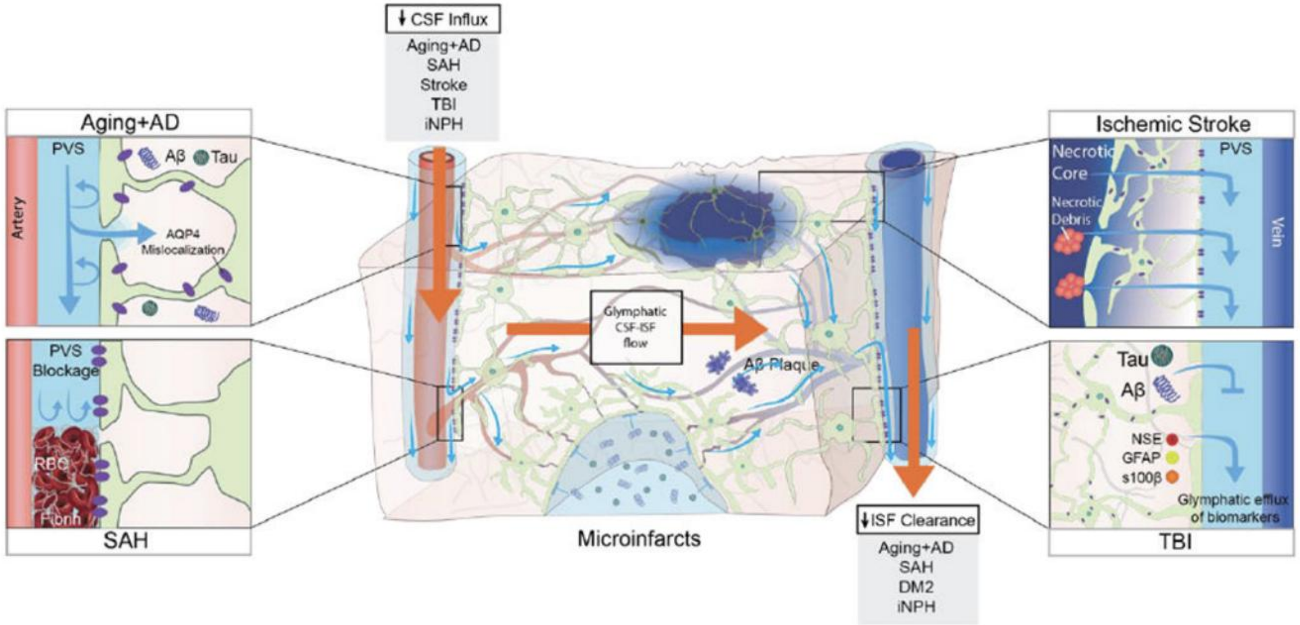


Figure 4. Pathological changes to the glymphatic pathway.

Aging and several diseases have been associated with a decrease in CSF influx to the glymphatic pathway and/or reduced clearance efficacy both in animals and in humans. In aging mice, the flow changes are likely caused by reduced vascular compliance, increased AQP4 expression and AQP4 mislocalization away from the astrocytic end-feet, which all cause reduced parenchymal influx of CSF.[23] In a human postmortem study, AQP4 expression increased with age, albeit without AQP4 mislocalization.[55] In murine models of AD, soluble and insoluble Aβ plaques provoke AQP4 mislocalization and impaired CSF influx.[34,56] In AD patients, CSF clearance rate is reduced and exhibits an inverse relationship with Aβ levels.[16] Post-mortem studies of AD patients identified AQP4 mislocalization and an increase in total AQP4 expression in AD patients compared to non-AD subjects.[55] In hemorrhagic stroke in mice and gyrenchephalic non-human primates, blood components leaking into the PVS, especially fibrin/fibrinogen deposits, occlude the PVS, which leads to reduced CSF influx.[61–63] In rodent models of ischemic stroke, necrotic cores are formed within the brain parenchyma, around which reactive astrocytes create a barrier (glial scar) to contain the injury and the toxic agents that form upon necrosis.[64] Contents of the necrotic core leak through the permeable glial scar into the PVS.[64] In mice, cerebral microinfarcts lead to a transient global reduction in glymphatic influx, and prolonged trapping of solutes within the infarct cores, probably due to reduced interstitial fluid turnover.[60] TBI in mice leads to reduced glymphatic clearance, and biomarkers of the injured parenchyma are transported through the glymphatic pathway towards the cervical lymphatic system.[42] In iNPH patients, glymphatic function is broadly impaired and characterized by both a delayed influx and a reduced clearance rate following intrathecal contrast injection.[15] In rat models of diabetes mellitus type 2 (DM2), CSF tracers remain trapped within the brain parenchyma for prolonged periods, suggesting that perivenous efflux is decreased.[68] This finding has not yet been replicated in humans, but we speculate

> Proc Natl Acad Sci U S A. 2024 Oct 15;121(42):e2407246121. doi: 10.1073/pnas.2407246121. Epub 2024 Oct 7.

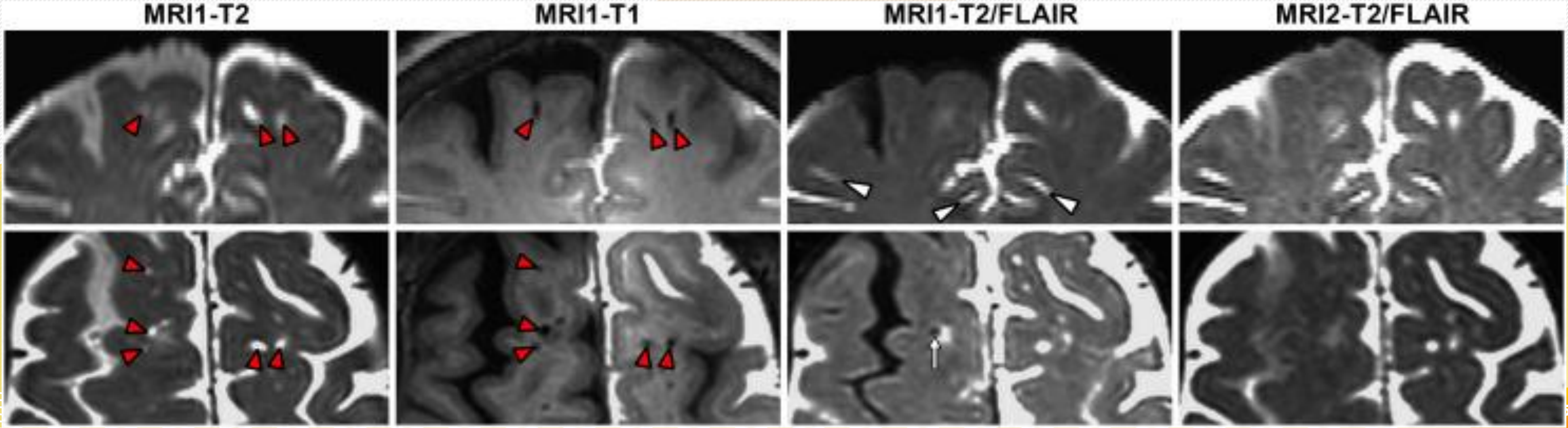
The perivascular space is a conduit for cerebrospinal fluid flow in humans: A proof-of-principle report

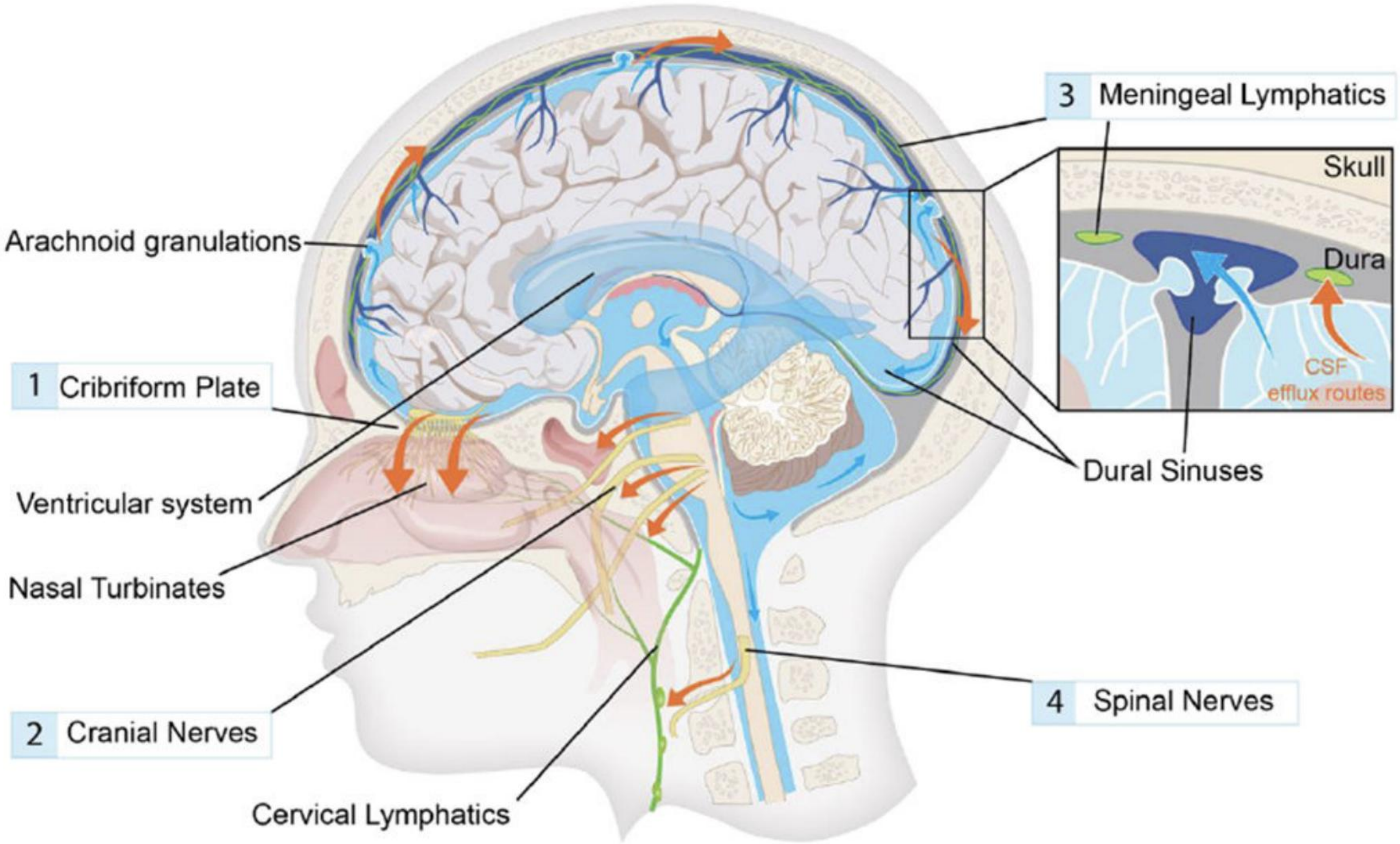
Erin A Yamamoto [#] [1], Jacob H Bagley [#] [1] [2], Mathew Geltzeiler [3], Olabisi R Sanusi [1], Aclan Dogan [1], Jesse J Liu [1], Juan Piantino [4]

Affiliations + expand

PMID: 39374384 PMCID: PMC11494350 DOI: 10.1073/pnas.2407246121

Fig. 1. Visualization of perivascular spaces by intrathecal contrast-enhanced brain MRI. Intrathecal contrast-enhanced brain MRI in coronal (*A*–*D*) and axial planes (*E*–*H*). T2 (*A* and *E*), T1 (*B* and *F*), and T2/FLAIR (*C* and *G*) sequences from timepoint 1, and T2/FLAIR from timepoint 2 (*D* and *H*) are shown. Some MV-PVSs decrease in signal intensity while others increase between timepoints 1 and 2. Red arrowheads: MV-PVS on T1 and T2 sequences. White arrow: Postcontrast, nonenhancing MV-PVS. White arrowheads: Enhancing MV-PVSs (*D* and *H*).




