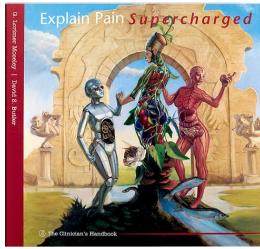
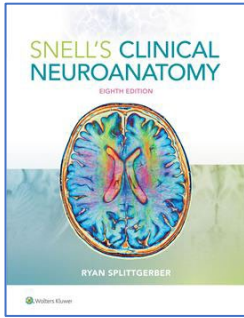


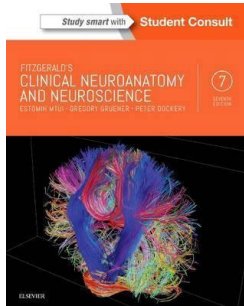
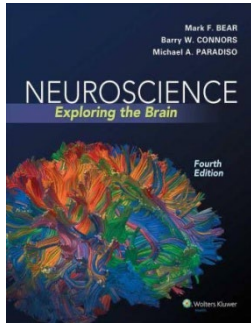


NEUROSCIENCE LEVEL 1

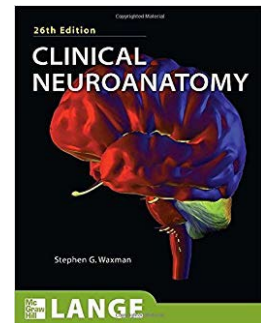
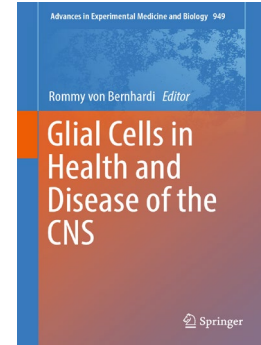
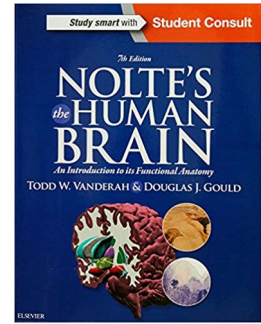
## 2 Neurobiology of Glial Cells



# Book References to support Power Points



- Snell RS. Clinical neuroanatomy: Lippincott Williams & Wilkins 2019. 8<sup>th</sup> Ed. Chapter 2 Neurons and Neuroglia, p. 33-69
- Bears M, Connors B, Paradiso M. *Neuroscience; Exploring the Brain*: Lippincott Williams & Wilkins. 2016. 4<sup>th</sup> Ed. Chapter 2 Neurons and Glia, p. 23-36
- Mtui E, Gruener G, Dockery P. Fitzgerald's Clinical Neuroanatomy and Neuroscience: Elsevier Health Sciences 2016. 7<sup>th</sup> Ed. Chapter 6 Neurons and Neuroglia, p. 63-74
- Vanderah T, Gould DJ. Nolte's The Human Brain E-Book: An Introduction to its Functional Anatomy: Elsevier Health Sciences 2016. 7<sup>th</sup> Ed. Chapter 1 An Introduction to the Nervous System, p. 1-38
- von Bernhardt R., Eugenín-von Bernhardt J., Flores B., Eugenín León J. (2016) Glial Cells and Integrity of the Nervous System. In: von Bernhardt R. (eds) Glial Cells in Health and Disease of the CNS. Advances in Experimental Medicine and Biology, vol 949. Springer, Cham
- Waxman SG. Clinical neuroanatomy: McGraw-Hill Education 2016. 26<sup>th</sup> Ed. Chapter 1 Fundamentals of the Nervous System, p. 1-6 and Chapter 2 Development and Cellular Constituents of the Nervous System, p. 7-17
- Butler D, Moseley G. Explain pain supercharged. *Adelaide City West* 2017. Chapter 2 & 3



# Additional Bibliography

- Anderson G, Maes M. Sirtuins, Mitochondria and the Melatonergic Pathway in Alzheimer's Disease. 2020.
- Anderson G, Maes M. Mitochondria and immunity in chronic fatigue syndrome. *Progress in Neuro-Psychopharmacology and Biological Psychiatry*. 2020;109976.
- Anderson G, Reiter RJ. Melatonin: Roles in influenza, Covid-19, and other viral infections. *Reviews in Medical Virology*. 2020;30(3):e2109.
- Anderson G, Reiter RJ. COVID-19 pathophysiology: interactions of gut microbiome, melatonin, vitamin D, stress, kynurenine and the alpha 7 nicotinic receptor: Treatment implications. *Melatonin research*. 2020;3(3):322-345.
- Anderson G. Integrating pathophysiology in migraine: Role of the gut microbiome and melatonin. *Current pharmaceutical design*. 2019;25(33):3550-3562.
- Anderson G, Maes M. Gut dysbiosis dysregulates central and systemic homeostasis via suboptimal mitochondrial function: assessment, treatment and classification implications. *Current Topics in Medicinal Chemistry*. 2020;20(7):524-539.
- Gevezova M, Sarafian V, Anderson G, Maes M. Inflammation and Mitochondrial Dysfunction in Autism Spectrum Disorder. *CNS & Neurological Disorders-Drug Targets (Formerly Current Drug Targets-CNS & Neurological Disorders)*. 2020.
- Grubišić V, Gulbransen BD. Enteric glia: the most alimentary of all glia. *The Journal of physiology*. 2017;595(2):557-570.
- Hagan T, Cortese M, Roupheal N, et al. Antibiotics-driven gut microbiome perturbation alters immunity to vaccines in humans. *Cell*. 2019;178(6):1313-1328. e1313.
- Kho ZY, Lal SK. The human gut microbiome—a potential controller of wellness and disease. *Frontiers in microbiology*. 2018;9:1835.
- Lerner A, Neidhöfer S, Matthias T. The gut microbiome feelings of the brain: a perspective for non-microbiologists. *Microorganisms*. 2017;5(4):66.
- Liu H, Leak RK, Hu X. Neurotransmitter receptors on microglia. *Stroke and Vascular Neurology*. 2016;1(2):52-58.
- Margolis KG, Gershon MD. Enteric neuronal regulation of intestinal inflammation. *Trends in neurosciences*. 2016;39(9):614-624.
- Quigley EM. Microbiota-brain-gut axis and neurodegenerative diseases. *Current neurology and neuroscience reports*. 2017;17(12):94.



# Additional Bibliography

- Schain M, Kreisl WC. Neuroinflammation in neurodegenerative disorders—a review. *Current neurology and neuroscience reports* 2017;17(3):25.
- Wilton DK, Dissing-Olesen L, Stevens B. Neuron-glia signaling in synapse elimination. *Annual review of neuroscience* 2019;42:107-27.
- Vilalta A, Brown GC. Neurophagy, the phagocytosis of live neurons and synapses by glia, contributes to brain development and disease. *The FEBS journal* 2018;285(19):3566-75.
- Marina N, Teschemacher AG, Kasparov S, et al. Glia, sympathetic activity and cardiovascular disease. *Exp Physiol* 2016;101(5):565-76.
- Mayegowda SB, Thomas C. Glial pathology in neuropsychiatric disorders: a brief review. *J Basic Clin Physiol Pharmacol* 2019;30(4)
- Allen NJ, Lyons DA. Glia as architects of central nervous system formation and function. *Science* 2018;362(6411):181-85.
- Barros LF, Brown A, Swanson RA. Glia in brain energy metabolism: A perspective. *Glia* 2018;66(6):1134-37.
- Tsuda M. Modulation of pain and itch by spinal glia. *Neuroscience bulletin* 2018;34(1):178-85.
- Quintana FJ. Astrocytes to the rescue! Glia limitans astrocytic endfeet control CNS inflammation. *The Journal of clinical investigation* 2017;127(8):2897-99.
- Morales-Soto W, Gulbransen BD. Enteric glia: a new player in abdominal pain. *Cellular and molecular gastroenterology and hepatology* 2019;7(2):433-45.
- Robel S, Sontheimer H. Glia as drivers of abnormal neuronal activity. *Nat Neurosci* 2016;19(1):28.
- Peters A. The effects of normal aging on myelin and nerve fibers: a review. *J Neurocytol* 2002;31(8-9):581-93.
- Cabarrocas J, Savidge TC, Liblau RS. Role of enteric glial cells in inflammatory bowel disease. *Glia* 2003;41(1):81-93.
- Costa FAL, Neto FLM. Satellite glial cells in sensory ganglia: its role in pain. *Brazilian Journal of Anesthesiology (English Edition)* 2015;65(1):73-81.
- Reyes RE, Zhang Z, Gao L, Asatryan L. Microbiome meets microglia in neuroinflammation and neurological disorders. *Neuroimmunology and Neuroinflammation*. 2020;7(3):215-233.
- Rudzki L, Maes M. The microbiota-gut-immune-glia (MGIG) axis in major depression. 2020.
- Shoemark DK, Allen SJ. The microbiome and disease: reviewing the links between the oral microbiome, aging, and Alzheimer's disease. *Journal of Alzheimer's Disease*. 2015;43(3):725-738.

# Additional Bibliography

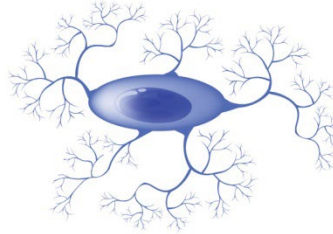
- von Bernhardt R, Eugenín-von Bernhardt J, Flores B, et al. Glial Cells and Integrity of the Nervous System. *Adv Exp Med Biol* 2016;949:1-24. doi: 10.1007/978-3-319-40764-7\_1
- Bernstein H-G, Steiner J, Guest PC, et al. Glial cells as key players in schizophrenia pathology: recent insights and concepts of therapy. *Schizophr Res* 2015;161(1):4-18.
- Cragnolini AB, Lampitella G, Virtuoso A, et al. Regional brain susceptibility to neurodegeneration: what is the role of glial cells? *Neural regeneration research* 2020;15(5):838.
- Cullen CL, Young KM. How does transcranial magnetic stimulation influence glial cells in the central nervous system? *Frontiers in neural circuits* 2016;10:26.
- Fernández-Albarral JA, Salobar-García E, Martínez-Páramo R, et al. Retinal glial changes in Alzheimer's disease—A review. *Journal of optometry* 2019;12(3):198-207.
- Fujita Y, Yamashita T. The effects of leptin on glial cells in neurological diseases. *Frontiers in neuroscience* 2019;13:828.
- Hidalgo-Lanussa O, Baez-Jurado E, Echeverría V, et al. Lipotoxicity, neuroinflammation, glial cells and oestrogenic compounds. *J Neuroendocrinol* 2019:e12776.
- Jäkel S, Dimou L. Glial cells and their function in the adult brain: a journey through the history of their ablation. *Frontiers in cellular neuroscience* 2017;11:24.
- Ji R-R, Chameissian A, Zhang Y-Q. Pain regulation by non-neuronal cells and inflammation. *Science* 2016;354(6312):572-77.
- Kastrioti ME, Adameyko I. Specification, plasticity and evolutionary origin of peripheral glial cells. *Current opinion in neurobiology* 2017;47:196-202.
- Krames ES. The dorsal root ganglion in chronic pain and as a target for neuromodulation: a review. *Neuromodulation: Technology at the Neural Interface* 2015;18(1):24-32.
- Slattery J, MacFabe DF, Frye RE. The significance of the enteric microbiome on the development of childhood disease: a review of prebiotic and probiotic therapies in disorders of childhood. *Clinical Medicine Insights: Pediatrics*. 2016;10:CMPed. S38338.
- Hao W-Z, Li X-J, Zhang P-W, Chen J-X. A review of antibiotics, depression, and the gut microbiome. *Psychiatry Research*. 2020;284:112691.
- Zubcevic J, Richards EM, Yang T, et al. Impaired autonomic nervous system-microbiome circuit in hypertension: a premise for hypertension therapy. *Circulation Research*. 2019;125(1):104-116.

# Glial Cells

**Oligodendrocytes**

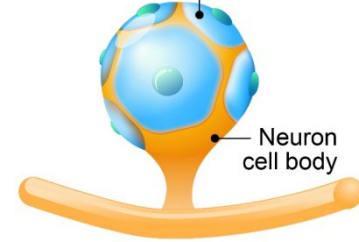


**Microglia**

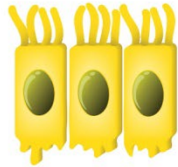


Satellite cell

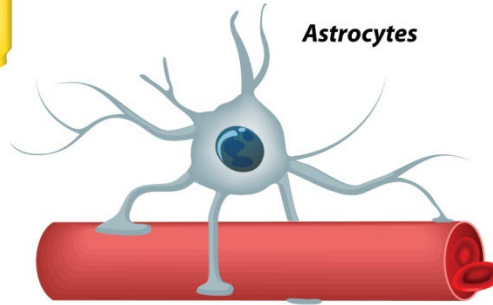
Neuron cell body



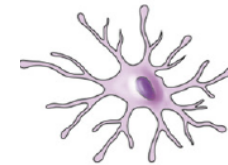
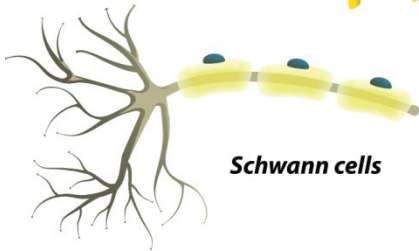
**Ependymal cells**



**Astrocytes**



**Schwann cells**



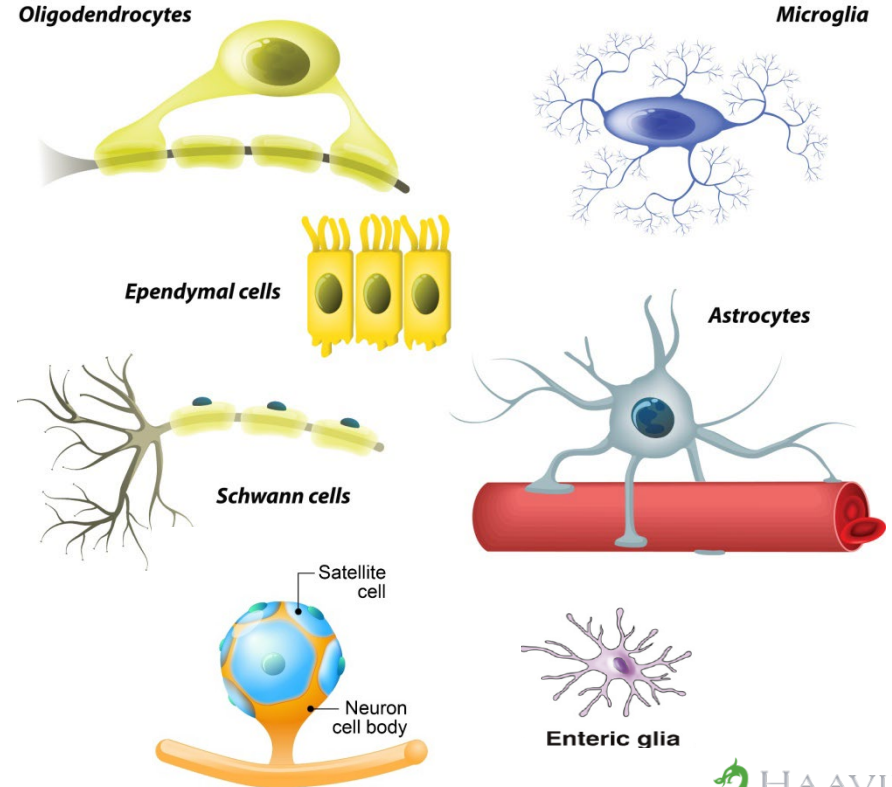
**Enteric glia**

# Glial Cells

- Support and protection for neurons
- Supply nutrients and oxygen to neurons
- Insulate neurons
- Destroy pathogens
- Remove dead neurons
- Generate the most neurons and glial cells
- Sense O<sub>2</sub> and Ph in brain; vital for homeostasis
- Support synaptic strength, synaptic formation & pruning; i.e. vital for neuroplasticity
- Alter brain states, such as sleep
- Communicate with other Glia and with neurons; discovered glio-transmitters
- Play a major role in chronic pain, neurodegeneration and neurological disorders
- Play a vital role in initiating and maintaining high sympathetic nervous system activity, increasing inflammation, and contributing to the development of chronic diseases such as cardiovascular disease