3 Meningeal Lymphatics
Skull
Dura
CSF
efflux routes
Arachnoid granulations
1 Cribriform Plate
Ventricular system
Nasal Turbinates
2 Cranial Nerves
Cervical Lymphatics
Dural Sinuses
4 Spinal Nerves

Article

Increased CSF drainage by non-invasive manipulation of cervical lymphatics

https://doi.org/10.1038/s41586-025-09052-5

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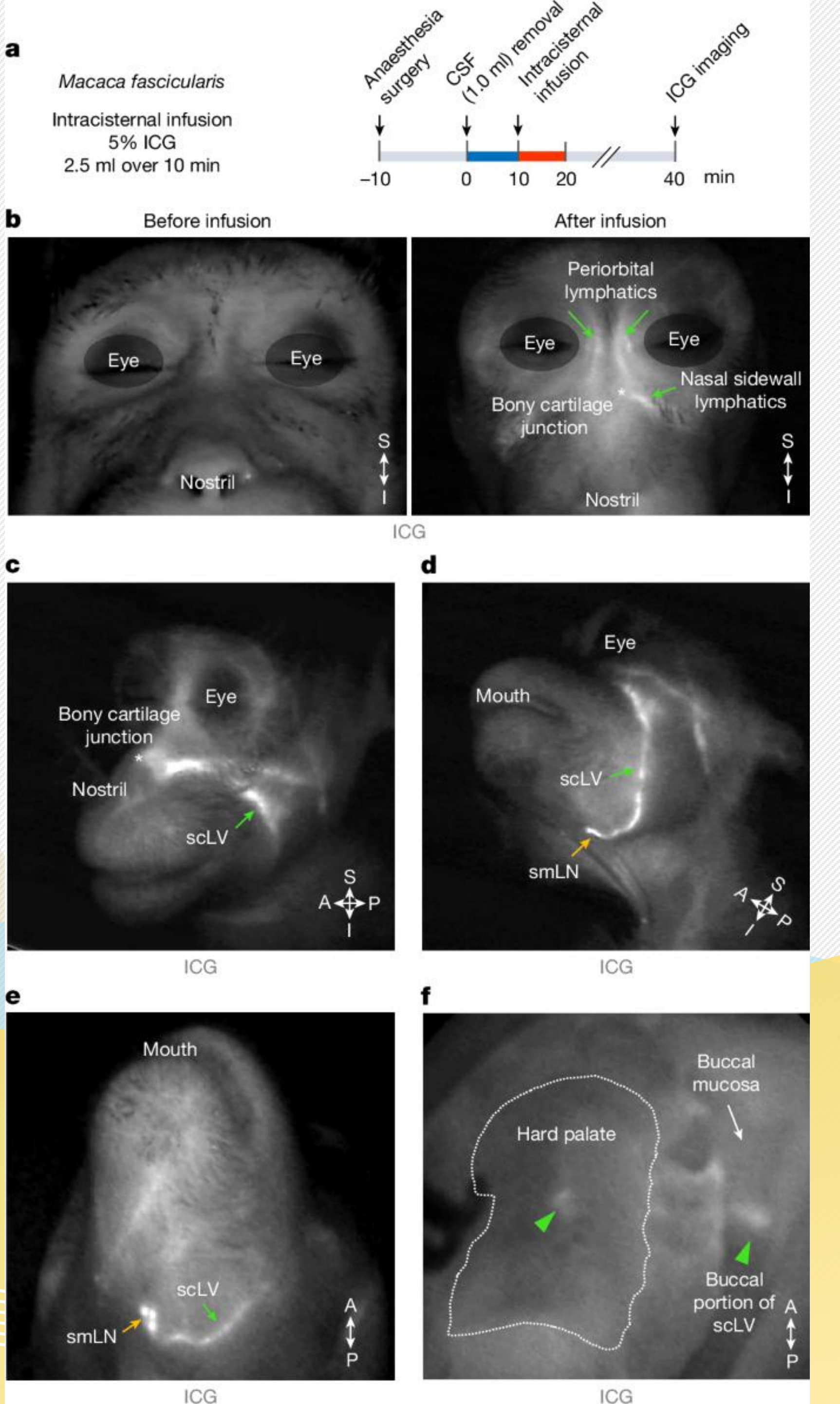
Check for updates

Hokyung Jin[1,2,9], Jin-Hui Yoon[1,9], Seon Pyo Hong[1,9], Yu Seok Hwang[3], Myung Jin Yang[1], Jieun Choi[2], Hae Jin Kang[1], Seung Eun Baek[1], Cheolhwa Jin[1,2], Junho Jung[1], Hae Jin Kim[4], Jincheol Seo[5], Jinyoung Won[5], Kyung Seob Lim[6], Chang-Yeop Jeon[5], Youngjeon Lee[5,7], Michael J. Davis[4], Hyung-Soon Park[3], Donald M. McDonald[8] & Gou Young Koh[1,2] ✉

Cerebrospinal fluid (CSF) in the subarachnoid space around the brain drains to lymph nodes in the neck, but the connections and regulation have been challenging to identify[1–24]. Here we used fluorescent tracers in *Prox1*–GFP lymphatic reporter mice to map the pathway of CSF outflow through lymphatics to superficial cervical lymph nodes. CSF entered initial lymphatics in the meninges at the skull base and continued through extracranial periorbital, olfactory, nasopharyngeal and hard palate lymphatics, and then through smooth muscle-covered superficial cervical lymphatics to submandibular lymph nodes. Tracer studies in adult mice revealed that a substantial amount of total CSF outflow to the neck drained to superficial cervical lymph nodes. However, aged mice had fewer lymphatics in the nasal mucosa and hard palate and reduced CSF outflow to cervical lymph nodes. Superficial cervical lymphatics in aged mice had increased endothelial cell expression of *Nos3*, encoding endothelial nitric oxide synthase (eNOS), but had less eNOS protein and impaired nitric oxide signalling. Manipulation of superficial cervical lymphatics through intact skin by a force-regulated mechanical device doubled CSF outflow and corrected drainage impairment in aged mice. This manipulation increased CSF outflow by compressing superficial cervical lymphatics while having little effect on their normal spontaneous contractions. Overall, the findings highlight the importance of superficial cervical lymphatics for CSF outflow and the potential for reversing CSF drainage impairment by non-invasive mechanical stimulation.

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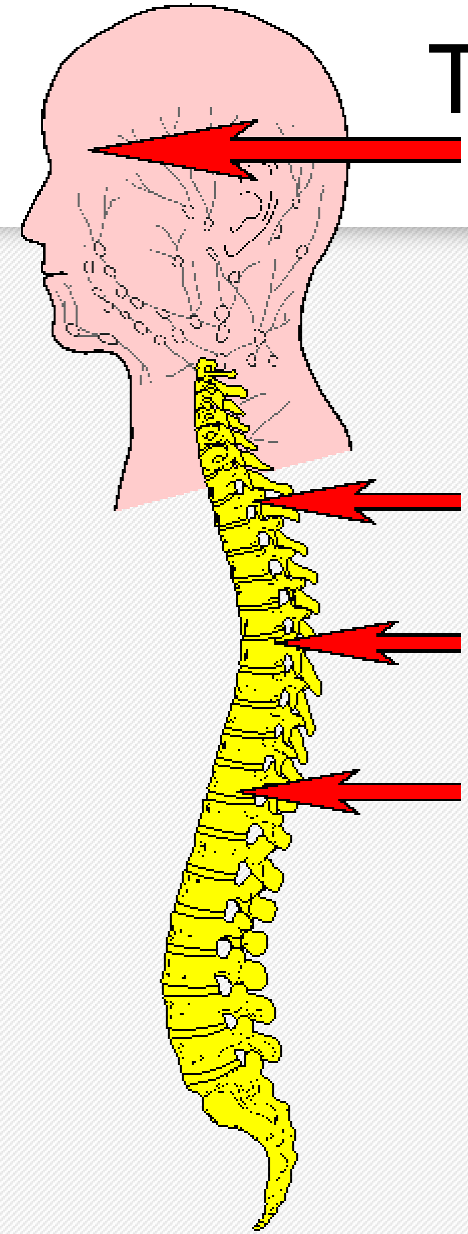
STAGES LEADING UP TO CFS/ME

STAGES LEAD

1



Trauma/ Congenital

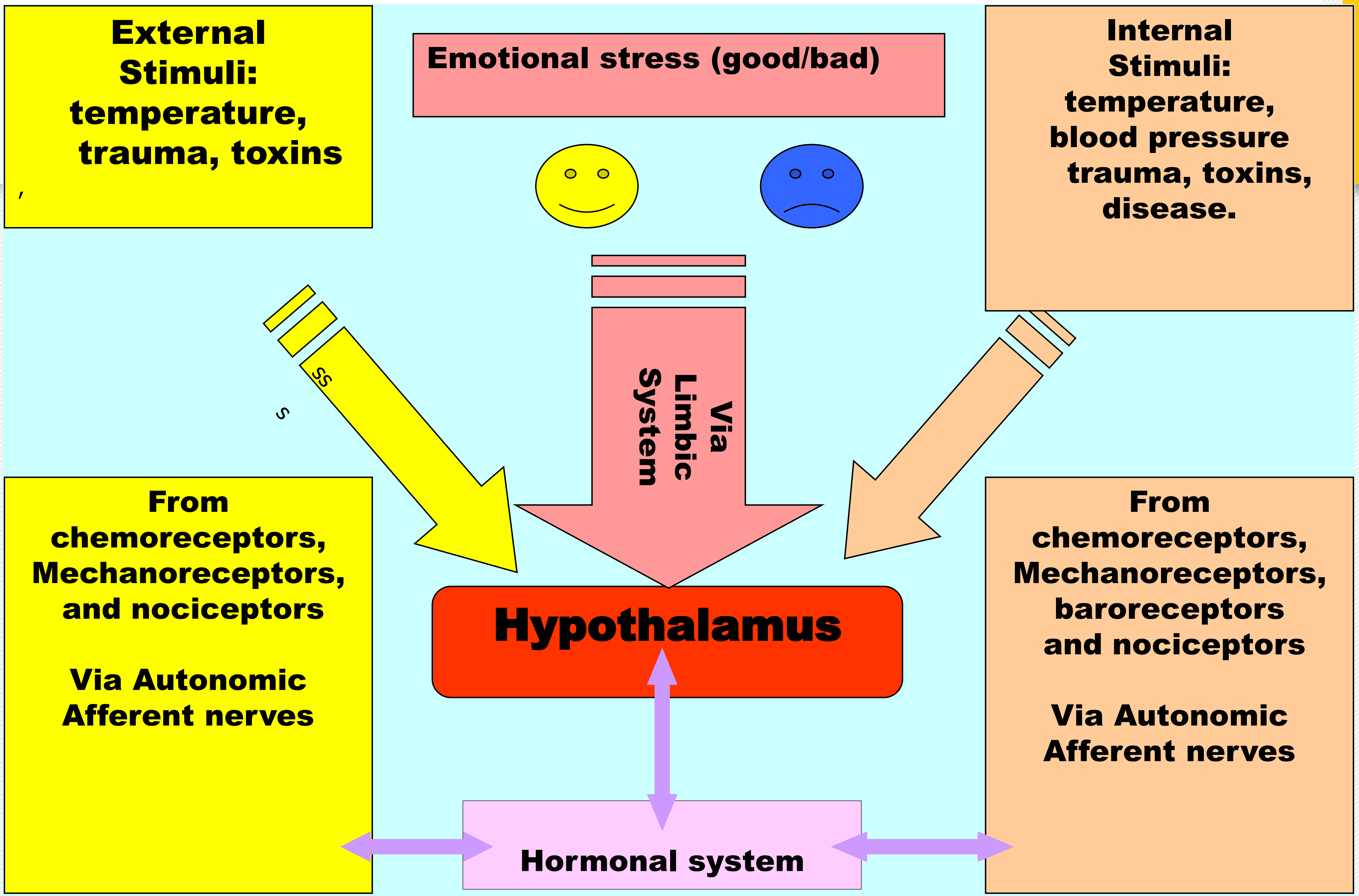
Physical damage/abnormality
affecting perivascular spaces.
(olfactory; optic; trigeminal; auditory)

Spinal Canal and alongside
Spinal Nerve Roots

Build Up of Stress:

- Emotional Trauma
- Physical Trauma/Pain
- Immunological Trauma
  (Infections or Sensitivities/ Allergies)
- Environmental Trauma (Pollution)
- Other Pathologies

STAGES LEADING UP TO CFS/ME



STAGES LEADING UP TO CFS/ME

SYMPATHETIC OVERLOAD

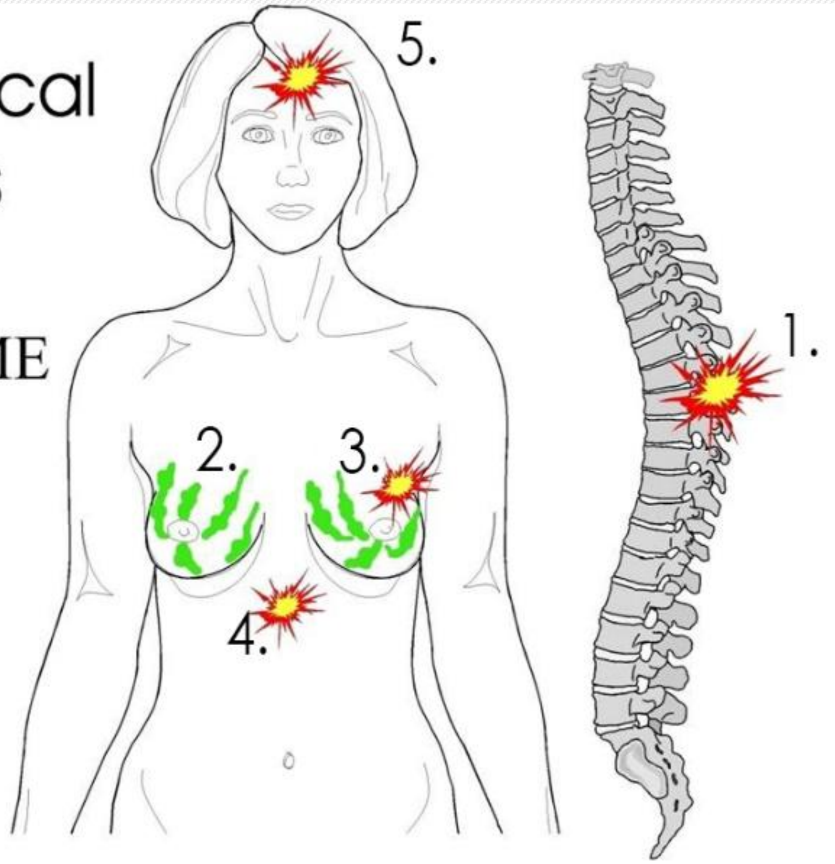
SYMPATHETIC DYSFUNCTION

RETROGRADE LYMPH FLOW

TOXICITY INCREASES IN CNS (HYPOTHALAMUS)