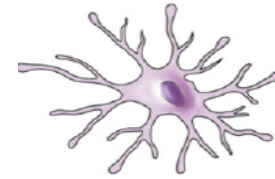
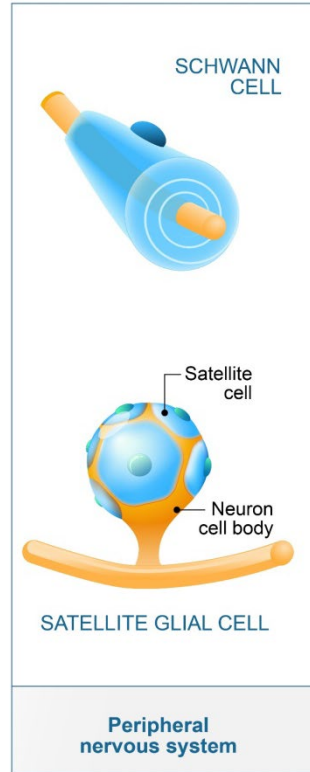
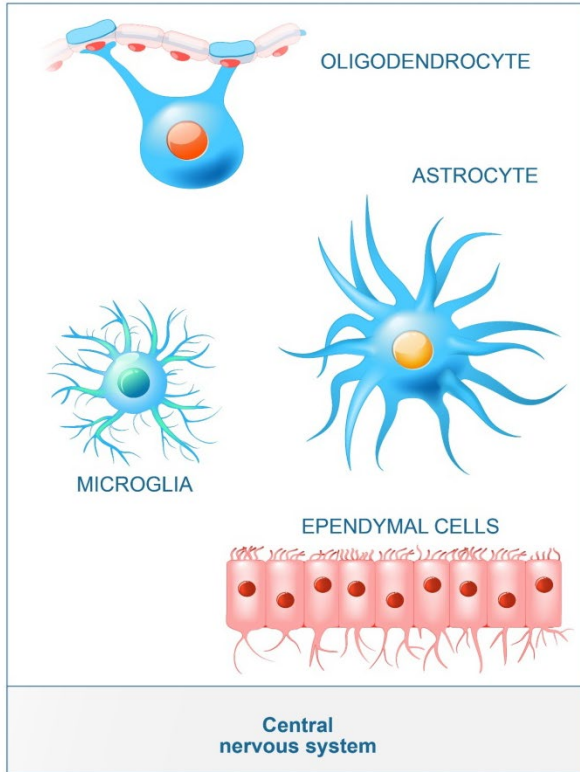
# Different Types of Neuroglial Cells

- **Oligodendrocytes**
  - form myelin sheaths in **CNS**
  - each wraps processes around many nerve fibers
- **Schwann cells**
  - myelinate fibers of **PNS**
  - Each segment of myelin = one Schwann cell
- **Astrocytes**
  - contribute to BBB & regulate composition of brain tissue fluid
  - most abundant glial cells - form framework of CNS
  - Regulate metabolism
  - Modulate neuronal transmission (synapses)
  - Important for CNS development and repair
- **Ependymal cells**
  - line cavities & produce CSF
- **Microglia** (macrophages) formed from monocytes
  - concentrate in areas of infection, trauma or stroke
- **Satellite cells**
  - cover the surface of nerve **cell** bodies in sensory, sympathetic, and parasympathetic ganglia.
- **Enteric glia**
  - Found in the gut





# Neuroglial Cells of CNS vs PNS

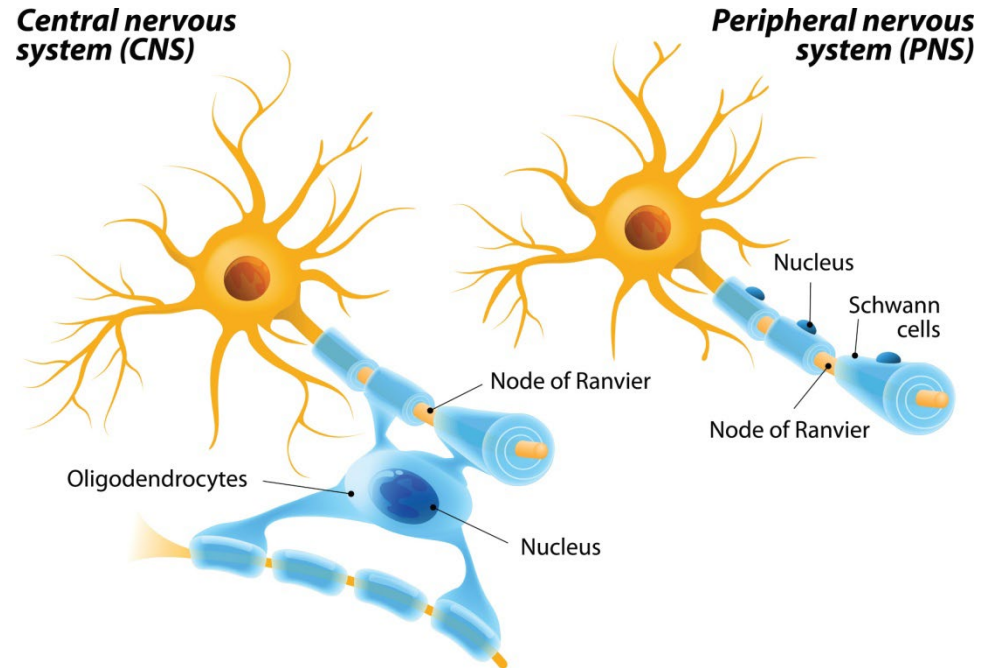


**Enteric glia**

In addition, new data suggests that enteric glia, a unique type of peripheral glia found within the enteric nervous system, have the potential to modify visceral perception through interactions with neurons and immune cells. Implicated in abdominal pain. (Morales et al. 2018)

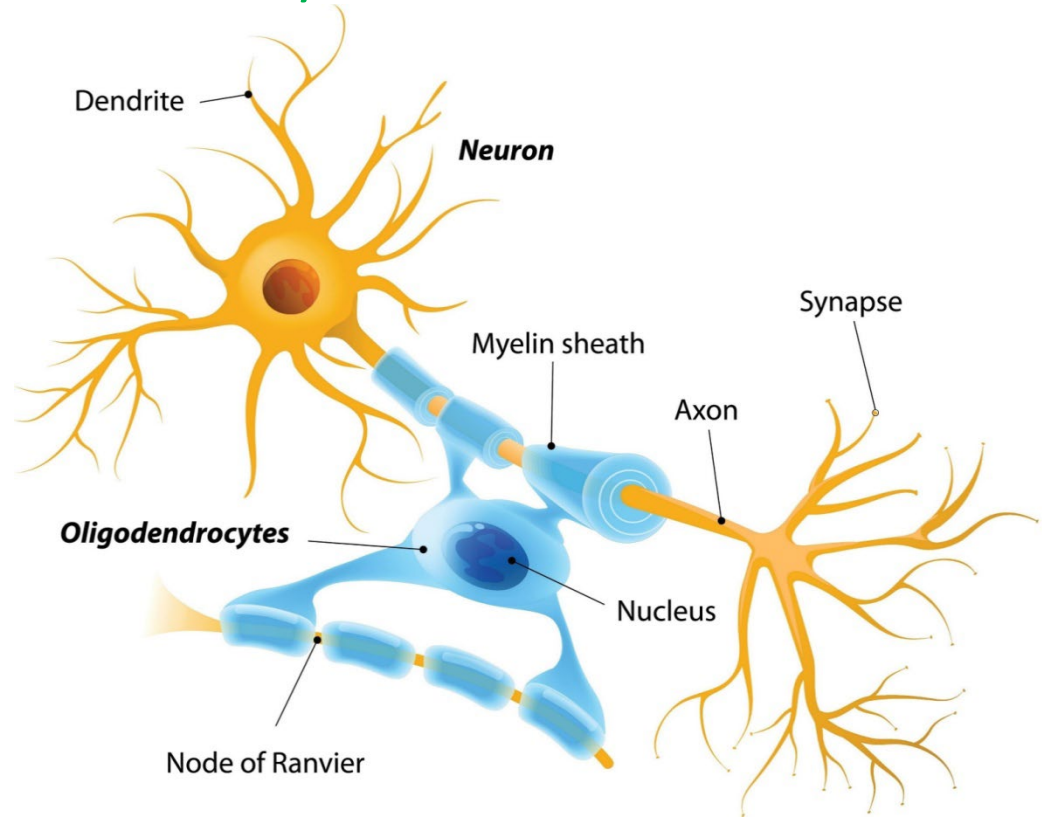
- **Insulating** layer around a nerve fiber
  - oligodendrocytes in CNS
  - Schwann cells in PNS
- **Looks white** as formed from wrappings of plasma membrane
  - 20% protein & 80% lipid
- **Nodes of Ranvier** = Gaps between myelin segments
- **Neuroplasticity** – their presence, the number, distribution, length and thickness of myelin sheaths all affect action potential conduction velocity

# Myelin Sheath



# Oligodendrocytes

- Small cell bodies and a few delicate processes.
- Surround nerve cell bodies and form myelin sheath around nerve axons in the CNS (Schwann cells in PNS)
- Unlike Schwann cells in PNS, a single Oligodendrocyte in CNS can form several segments of Myelin.
- Can form as many as 60 internodal segments of myelin