CFS/ ME

Physical Signs of CFS/ME



1. Long standing thoracic spinal problem (with tenderness at T4/T5/T6 segments).
2. Varicose lymph (megalymphatics)
3. Perrin's Point
4. Coeliac plexus
5. Reduction in cranio-sacral rhythm (CRI)

Hypothalamus

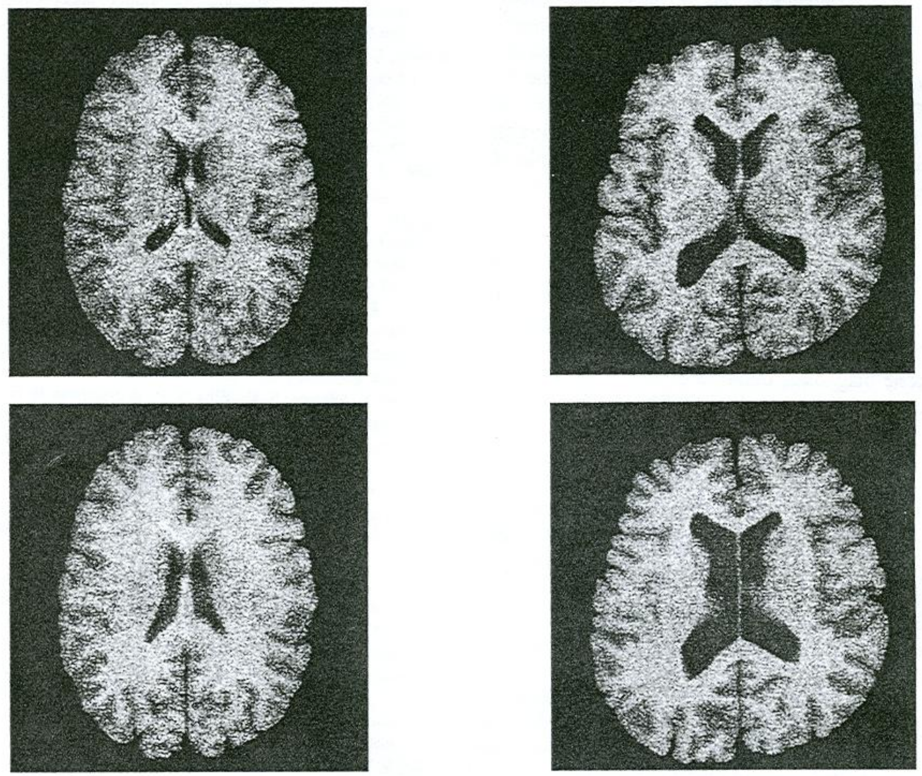


Figure 33 Ventricular enlargement in CFS/ME (Lange *et al.*, 2001)

Ventricular size increase has been seen in some CFS/ME patients compare with normal scans. The size of lateral ventricles in two contiguous slices in a cfs/me sufferer (right) are much larger than the healthy control (left).

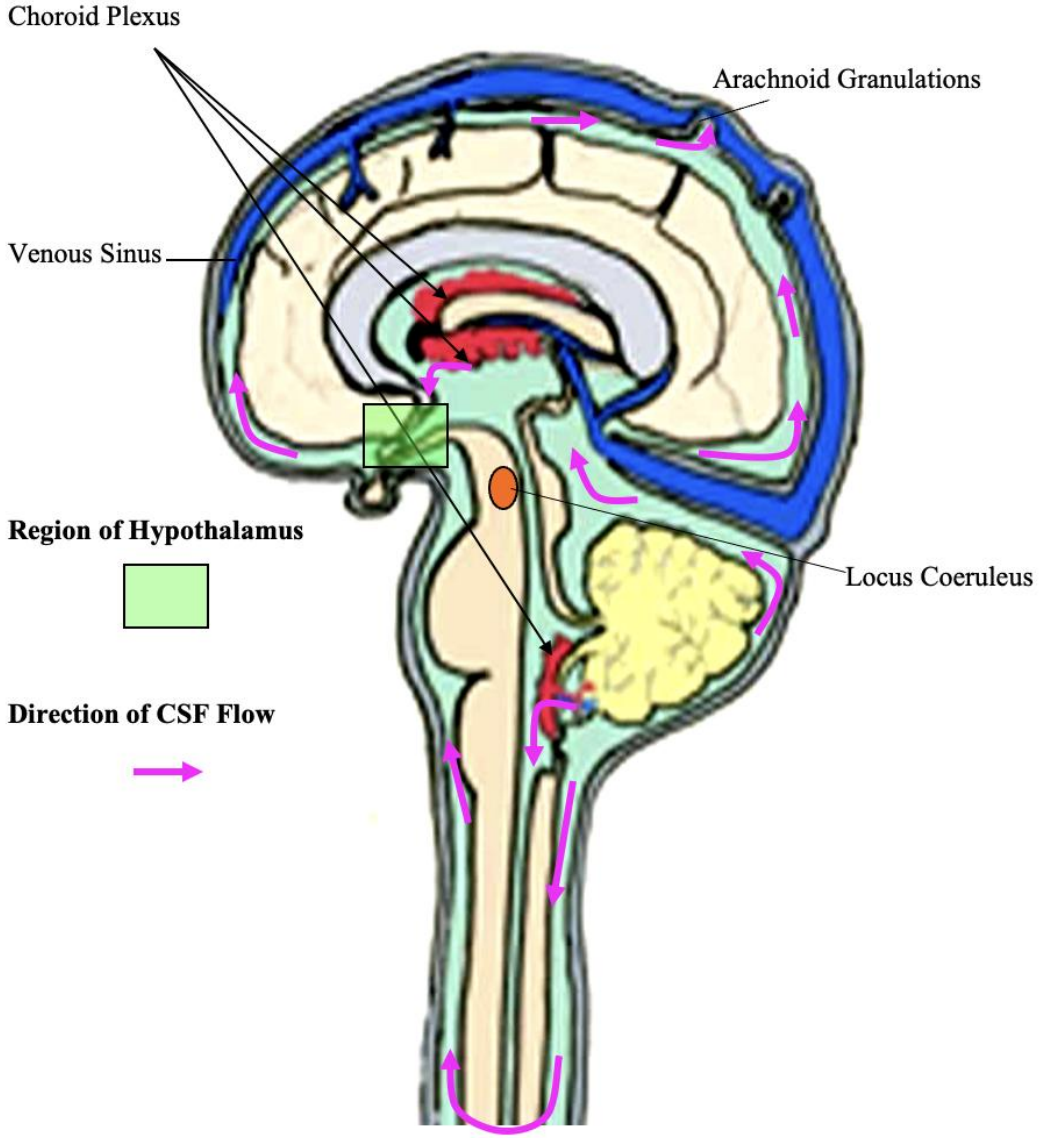


Figure 32 Diagram showing cerebrospinal fluid flow

(Drawn by the author based on original drawing by Netter in Felten and Joszefowicz, 2003)

The fluid's journey is shown from its production at the choroid plexus around the brain and spinal cord with most of the CSF draining into the venous sinuses. Further drainage also takes place via the extra-cerebral and extra-spinal lymphatics (see section 3.1.2).

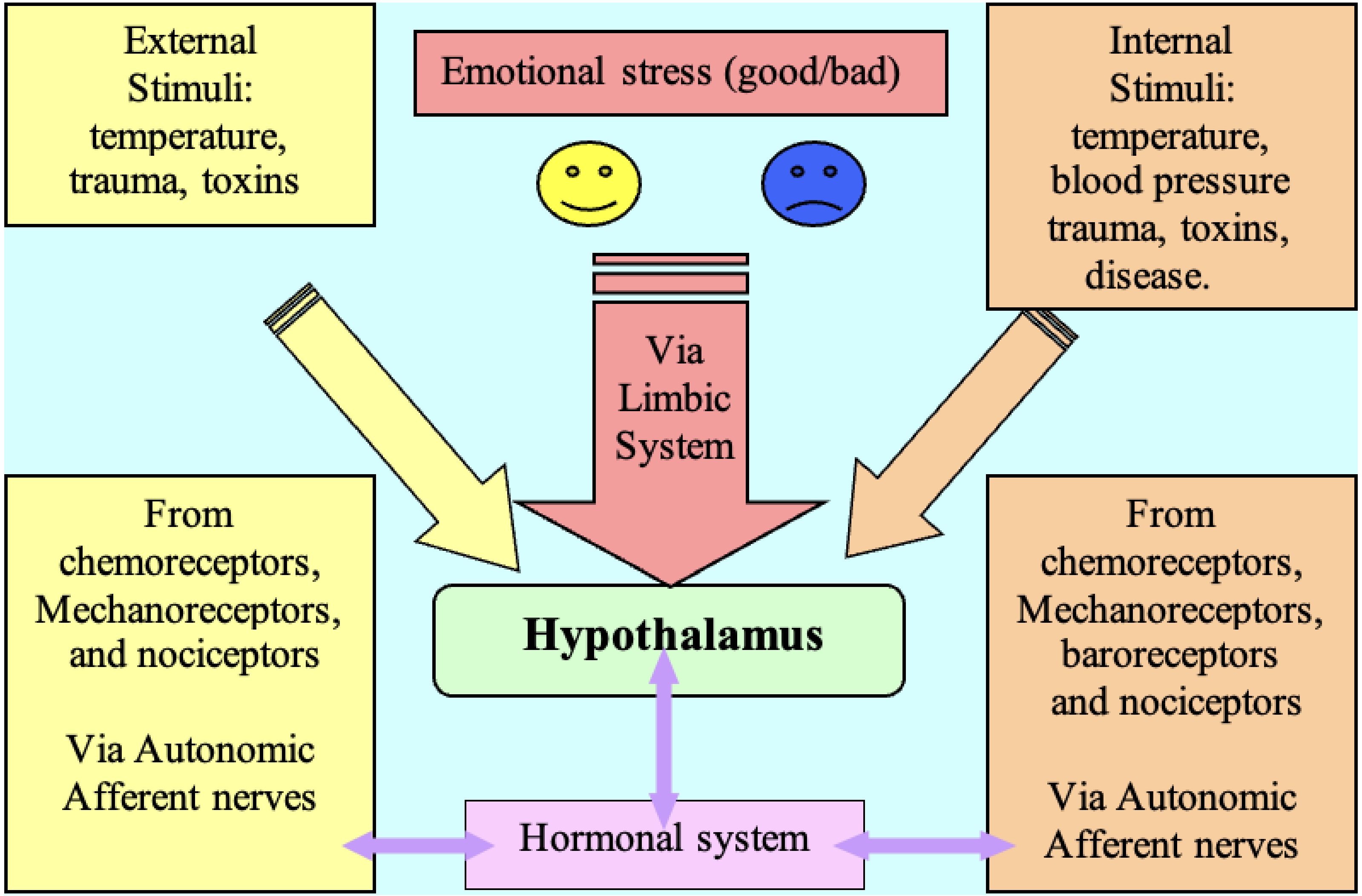
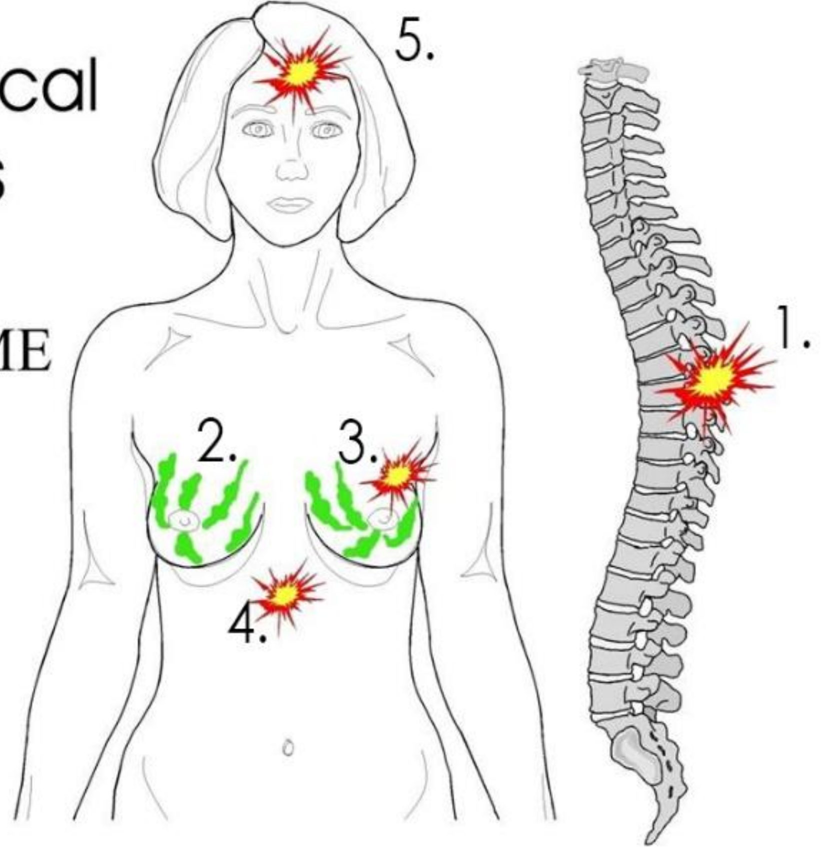


Figure 31 The afferent (sensory) component of the autonomic nervous system

A schematic diagram simplifying a complex interaction within the nervous and hormonal systems of the sensory component of the ANS. A barrage of messages are continuously sent to the hypothalamus from all manner of stimuli.