# Oligodendrocytes

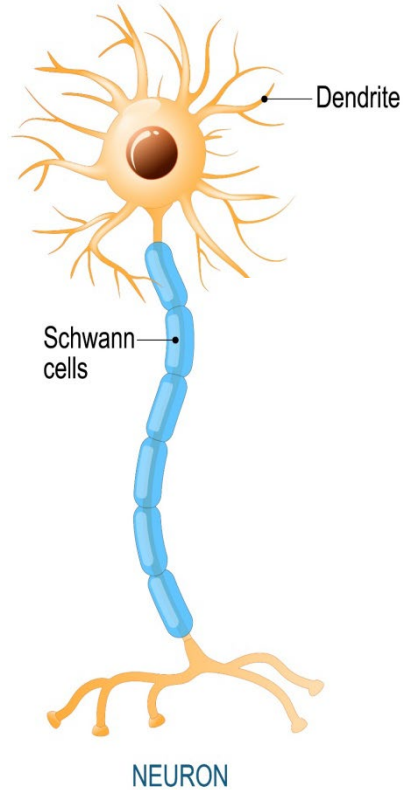


- Responsible for myelin numbers, distribution, thickness and length.
- So important for neural plasticity
- Influences timing of nerve to nerve communication by changing action potential propagation speed

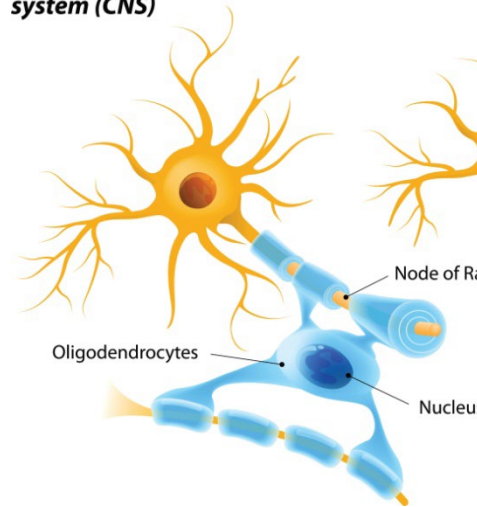
- Have neurotransmitter receptors to respond to nerves
- Have a range of ion channels and ion transporters
- Neuronal activity likely changes oligodendrocytes' myelin making activity (to change distribution, numbers, thickness and length) as needed

# Schwann Cells

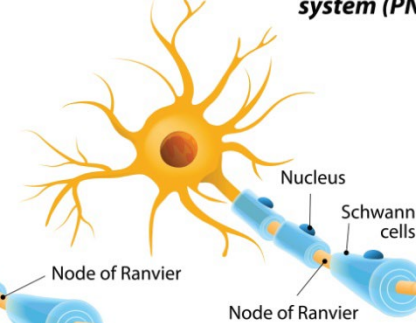
- Myelinate cell axons of PNS
- Each segment of myelin = one Schwann cell



**Central nervous system (CNS)**



**Peripheral nervous system (PNS)**

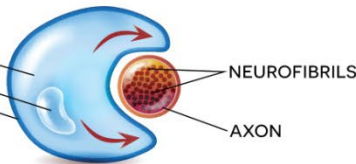




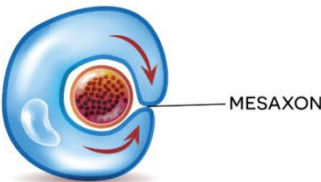
# MYELIN SHEATH FORMATION STAGES

**SCHWANN CELL:**

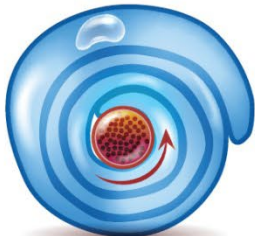
- CYTOPLASM
- NUCLEUS
- MEMBRANE



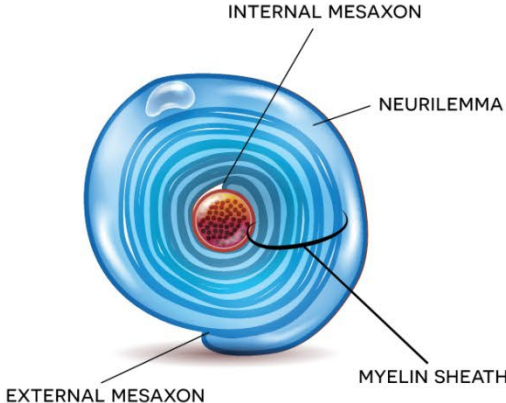
**1.**



**2.**



**3.**



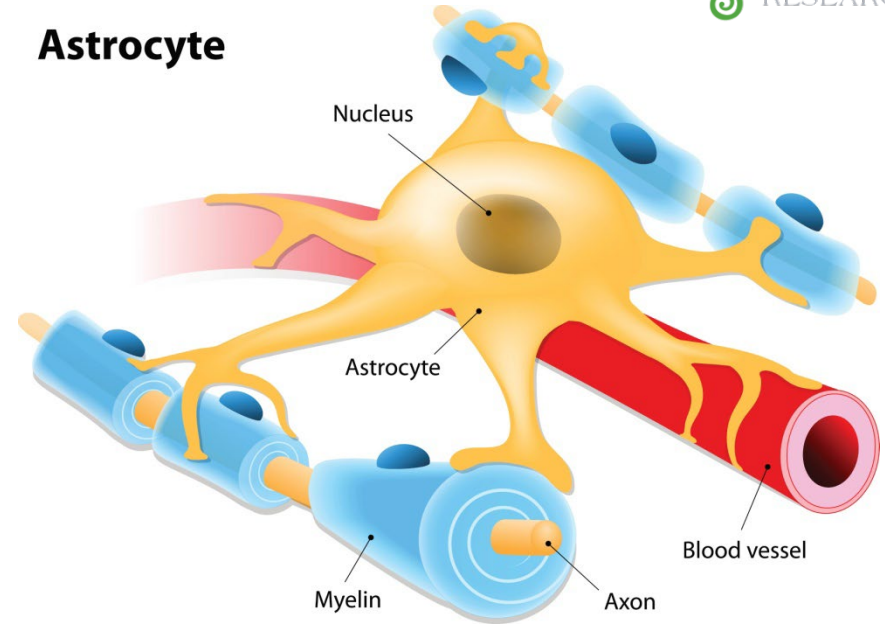
**4.**

# Astrocytes

- Is the most abundant glial cell
- Form framework of CNS, scaffolding for nerves, fill the space between nerves
- Regulate chemical content of extracellular space
- Cover and isolate synapses and remove neurotransmitters from synaptic gap
- Also regulate  $K^+$  ions in extracellular space
- Two types
  - Protoplasmic – around cell bodies
  - Fibrous – around axons
- Perivascular feet maintain BBB

© Haavik Research 2022

## Astrocyte

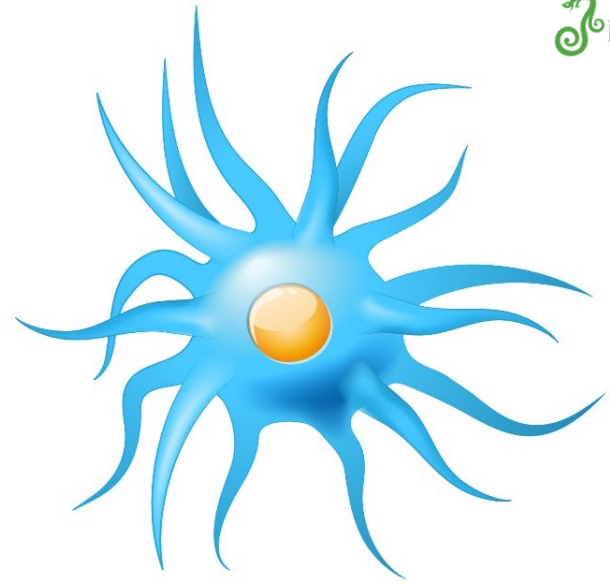


## Form the outer & inner glial limiting membranes

- Outer limiting membrane found beneath pia mater
- Inner limiting membrane found beneath the ependyma lining the ventricles and central canal of spinal cord

# Astrocytes

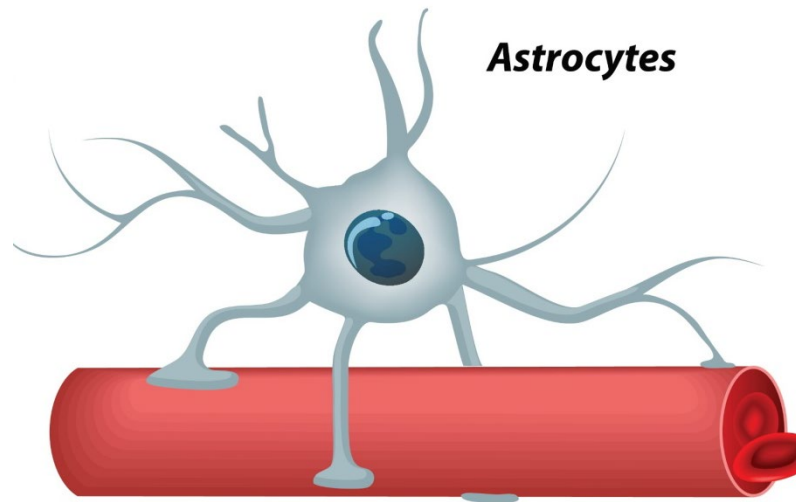
- Surround axon hillock and cover Nodes of Ranvier
- Synaptic insulators as covers the connections between cells
  - Thus modulate neuronal transmission; thus important for neuroplasticity
- Connected with each other by gap junctions
- Serve as a scaffolding for the migration of immature neurons
- Store glycogen – feed neurons



- Phagocytic – clean up dead tissue, thus important in both CNS development and repair
- Replacement gliosis – replace damaged neurons

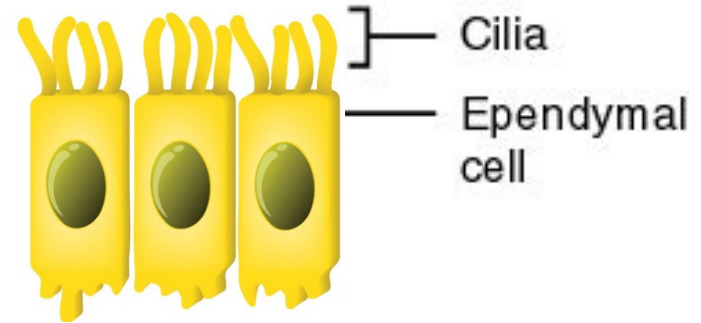
# Astrocytes

- Respond to neurotransmitters
- Astrocytes are fundamentally important for glutamate and GABA neurotransmission in the brain.
- Existence of glial-transmitters
- Influence immune function via cytokines
- Contribute to chronic pain
- Implicated in CNS various diseases



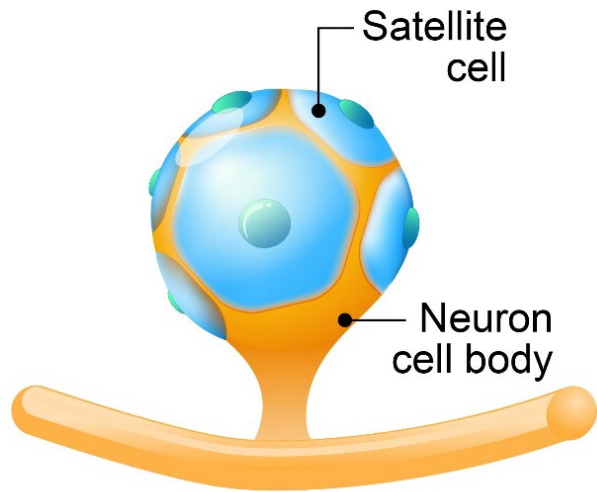
# Ependymal Cells

- Line the cavities of the brain and central canal of the spinal cord
- Form a single layer of cuboidal or columnar cells
- Contain microvilli and cilia
- Contribute to the flow of the CSF
- Three types:
  1. **Ependymocytes** – line ventricles, gap junctions between cells so CSF has free communication with CNS tissue
  2. **Tanycytes** – lines the floor of 3<sup>rd</sup> ventricle overlying the hypothalamus. Thought to transport chemical substances from CSF to hypophyseal portal system.
  3. **Choroidal epithelial cells** – covers the surface of the choroid plexii, tight junctions between cells to prevent leakage of CSF into underlying tissue





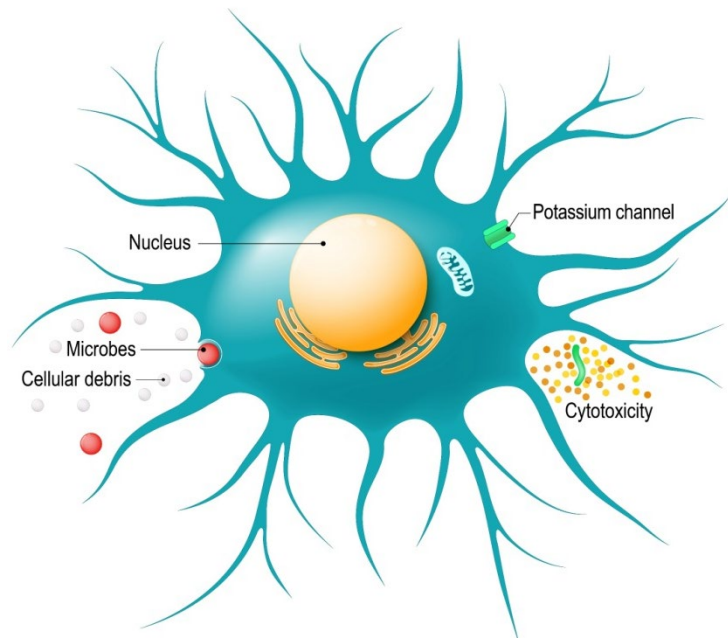
# Satellite glial cells



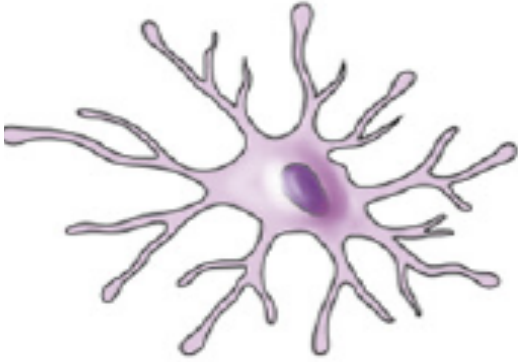
- Surround nerve cell bodies in peripheral nerve ganglia, and surround entire ganglia
- Physiologically similar to astrocytes; monitor perineural environment
- Communicate bidirectionally with neurons and with each other via gap junctions
- Implicated in chronic pain initiation and maintenance

# Microglia

- Embryologically unrelated to the other glial cells
- Closely resemble connective tissue macrophages
- Smallest of all neuroglia
- Found throughout entire CNS
- Migrate into nervous system during fetal development
- Increase in number and become activated in the presence of damaged nervous system tissue.
- Can become actively phagocytic
- Astrocytes and microglia in the central nervous system and satellite glia in dorsal root ganglia **contribute to chronic pain** states through reactive gliosis, the modification of glial networks, and the synthesis and release of neuromodulators.
- microglia have also been implicated in synapse formation.



# Enteric Glia

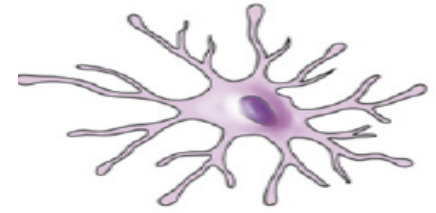


neurotrophic factor (GDNF)

- Implicated in inflammatory bowel disease and chronic abdominal pain

- Similar in structure and function to astrocytes. Also some similarities with Schwann cells.
- Greatly outnumber enteric neurons, and enteric glia cover the enteric neurons
- Connected via gap junctions and connect to blood vessels
- Protect enteric neurons and regulate their activity
- Maintain integrity and permeability of gut mucosa

# Known Enteric Glial Cell Functions



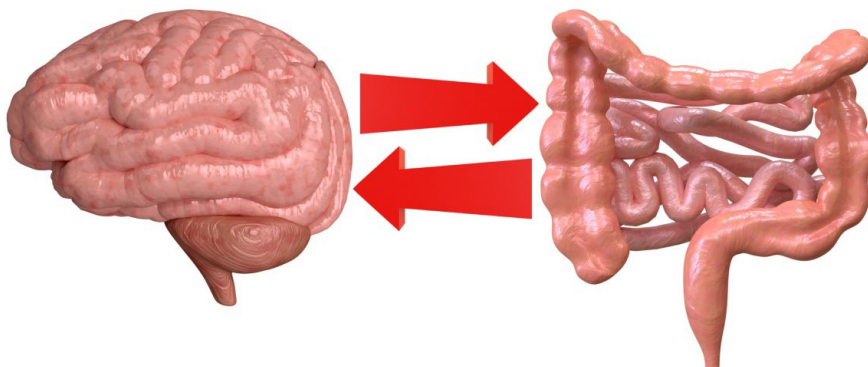
1. Maintenance of intestinal barrier functions
2. Protect enteric neurons
3. React to damaged neurons or tissue trauma, infections, immune insult or inflammation
4. Respond to and produce cytokines and chemokines that impact local events
5. Protect local tissue integrity
6. Regulate neuronal activity
7. Control GI motility
8. Regulate mucosal secretion
9. Regulate mucosal immunity
10. Act as progenitor cells
11. Protect, support, and maintain the mucosal neural network
12. Constrain microbiota composition towards increased anti-inflammatory and decreased pro-inflammatory bacterial lineages
13. Modulate epithelial cell proliferation, differentiation, and healing
14. Defend intestinal mucosa against pathogen invasion

# Glial cell influence on Microbiome and Gut-Brain Axis

- Gut-Brain Axis is Influenced & Regulated at multiple levels:

- Microbiome
- Nutrient intake
- Stress levels
- Enteric glial cells
- Nervous system
- Endocrine system
- Immunological system
- Brain

## Gut-Brain Connection



A breakdown in the gut-brain axis can lead to inflammatory-, autoimmune-, neurodegenerative-, metabolic-, mood-, behavioral-, cognitive-, autism-spectrum-, stress- and pain-related disorders.