Physical Signs of CFS/ME



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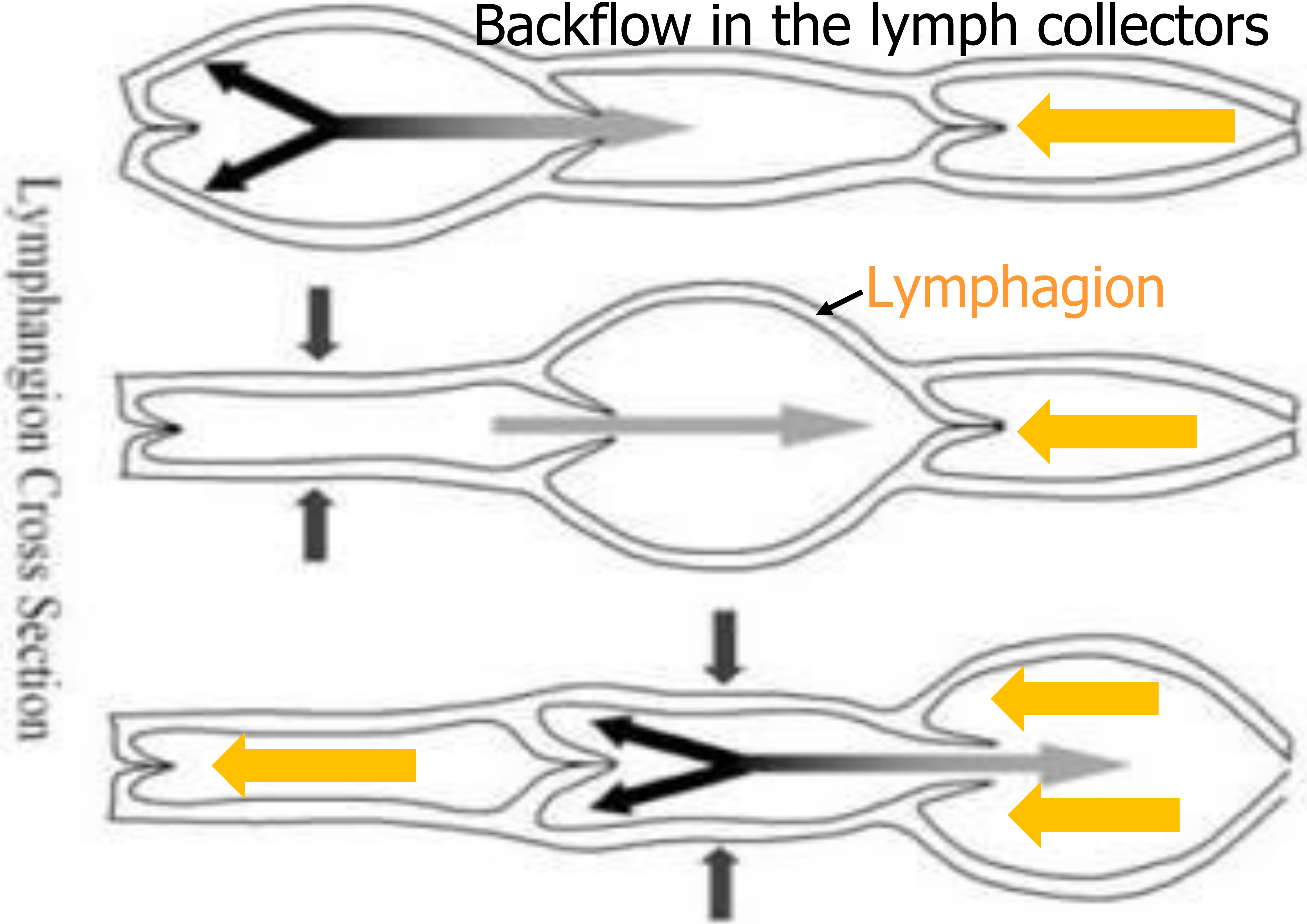
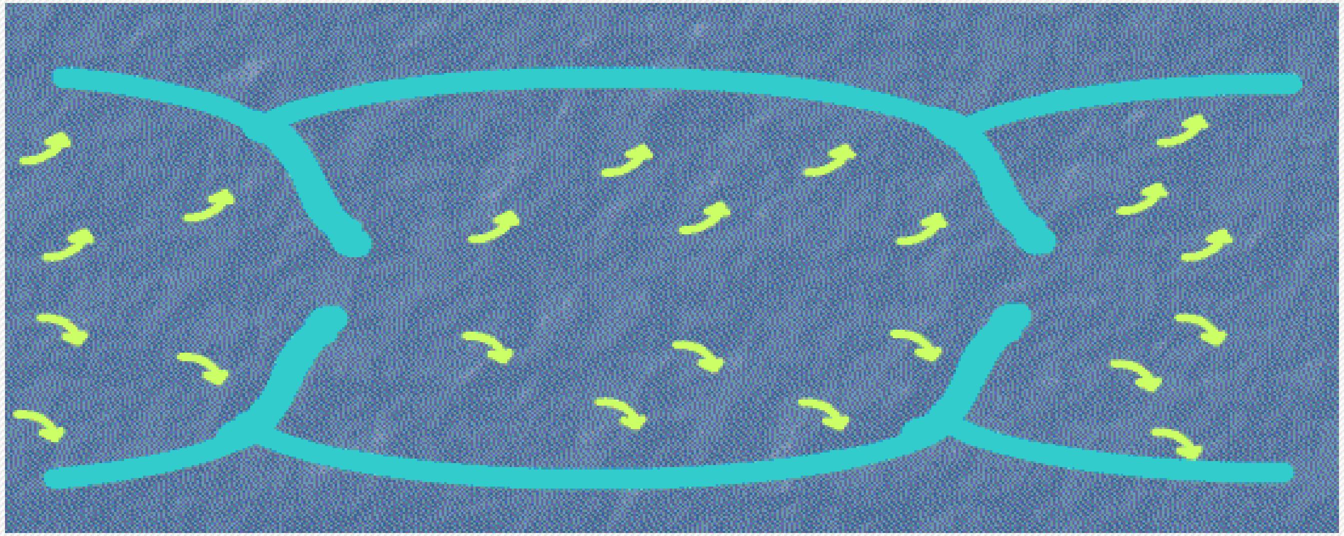
3. Perrin's Point
4. Coeliac plexus
5. Reduction in cranio-sacral rhythm (CRI)