Intestinal Permeability can be caused by:

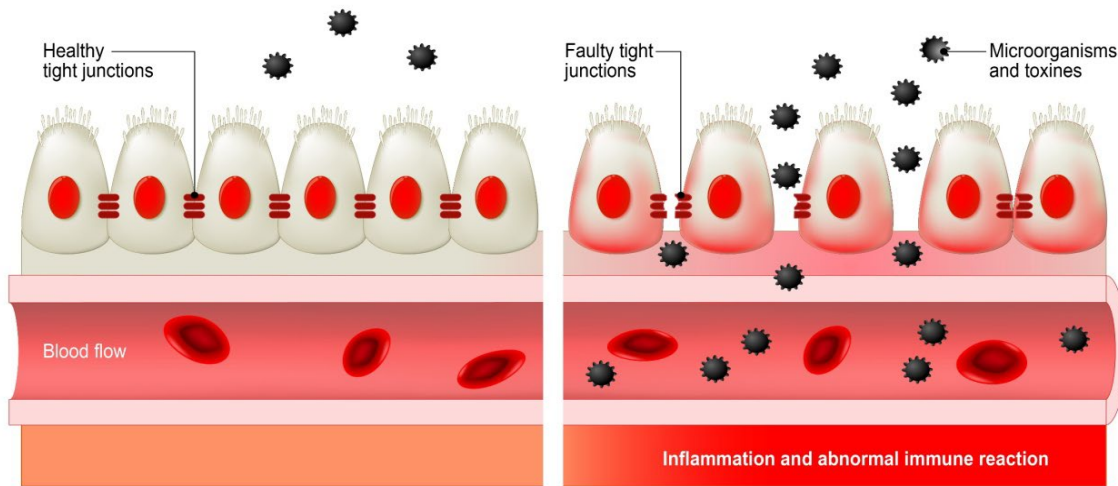
- stress
- obesity
- western diet
- allergens
- carcinogens
- Vit A or D deficiency
- food additives
- certain drugs
- heavy metals

Gut permeability allows the following to enter circulation:

- microbial metabolites
- cytokines
- toxins
- allergens
- carcinogens
- food additives