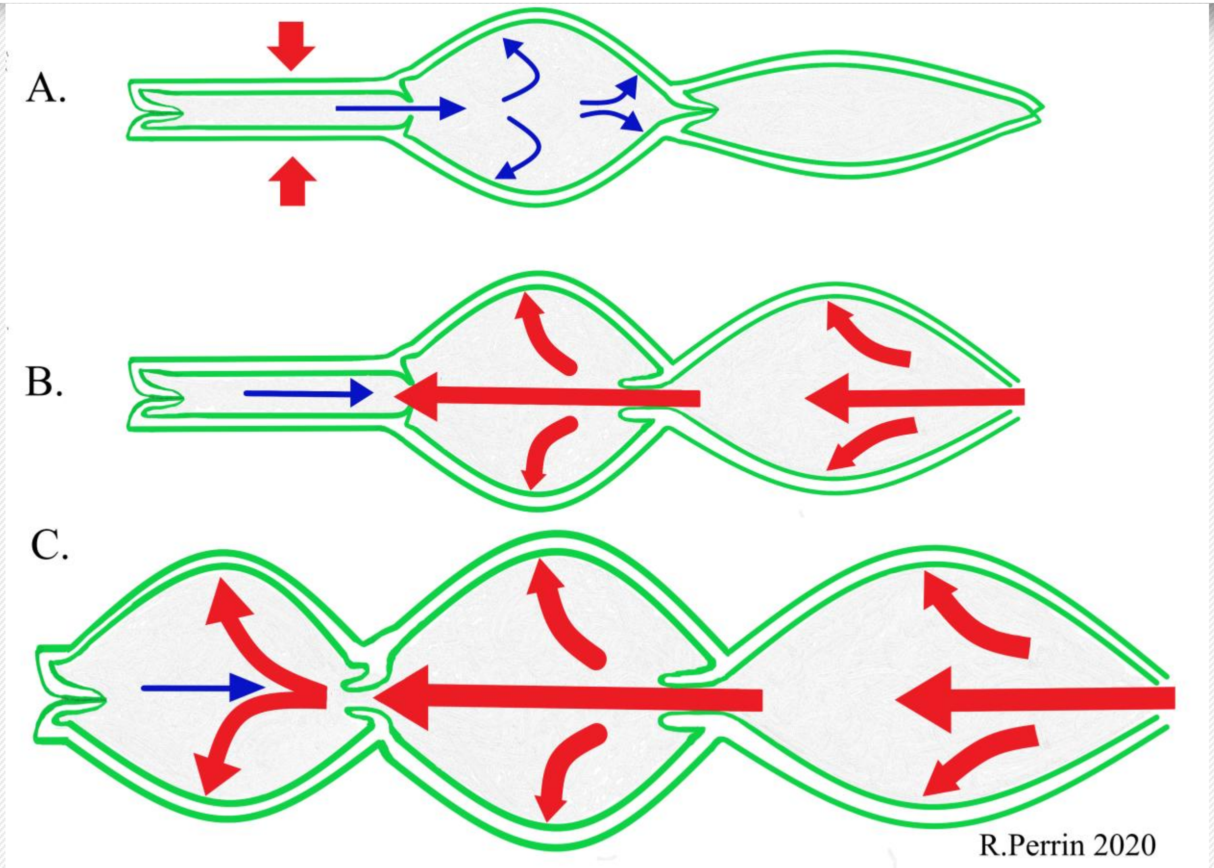
Backflow in the lymph collectors



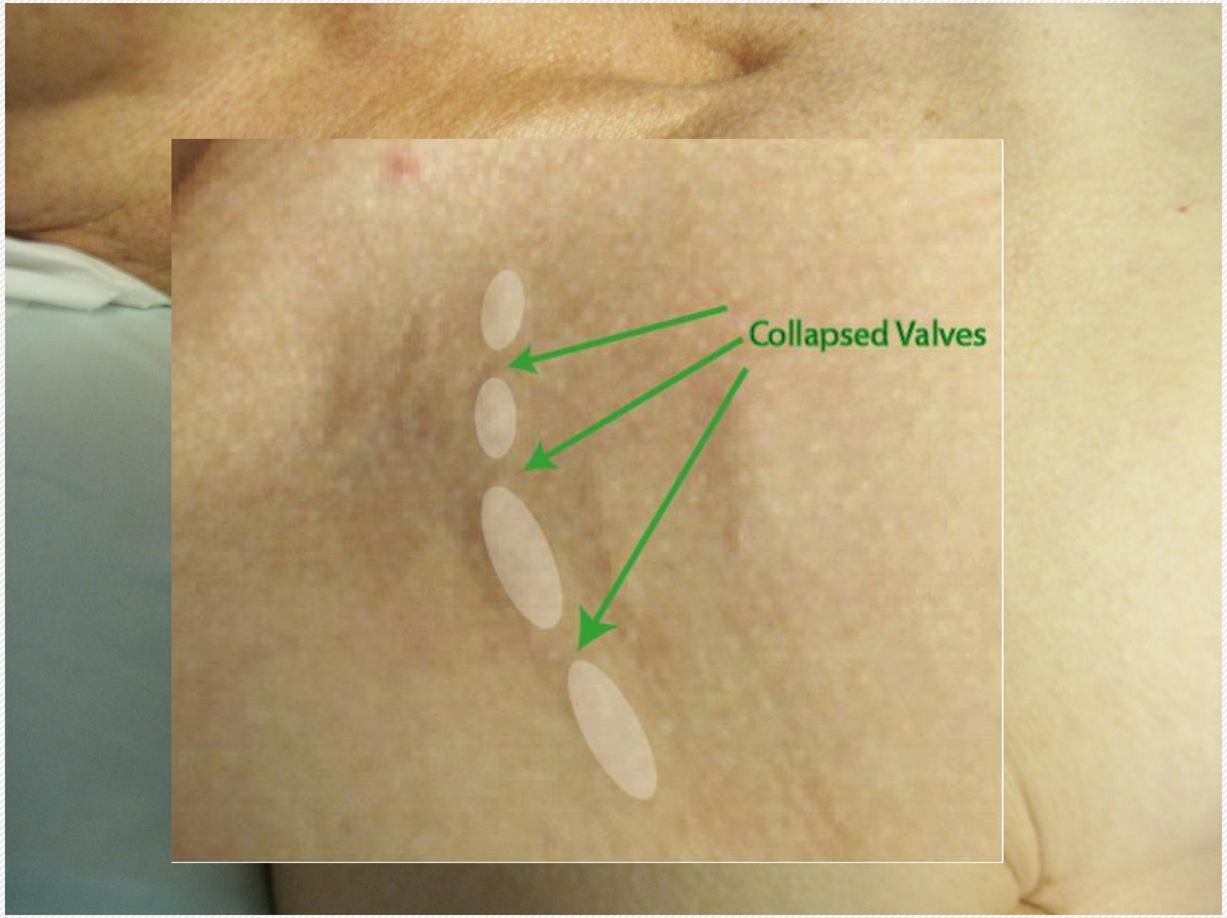
Varicose Mega-Lymphatics



The formation of Varicose Megalymphatics



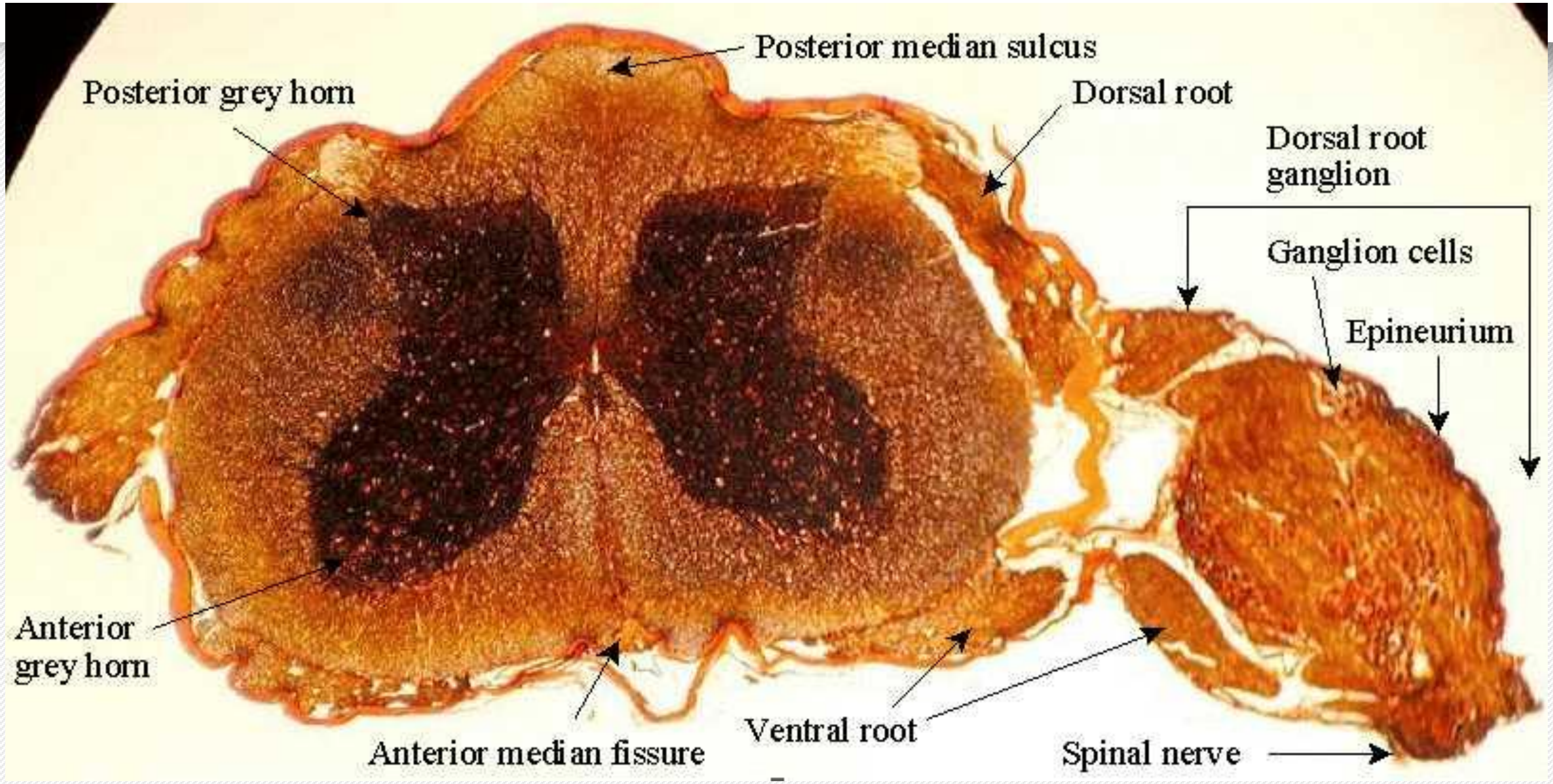
Varicose Mega-Lymphatic Vessels

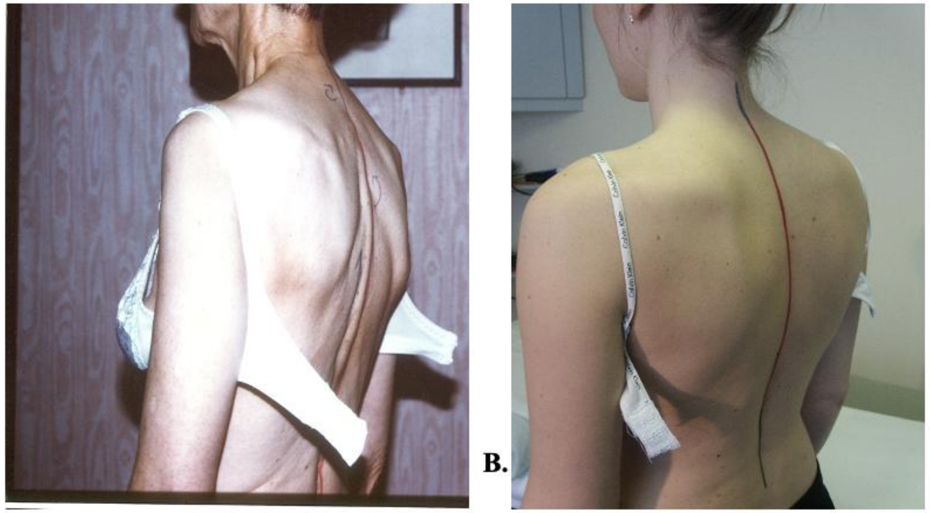


Varicose Lymphatic Vessels

Lynn Gilderdale

DORSAL ROOT GANGLION

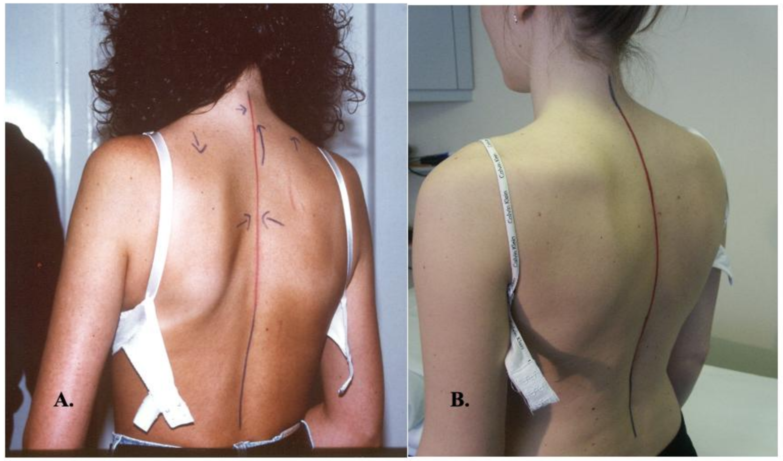




A. B.

Figure 3 Case 3 Spondylitis seen in severe long term sufferer of CFS/ME

Photo A. shows the fusion that has taken place in the patient's thoracic spine due to marked spondylotic changes that have taken place concurrently with over two decades of severe symptoms of CFS/ME. The postural disturbances contrast greatly from a normal s-shaped curvature in a healthy spine seen in photo B.



A. B.

Figure 4 Case 4 showing a flattened mid thoracic spine

Photo A. on the left shows the familiar flattening of the mid thoracic spine seen in many CFS/ME patients. This differs from a normal spinal posture in the healthy subject on the right.

A. B. C. D.

Figure 1 Case 1 demonstrating rotation and flatness of mid thoracic spine

Photo A. shows the rotational torsion occurring in a CFS patient's dorsal spine. Photo B. shows flatness in the upper part of her dorsal spine, and accentuated kyphosis at the cervico-dorsal junction. The postural problems in the patient are compared with the normal curvature of a healthy subject seen in photos C and D.

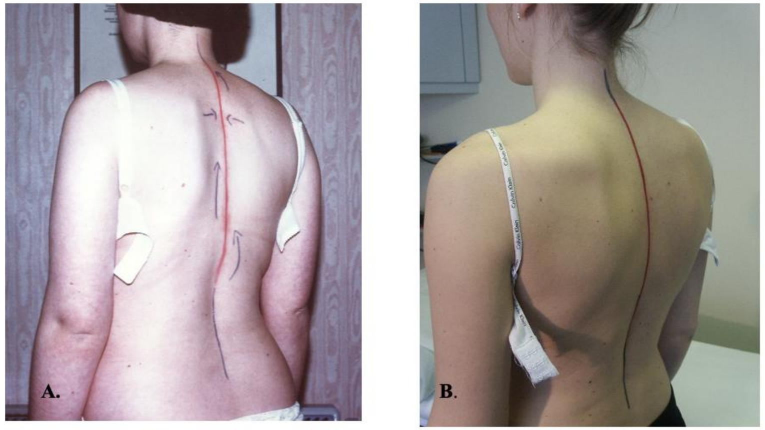
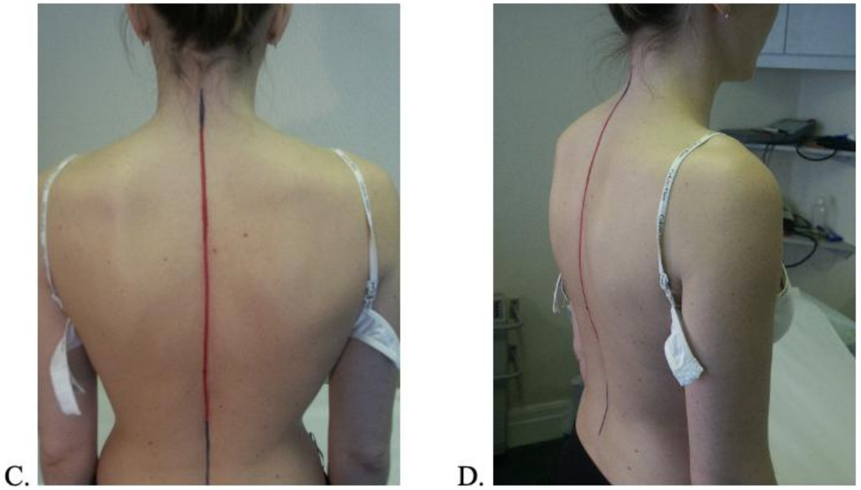


Figure 2 Case 2 further illustrating flatness and rotation of mid dorsals

Photo A. demonstrates minor scoliosis in the patient's thoracic spine. The two arrows pointing towards the spinal column show a lordotic region of her spine rather than the normal convex curve we would expect to find at this region. The postural disturbances seen are compared to a normal posture in a healthy subject seen in photo B.



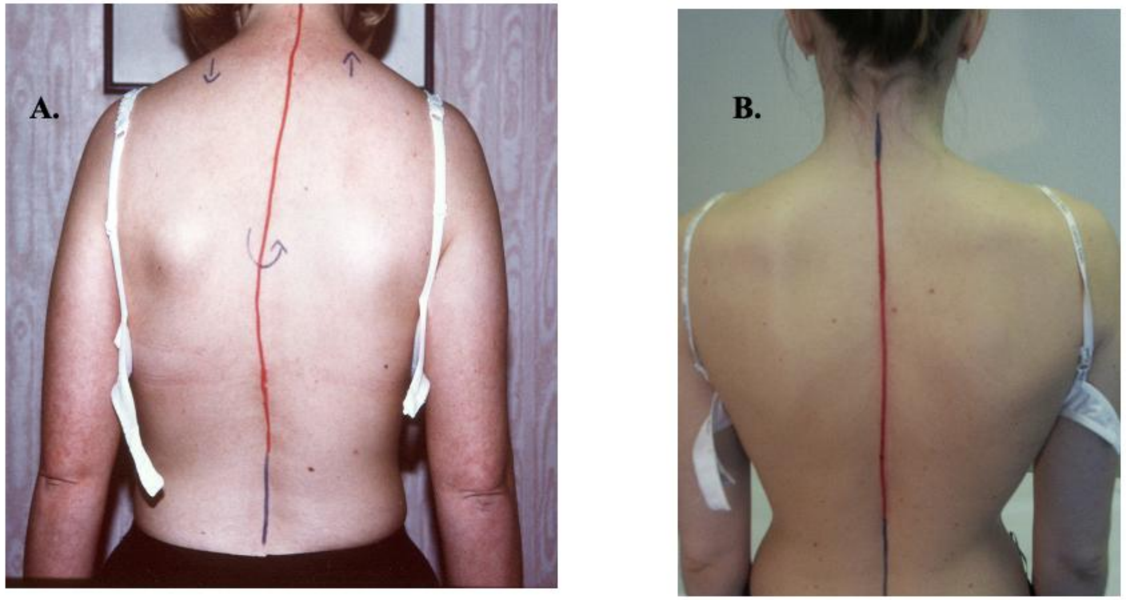


Figure 6 Case 6 illustrating scoliotic thoracic spine

Photo A. shows a CFS/ME patient with noticeable side bending of the thoracic spine to the right with apparent rotation to the left. The scoliosis contrasts with the straight healthy spine in photo B.

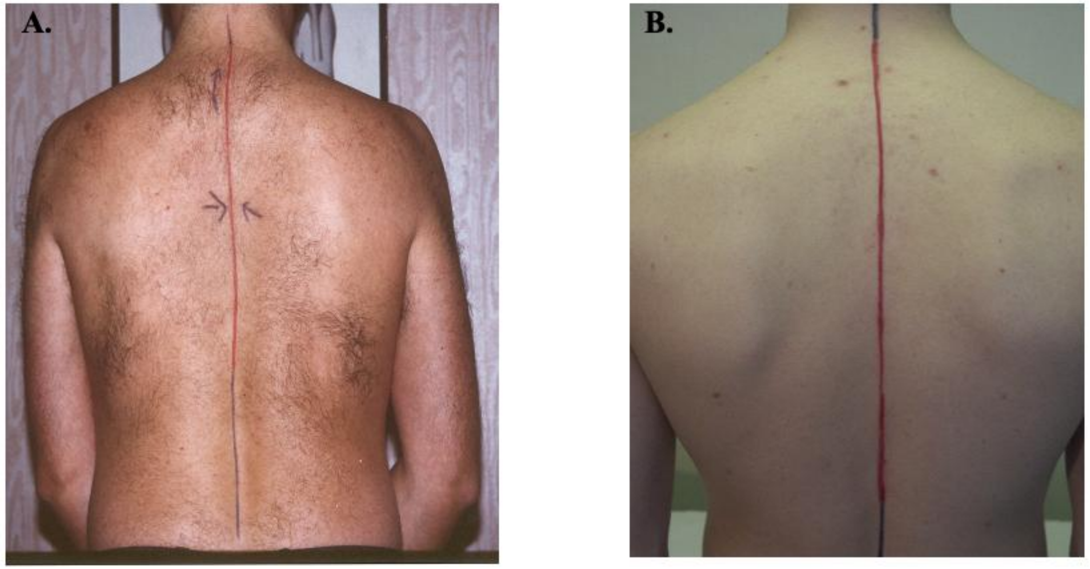


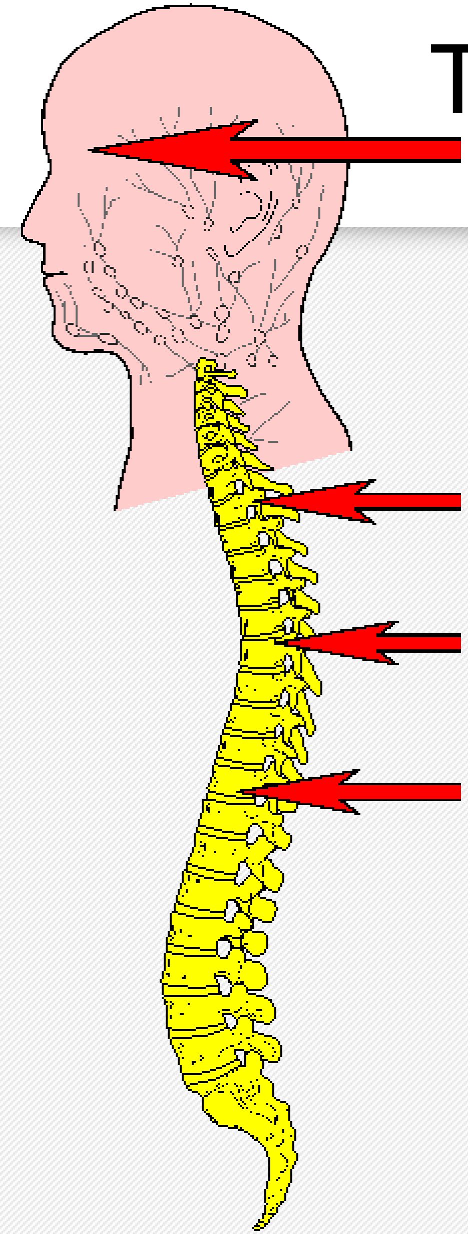
Figure 5 Photograph showing a male patient with a loss of mid thoracic kyphosis

In photo A. on the left arrows indicate a flatness in the mid thoracic spine compared with photo B. of a straight and healthy spine

STAGES LEADING UP TO CFS/ME

STAGES LEAD

1



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(olfactory; optic; trigeminal; auditory)

Spinal Canal and alongside Spinal Nerve Roots

Build Up of Stress:

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- Physical Trauma/Pain
- Immunological Trauma
  (Infections or Sensitivities/ Allergies)
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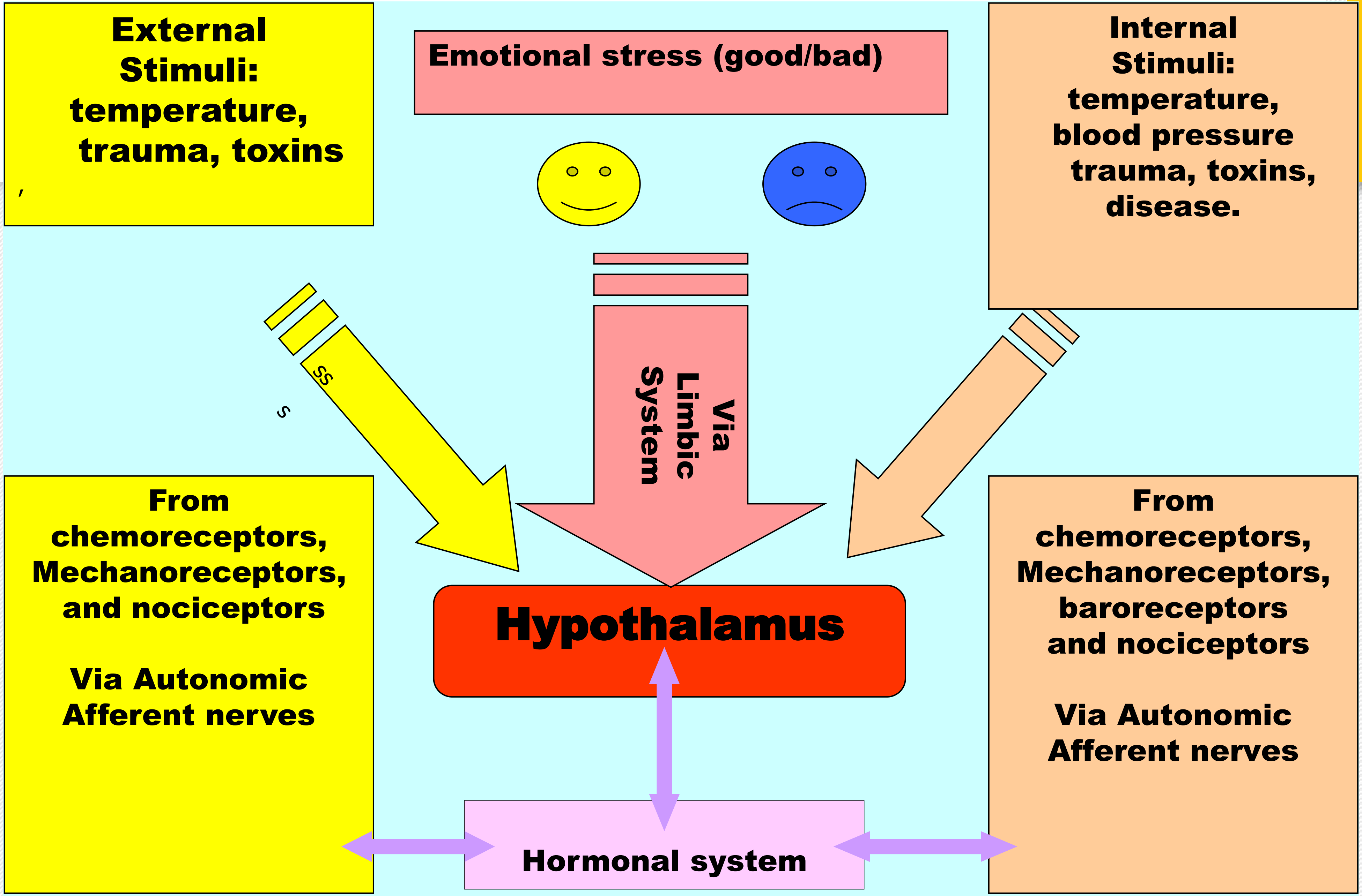
- Other Pathologies

STAGES LEADING UP TO CFS/ME



STAGES LEADING UP TO CFS/ME

SYMPATHETIC OVERLOAD

↓

SYMPATHETIC DYSFUNCTION

↓

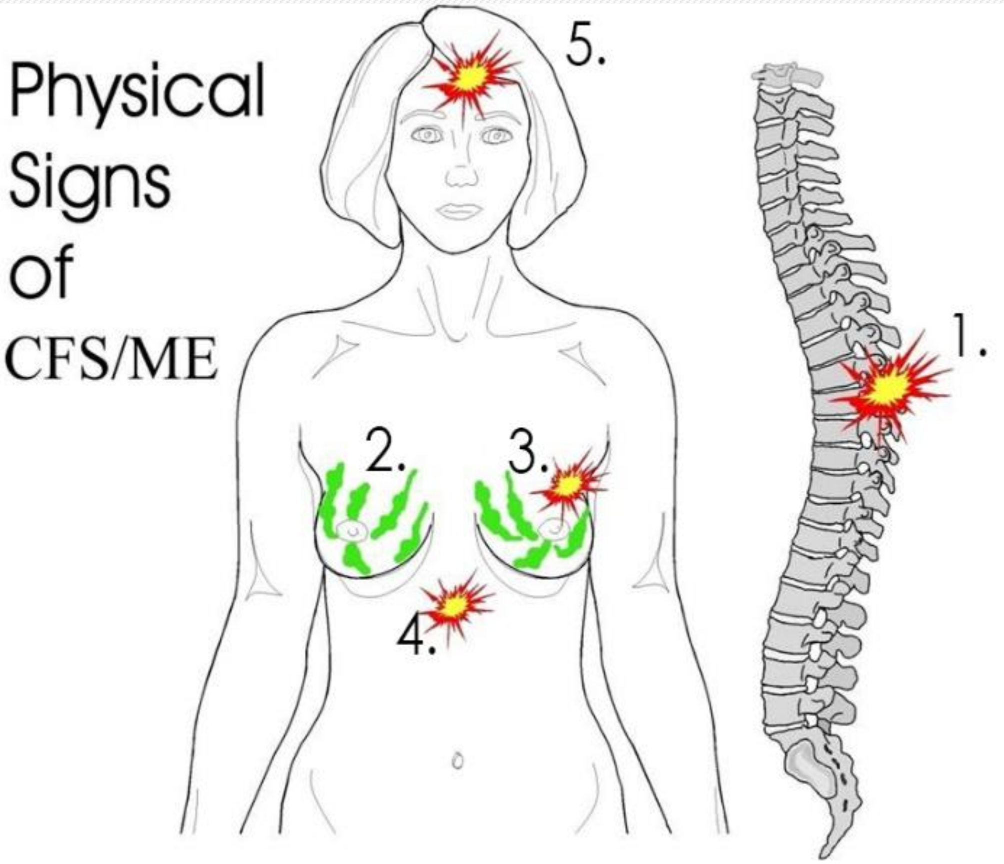
RETROGRADE LYMPH FLOW

↓

TOXICITY INCREASES IN CNS (HYPOTHALAMUS)

↓

CFS/ ME



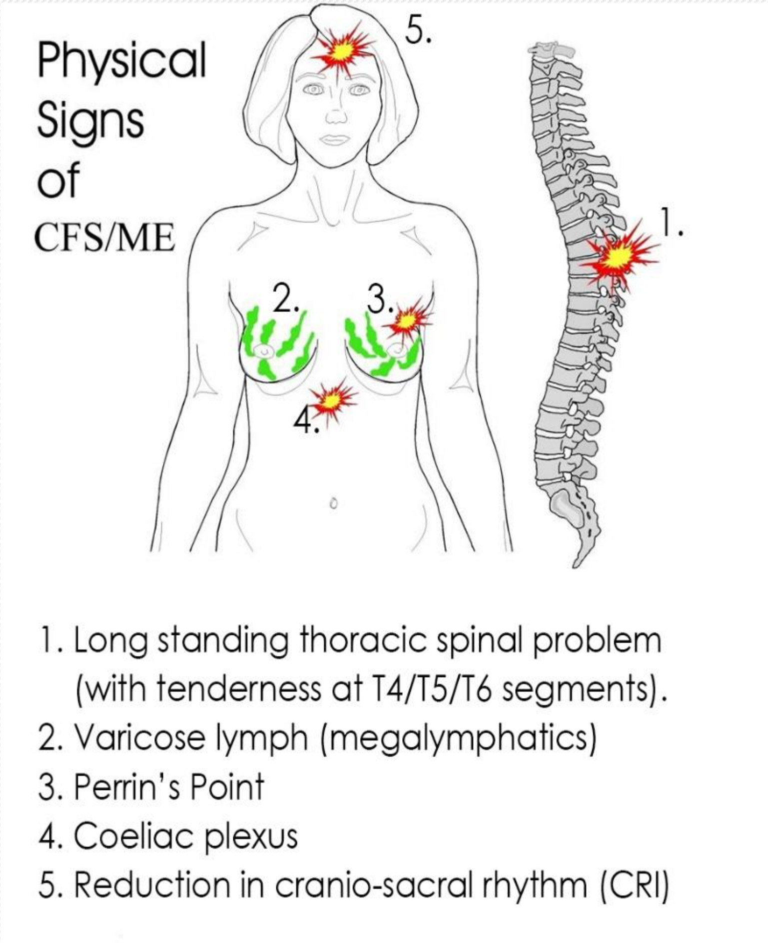
1. Long standing thoracic spinal problem (with tenderness at T4/T5/T6 segments).
2. Varicose lymph (megalymphatics)
3. Perrin's Point
4. Coeliac plexus
5. Reduction in cranio-sacral rhythm (CRI)

Diagnosing ME/CFS with Perrin Criteria

It was found that, overall, practitioners were more accurate at diagnosing participants when using only 2 of the 5 signs

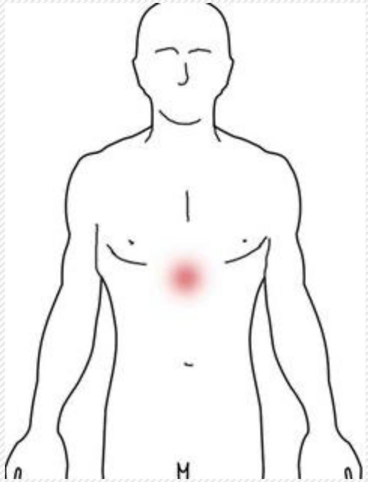
(tender coeliac plexus and postural/ mechanical disturbance of the thoracic spine).