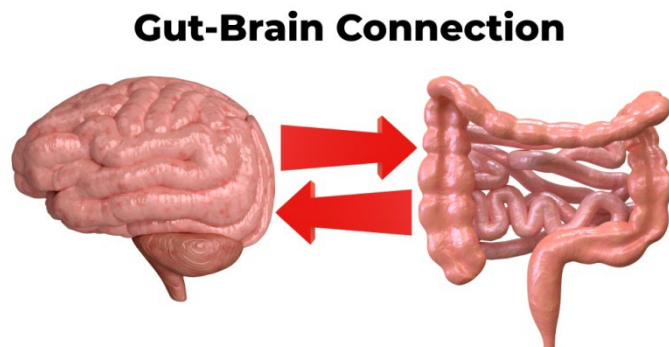
**Increases  
Inflammation**

## INTESTINAL PERMEABILITY

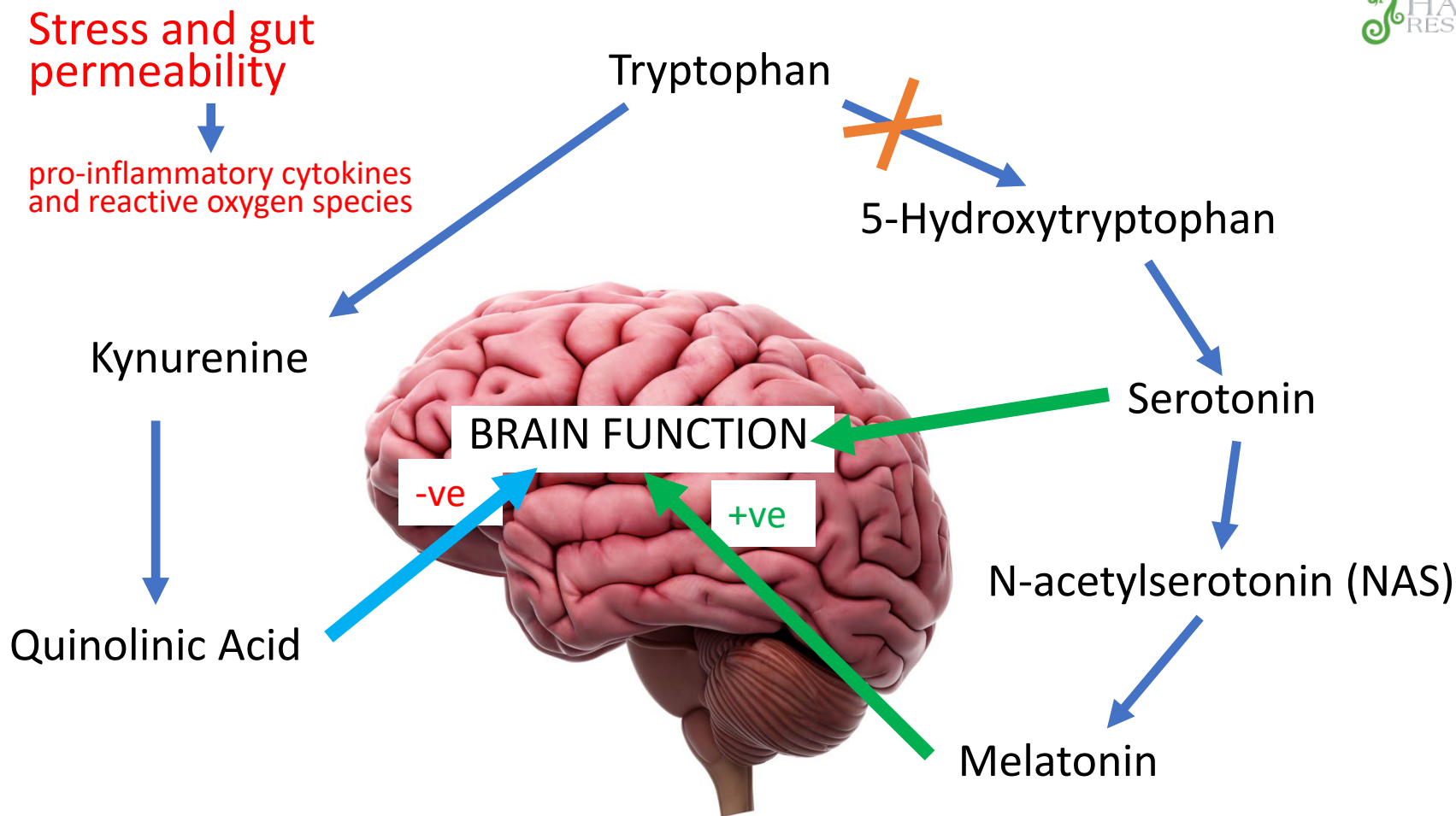


# Glial cell dysfunction is known to lead to:

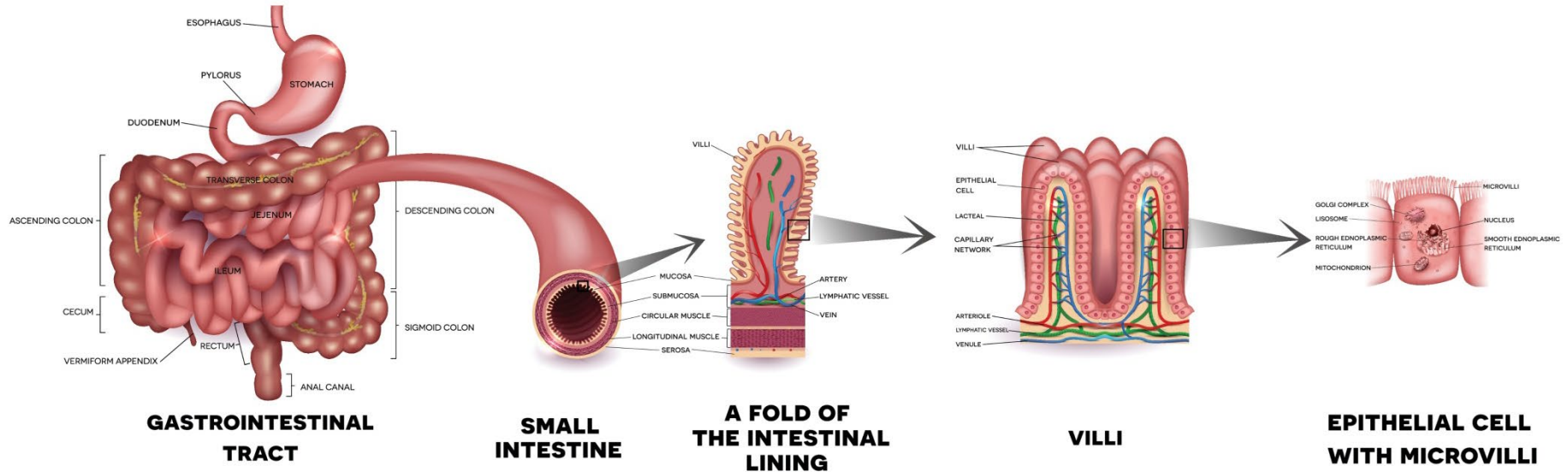
- Schizophrenia
- Bipolar disorder
- Attention deficit hyperactivity disorder (ADHD)
- Anxiety disorders
- Dementia
- Major depressive disorder
- Parkinson's disease
- Autism spectrum disorder
- Amyotrophic lateral sclerosis
- Alzheimer's diseases
- Prion diseases
- Encephalopathies
- Creutzfeldt-Jakob disease
- Depression and/or Anxiety
- Behaviour, Mood and/or Cognition
- Stress & Fatigue
- Stroke

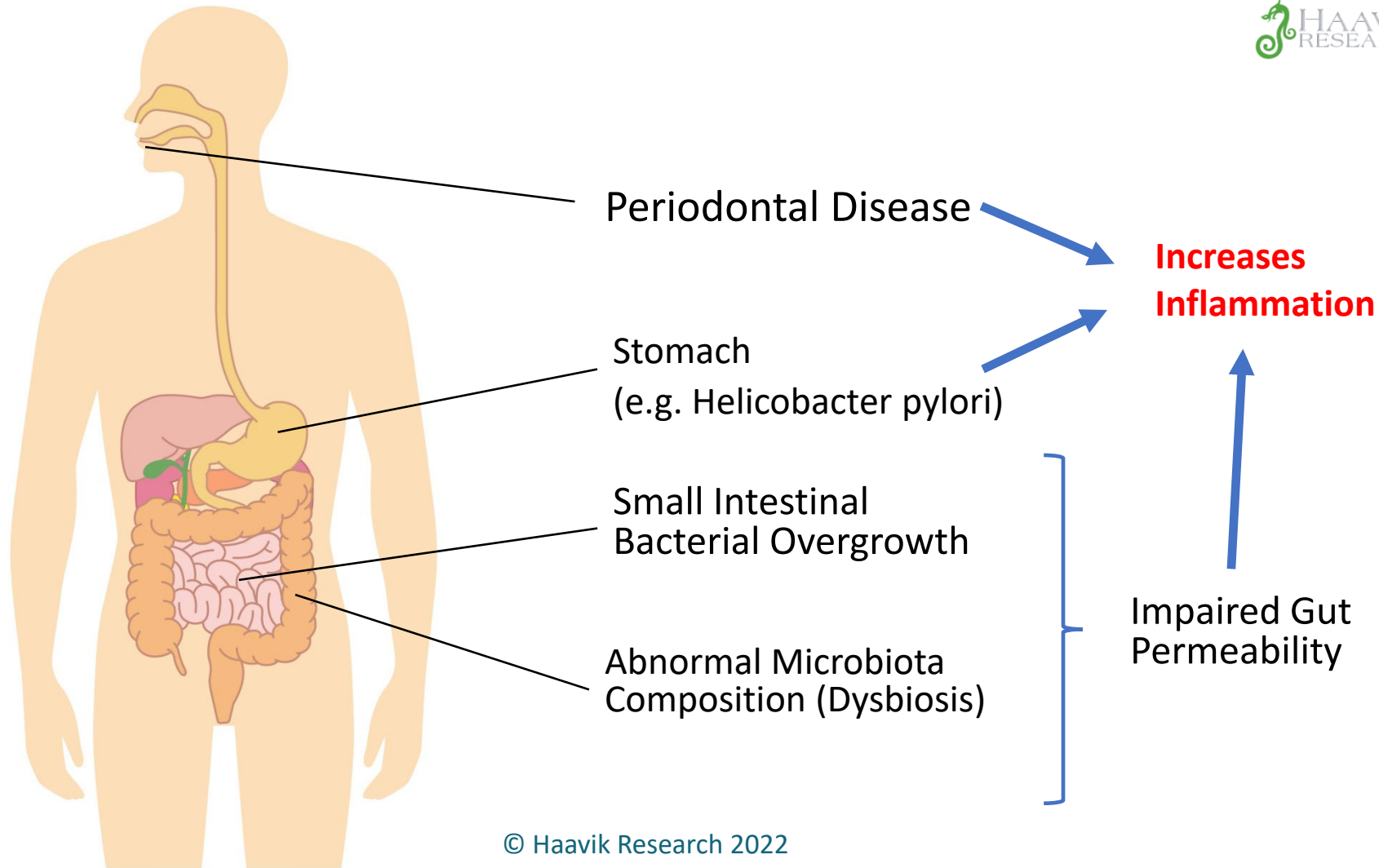


- Motility disorders
  - Constipation
  - diarrhoea
- Malabsorption syndromes
- Infectious gastroenteritis
- Inflammatory bowel disease
  - Chron's Disease
  - Ulcerative Colitis
  - Intestinal inflammation
  - Irritable bowel syndrome



# Enteric Glial cell function in the gastrointestinal tract

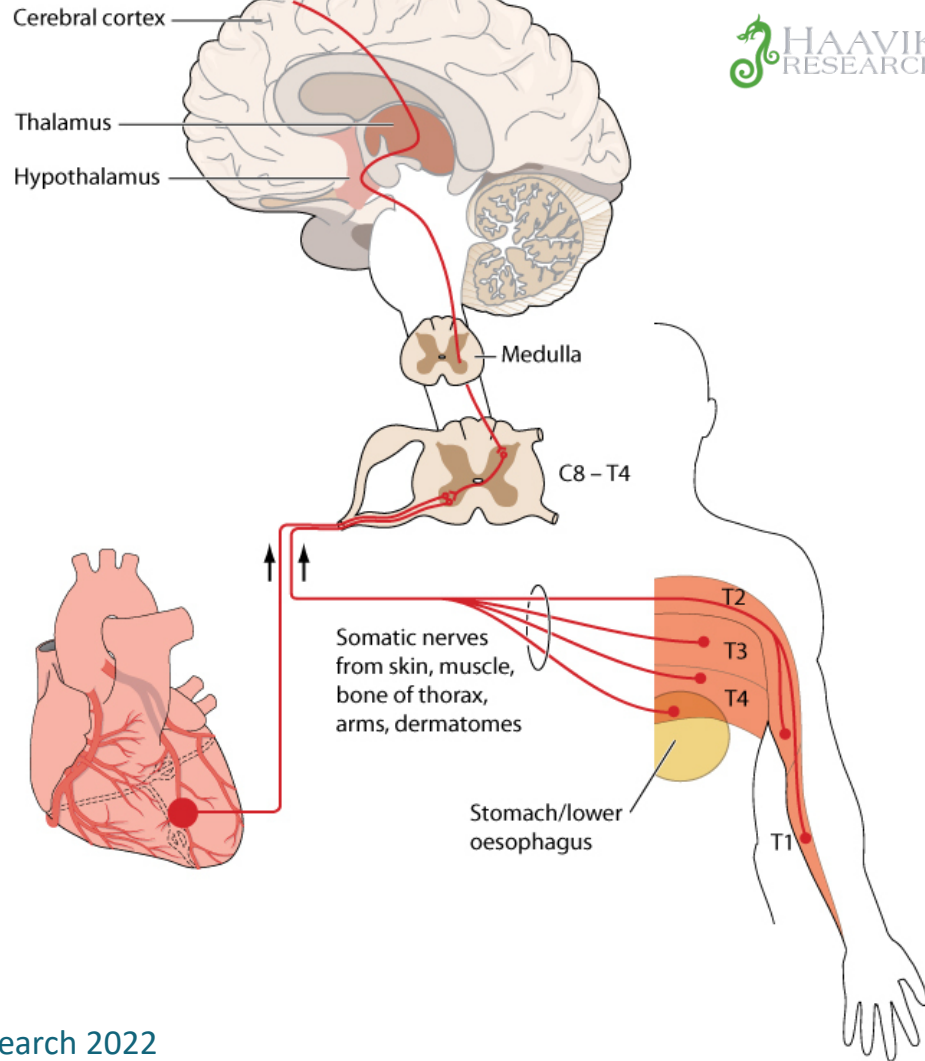






# Glial cell influence on inflammation and chronic disease

- Astrocytes and microglia can modulate sympathetic nervous system activity
- Increased sympathetic tone over time contributes to maladaptive increases in systemic arterial hypertension and chronic heart failure