Accuracy of diagnosis over 80%



1.Common postural disturbance, redness, tenderness and often increased temperature in the thoracic spine (Perrin RN, 1993).

2. Tenderness and often heat in the epigastrium (Perrin RN, 2007).



Screening for ME/CFS with 88.3% Accuracy!

Screening Efficacy (BMJ Open 2017)

Study Results [1]

Clinical Pearl

Quick (< 5 min) screen that confirms illness is *real and measurable*.

Exam Type	Accuracy
Standard physician exam	44%
Perrin 5-sign exam	86%
2-sign protocol (Coeliac + Thoracic)	**88.3%**

Evidence for Manual Treatment (Objective 2)

Osteopathic Principles

•Structure ↔ function. The body heals when mechanical obstacles are removed.

Recent Research

•*Jin et al., Nature 2025 [2]* → Gentle mechanical stimulation of cervical lymphatics **doubled CSF outflow**.
•*Iliff et al., Sci Transl Med 2012 [3]* → Defined CSF–ISF exchange pathway.
•*Perrin et al., J Med Eng Technol 1998* → Manual treatment improved fatigue and muscle function.

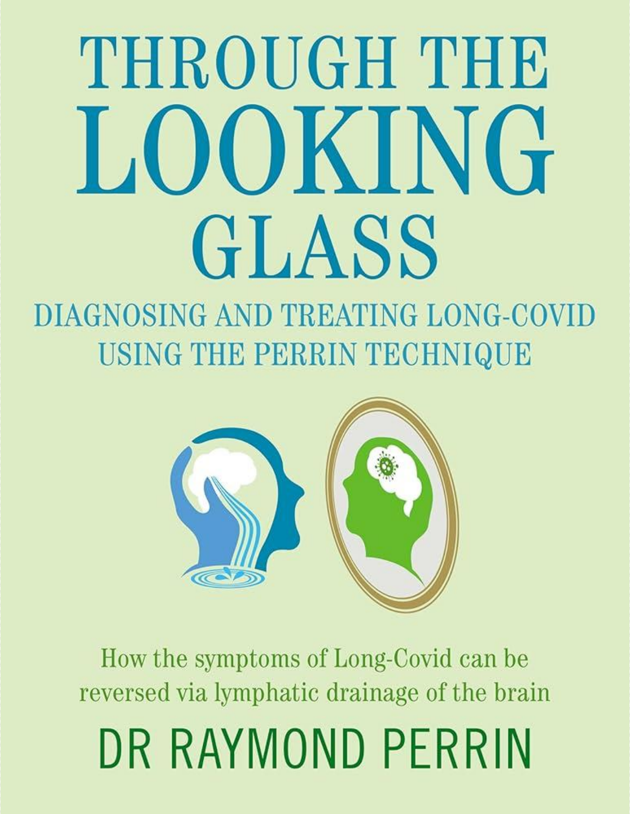
Comparison

Approach	Mechanism	Response
Duloxetine (FDA Approved FIBROMYALGIA)	Central pain modulation	~20%
OMT/Perrin Technique	Restores drainage + balances SNS	>70% functional gain

Perrin Technique Treatment Timeline & Patient Education

- **Diagnosis one day. Never treat same day as diagnosis.**
- **Structured, Prognostic score and plan for patients.**
- **Typical Course**
- Mild–Mod: 6–12 mo | Severe: 18–30 mo
  Schedule: Weekly × 12 → Bi-weekly × 12 → Monthly × 3 → Quarterly
- **Pacing Rule:** *“Do Half of What You Can.”* (Sanal-Hayes et al., J Transl Med 2023 [14])
- **Adjuncts:** Hydration • EPA-only Omega-3 • Milk Thistle • Sleep Hygiene

Long COVID and “Through the Looking Glass”

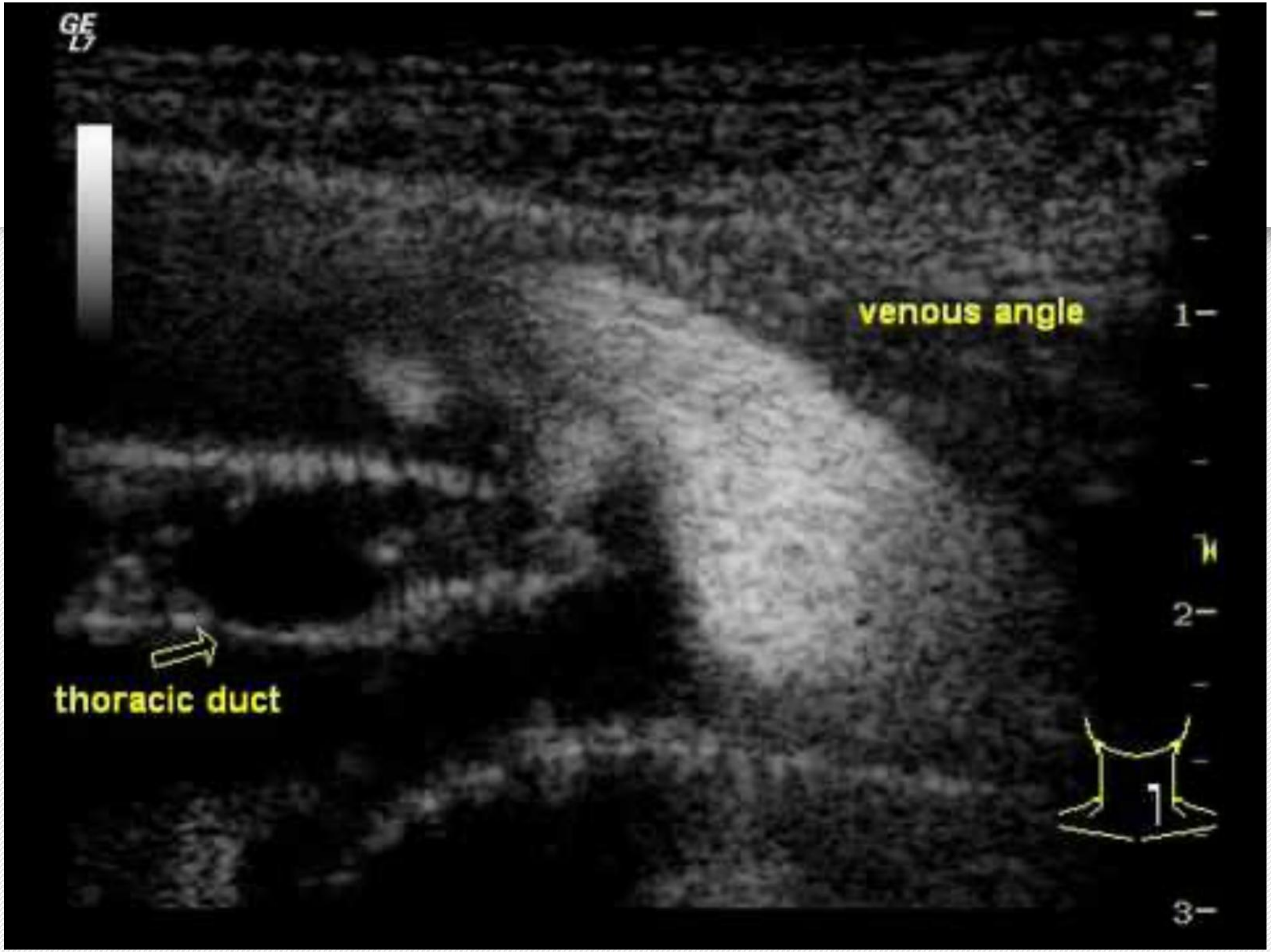


Shared Mechanism

•SARS-CoV-2 triggers hypothalamic inflammation → glymphatic congestion (Perrin et al., *Med Hypotheses 2020*).

•Identical Perrin signs appear in >70% Long COVID patients.

From Perrin (2024 [8])
“The mirror of Long COVID reflects the same toxic waters of ME/CFS — and the same hope of release.”



How much Lymph can a lymph pump pump?

Summary

- Neurolymphatic blockages and its affect on the hypothalamus is a plausible, treatable mechanism explaining ME/CFS, Fibromyalgia, and Long COVID
- Hands-On Osteopathic Manipulative Treatment and other noninvasive modalities show hope for improving blockages in the csf drainage (Alzheimer's Dz)
- You can easily identify and screen patients who may benefit from this treatment and help them find solutions that improve their lives.


The Perrin Technique
Relaxation
Pacing
The Perrin Technique
The Perrin Technique
Talk Therapy
Adaptogens
Chelation
YOU!
Diet
Supplements
Electrotherapy
Rest
Meditation
The Perrin Technique

Key Takeaways for Primary Care Clinicians

Tomorrow You Can:

1. Palpate Celiac + Thoracic → 88% screen accuracy.
2. Validate patients with objective findings.
3. Teach pacing and refer for osteopathic care.
4. Shift from symptom management → functional restoration.
5. Give your patients new hope!

References

- Hives L, Bradley A, Richards J, et al. *Can physical assessment techniques aid diagnosis in people with CFS/ME? BMJ Open*. 2017;7(11):e017521. doi:10.1136/bmjopen-2017-017521.
- Jin H, Yoon JH, Hong SP, et al. *Increased CSF drainage by non-invasive manipulation of cervical lymphatics. Nature*. 2025;643(8072):755–767. doi:10.1038/s41586-025-09052-5.
- Iliff JJ, Wang M, Liao Y, et al. *A paravascular pathway facilitates CSF flow through the brain parenchyma. Sci Transl Med*. 2012;4(147):147ra111.
- Louveau A, Smirnov I, Keyes TJ, et al. *Structural and functional features of CNS lymphatic vessels. Nature*. 2015;523(7560):337–341.
- Absinta M, Ha S-K, Nair G, et al. *Human and nonhuman primate meningeal lymphatic vessels. eLife*. 2017;6:e29738.
- Hablitz LM, Nedergaard M. *Circadian control of brain glymphatic and lymphatic fluid flow. Nat Commun*. 2020;11:4411.
- Perrin R, Riste L, Hann M, et al. *Into the Looking Glass: Post-viral syndrome post COVID-19. Med Hypotheses*. 2020;144:110055. doi:10.1016/j.mehy.2020.110055.
- Perrin RN. *Through the Looking Glass: Diagnosing and Treating Long COVID Using the Perrin Technique*. Hammersmith Books; 2024.
- NICE Guideline NG206. *Myalgic Encephalomyelitis/Chronic Fatigue Syndrome: Diagnosis and Management*. UK NICE; 2021.
- University of Central Lancashire Press Release (BMJ Open study summary). 2017.
- *The Rheumatologist*. *Physical Assessment for Chronic Fatigue Syndrome Just May Work*. 2017.
- Murdock MH, et al. *Multisensory gamma stimulation promotes glymphatic function. Nature*. 2024.
- Sanal-Hayes NEM, et al. *A scoping review of pacing strategies in ME/CFS. J Transl Med*. 2023.
- Still AT. *Philosophy and Mechanical Principles of Osteopathy*. Hudson-Kimberly; 1902.
- Sutherland WG. *The Cranial Bowl*. Free Press Co.; 1939.

Workshop- Hope & Healing for ME/CFS

- Please join us for hand—on portion. No touch experience required.
- Open Heart and Open Hands = Therapeutic Touch. Guest in the Home.
- Palpate the Cranial Mechanism (CRI) & assess vitality
- Diagnose & Screen with the 5 Physical signs as presented by Dr. Perrin
- Balance the Autonomic nervous system through 3 simple osteopathic techniques anyone can perform (OA Release, Rib Raising, Functional Sacral Release)
- Apply, Recheck, Reflect, and Balance
- Home Exercises & Self-treatment for your patients

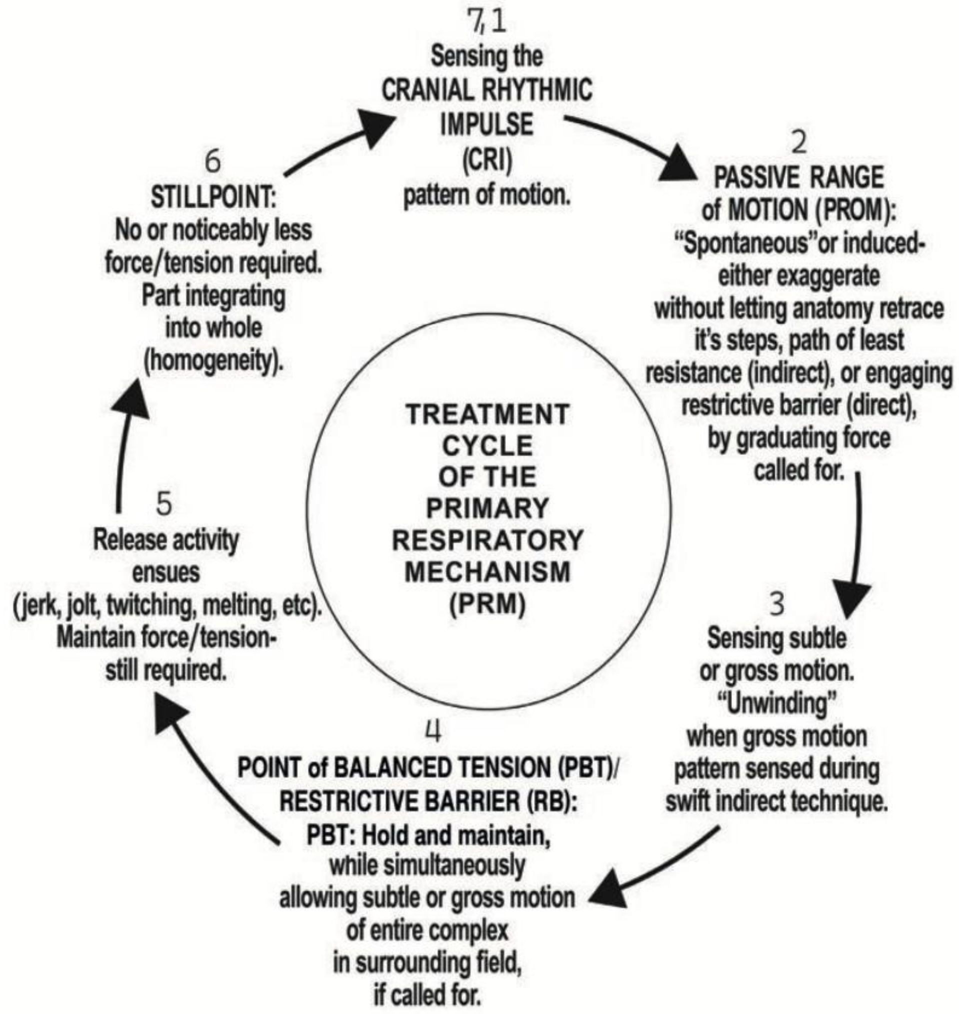


Figure 6: Treatment Cycle of the Primary Respiratory Mechanism

Perrin Technique, a Case Study

MOA 5/2026

Presented by Ryan Christensen D.O. and
Mary Goldman D.O.

Chief Complaint: 73yo F w/Fatigue

- Problems getting to and staying asleep
- Feel good and do too much, then crash for a day
- Brain Fog
- Difficulty explaining to those close to me that I cannot do what I have in the past
- Swelling globally, but mostly in the breast
- Coeliac tenderness and stomach upset with bloating
- Aching all over, with cramps in feet, dead sensation in legs, always worsened by cold
- Not short of breath, but at times breathing was difficult, chest felt fatigued

PMHx

- Born with hard head after prolonged labor
- Autoimmune disease (Idiopathic Thrombocytopenia Purpura) at 13 months with hospitalization and bone marrow (right patellar region), recovered just before spleen was about to be removed
- Fatigue, runny nose and congestion, headache most of the time in youth – exposed to black mold constantly → mono test negative as teen but very sick twice

PMHx slide 2

- Severe head trauma with temporal lobe seizure at 8 y/o—fell out of moving car on head with neck severely suddenly side bent to the left, chronic headaches thereafter
- Kicked by horse in back (16/y/o) resulting in chronic rotation and pain above and below T9 (thanks to Dr. Greenman for fixing, but flattening of spine continued

PSHx

- Broken nose first at 6 y/o, with surgery x2 in 1981 for nasal septal repair
- Breast cancer 1989, right mastectomy, failed implant attributed to Celiac Disease
- Repair of lymphatic leaking vessel post-mastectomy 2020

Physical Exam

- Perrin Score: 3.5/10
- Physical Signs of ME/CFS:

1. Mid Thoracic Spine problem 2 (Flatness Sunkenness)
2. Breast tissue varicose mega-lymphatics: 1
3. Perrin's point: 2
4. Celiac plexus region: 1
5. Cranial Rhythm (CRI):2
    - Regional areas cranial disturbance: CRI 3/10, R Inf vertical shear, SBS compression

Multiple toxic exposures

1. fungal/mold infested house as child
2. Carbon monoxide poisoning in pregnancy
3. Work exposure to toxic cleaner through ventilation system to my office one floor above, resulting in migraines and inability to work, which was when Hashimoto's Thyroiditis started
4. Black mold twice corrected in current home after water leaks, then aspergillosis1 yr ago

Activity History
(most CFS patients are very athletic/competitive)

- Grew up in ballet studio from 2.5 years old to 20 years old, intermediate advanced level
- Cleaned entire house since 11 years old, even when working 75-hour work week
- Taught swimming to young children, 3.5 hours in pool each Saturday
- Black Belt in Tae Kwon Do

Symptoms at Onset of Treatment

- Brain Fog – forget names or too tired to remember to do things
- Severe fatigue, spending time in bed but not sleeping well at all
- Gagging at times due to dry throat with thick phlegm (no heme)
- Periodic heaviness in chest
- Frustration

Emotional toll

- Family members could not understand why I went to bed instead of doing things with them
- Expectations that I would/could help people with their needs could not be met (uncharacteristic for me and everybody thought that I was angry with them)

Physical signs

- Left breast very swollen with enlarged veins, particularly at Perrin's Point where it was very tender
- Coeliac tenderness and marked abdominal bloating, despite a careful Celiac Diet
- Back aching, particularly after sitting, even if posture was aligned
- Rib tension severe, felt twisted since Mastectomy (not a Perrin physical sign)

Before PACING

- Worked very hard to get things done and ended up in bed for a very long night, putting me more behind
- Frustration at not being able to exercise
- Constant head fog, forgetting names
- Overwhelmed (but not at all times)

Treatment

- For the first month I felt much worse, but specific symptoms improved, such as back pain
- It took a long time before the shoulders and ribs released
- The brain fog comes and goes now, but is overall much better – my life requires a clear head, so I have no tolerance for this

What really changed most?

- I can lay in bed without feeling pressured to catch up all the time—it feels good!!
- People around me understand that I will refrain from overdoing and are much more appreciative for the things I have done for them in the past
- I am clearer about how I expect to be treated by those close to me and I calmly explain my limitations
- I have a physician who supports & understands me

Returning to some normalcy

- Ballet class 1-3 times a week, depending on PACING allowance
- Yin Yoga once a week—extremely helpful
- Walking dog for over a mile 3 times a week
- Able to do some gardening without flattening out
- Swelling has gone down well, except for where rescue dog face-planted me in February

Lab 1: Palpating the Cranial Rhythmic Impulse

- Goal: perceive the Cranial Rhythmic Impulse (CRI) — gentle 6–12 cycles/min expressing CNS vitality.
- Becker Hold (Occipital Cradle): Patient supine, quiet room. Sit at head of table; cradle occiput in palms, fingertips at sub-occipital ridge. Soften hands and let tissues guide. Observe expansion/contraction, rate, amplitude, symmetry.
- Interpretation:
  - Slow/shallow = reduced CSF mobility, sympathetic dominance.
  - Full/balanced = parasympathetic quieting, better drainage.
- 💭 Instructor Notes: 6–8 min demo and practice. Coach 'follow ease,' 'less is more.' Watch for jaw tension or dizziness. Goal is to get a sense of motion, score 0-10 (subjective) by palpation, evaluate Potency.
- "To find health should be the object of the doctor. Anyone can find disease." — A.T. Still

Lab 2: Balancing the Autonomic Nervous System

- Treatment Goal: Increase ParaNS (Vagal) tone, quiet SNS tone, appreciate the connection between the cranium and the sacrum.
- Remember CRI (0-10 score from prior). Great to do in the office while getting History.
- A. Occiput — Using Becker or vault hold encourage motion present. Sense for changes in blood flow.

  Increase Parasympathetic tone (Vagus). Follow ease until release or warmth. Reassess CRI.
- B. Rib Raising — Decrease Sympathetic firing (T1–L2). Lift ribs with slow oscillation, 2–3 min each side.

  Especially helpful around the cysterna chyli in the back. May go up the entire spine (stay in the gutter to the side of the muscles; articulating over the rib heads)
- C. Sacral Balancing — Increase Parasympathetic tone (S2–S4). Follow motion to balanced tension and wait

  for ease. DOs- hand to the sacrum (prone or supine), indirect motion, monitor locally as well as globally.
- 💬 Instructor Notes: 5 min each technique. No HVLA. Encourage noticing signs of parasympathetic activation (sigh, warmth, yawning, change in breathing, slowing HR, stillness). Reassess after change.

“When all of the fulcrums are synchronized there will be peace and harmony. -W.G. Sutherland DO

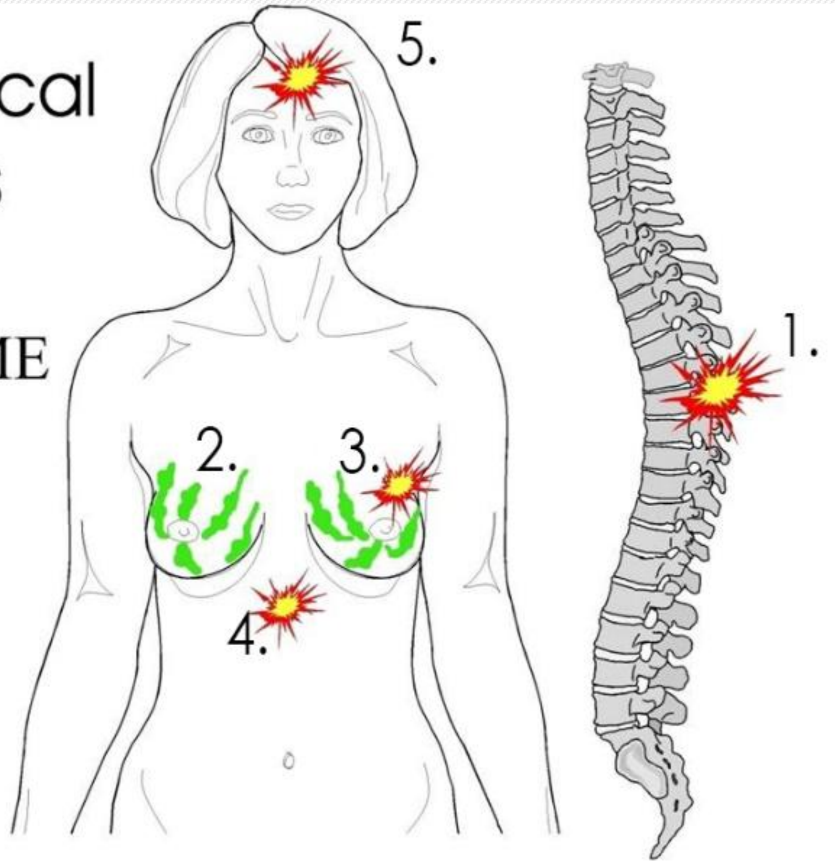
Lab 3: Diagnosing Physical Signs of ME/CFS

🔎 **3) Diagnosing the Five Perrin Signs of ME/CFS, Fibromyalgia, and Long COVID**

Sign	How to Find	Meaning
Thoracic flattening T4–T6	Rigid/tender segment	*Sympathetic facilitation
Varicose megalymphatics	Beaded cords chest/neck	Lymphatic reflux
Perrin's Point	2–3 cm sup-lat to L nipple	Thoracic duct irritation
Coeliac plexus tenderness	Below xiphoid	*Visceral SNS overload
Dampened CRI	Slow/uneven rhythm	Impaired drainage/ANS imbalance

- Two-sign protocol (Thoracic + Coeliac) ≈ 88% diagnostic accuracy (BMJ Open 2017).
- 💬 Instructor Notes: Practice assessing major signs. Feel for heat, TART, Trophic changes, May visibly see sunken spine and warm/tender celiac plexus. 12–15 min for all five signs. Light touch, clear consent, document findings.

Physical Signs of CFS/ME



1. Long standing thoracic spinal problem (with tenderness at T4/T5/T6 segments).
2. Varicose lymph (megalymphatics)
3. Perrin's Point
4. Coeliac plexus
5. Reduction in cranio-sacral rhythm (CRI)

Lab 4: Treatment Sequence

- Center → Assess CRI → Screen 5 Signs → Treat (OA, ribs, sacrum) → Recheck CRI → Educate on pacing and rest.
- **"Within that cerebrospinal fluid there is an invisible element that I refer to as the "Breath of Life." I want you to visualize this Breath of Life as a fluid within this fluid, something that does not mix, something that has potency as the thing that makes it move. Is it necessary to know what makes the fluid move? Visualize a potency, an intelligent potency, that is more intelligent than your own human mentality."** – *W. G. Sutherland DO*
- 💭 Instructor Notes: 15 min per dyad. Encourage noticing the moment of change. Debrief findings. Check other participants and complete screening. Note response of CRI after even minimal intervention.

Lab 5: Self Care & Pacing

- For Patients: Do half of what you feel able. Hydrate, breathe slowly, gentle movement, prioritize sleep. Pacing, Contrast Bathing, Avoiding PEM, and gentle movement. Hydration is also extremely important
- For Clinicians: Regulate yourself first. Calm breath, soft hands, document objective changes. Always reassess & remember to document the response to treatment. You may be the first safe clinician that validates the truth of their illness. This is powerful medicine. Encourage patient self-treatment.
- **“The cerebro-spinal fluid is one of the highest known elements that are contained in the body, and unless the brain furnishes this fluid in abundance, a disabled condition of the body will remain. He who is able to reason will see that this great river of life must be tapped and the withering field irrigated at once, or the harvest of health be forever lost.”**

—A. T. Still M.D. Philosophy and Mechanical Principles of Osteopathy

Thank You!

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More information and self-help Guide available at www.theperrintechnique.com

Please join us for the hands-on portion following the presentation.