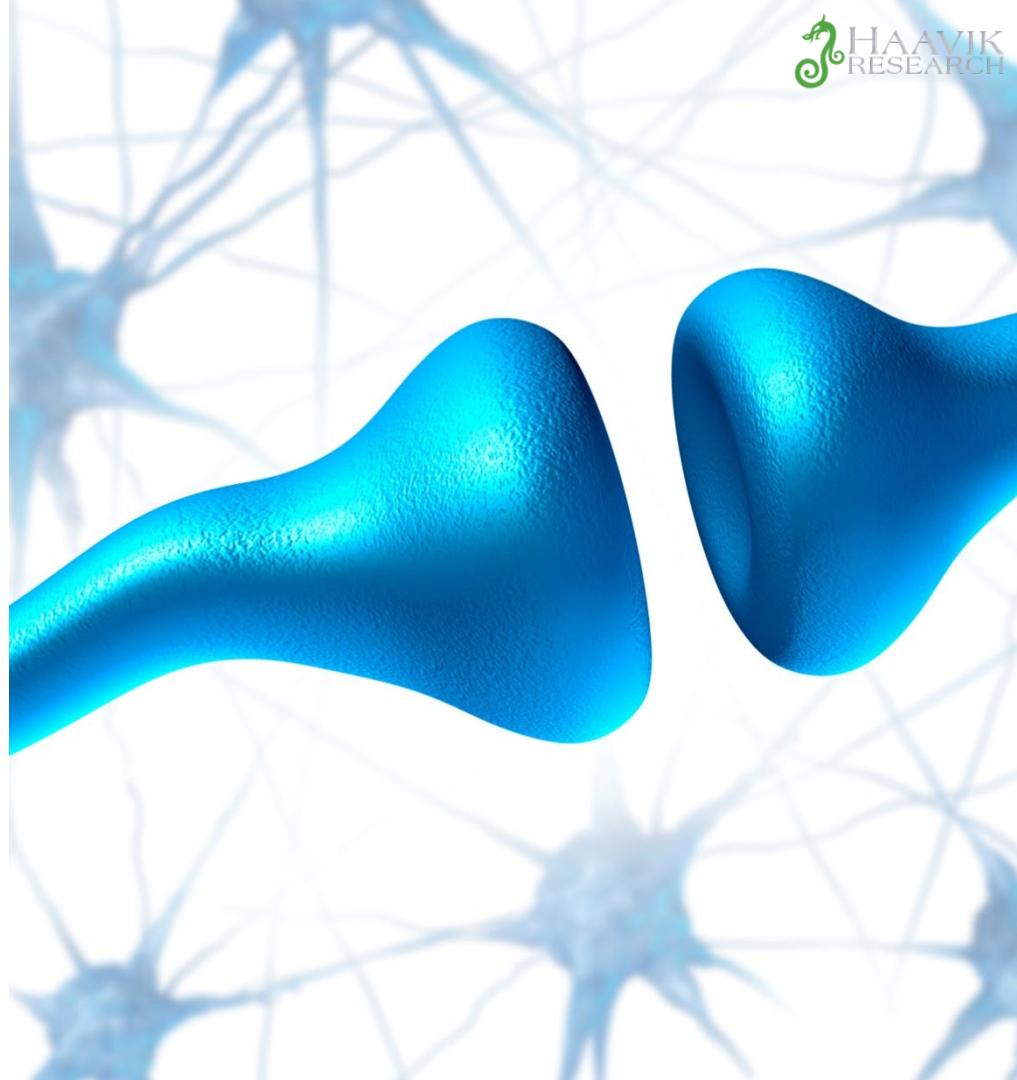
# Glial cells involvement in neurodegeneration and disease

- Early in the neurodegenerative process, glial cells activate and trigger an insidious neuroinflammatory reaction, metabolic decay, blood brain barrier dysfunction and energy impairment, boosting neuronal death
- Astrocytes, microglial cells, and oligodendrocytes are all implicated
- Glial cells implicated in Parkinson's and Alzheimer's diseases, epilepsy, multiple sclerosis, dementia, AIDS and Schizophrenia



# Glial cell influence on Neural Plasticity

- Gliotransmitters can influence synaptic plasticity between neurons
- Glial cells can influence both the pre-synaptic neuron and the post-synaptic neurone.
- Astrocytes, Oligodendrocytes and microglia have all been shown to regulate synaptic function



# Glial cells influence on chronic pain

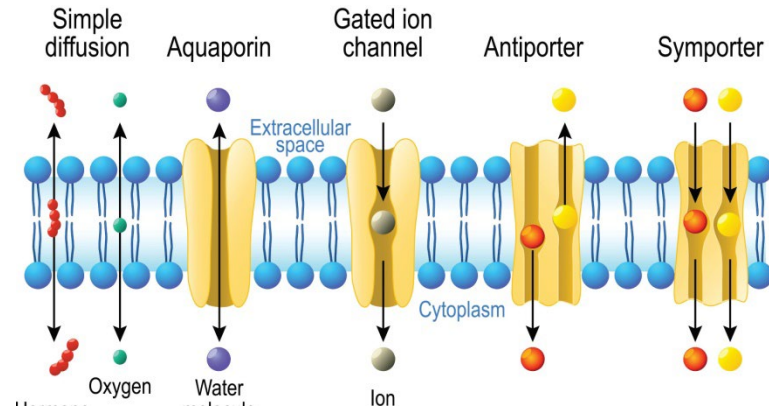
- Glial cells are responsive to neurotransmitters in pain circuits and produce, secrete, and regulate modulators that activate and sensitize nociceptors
- Astrocytes, Enterocytes, Oligodendrocytes, Schwann cells, Microglia, Satellite glial cells have all been implicated



# Glial cells and Homeostasis

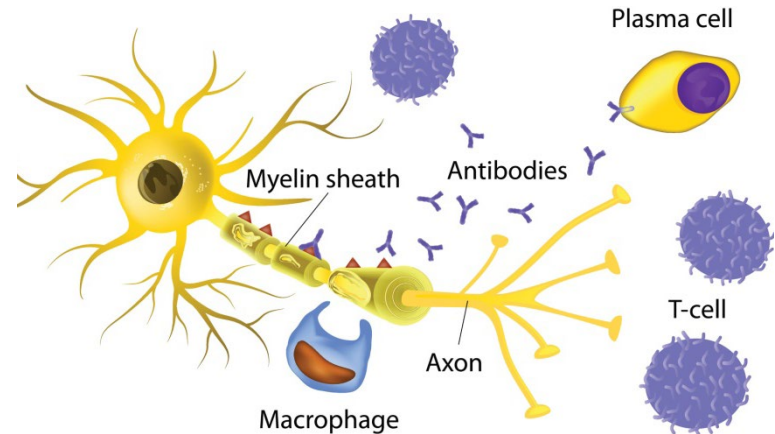
- Central chemosensory homeostatic functions
- Monitor oxygen, carbon dioxide and Ph in the brain
- Alter neuronal excitability, autonomic nerve function and adaptive bodily responses

## Membrane transporters



# Glial reaction to injury

- Astrocytes multiply, enlarge and become fibrous
- Oligodendrocytes expand and can lead to demyelination
- Microglia cells proliferate, become actively phagocytic, become antigen-presenting cells







# Thank You

DR. HEIDI HAAVIK

ENLIGHTENING THE  
WORLD ABOUT THE  
SCIENCE OF CHIROPRACTIC





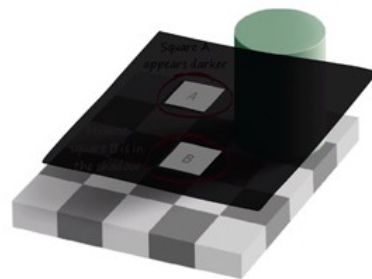
# Introduction to Chiropractic Care

The introduction to chiropractic video series is the perfect way to gain an understanding of why chiropractic care may help you and your family.



## The Beginners Guide to Chiropractic

In this first introductory video we explore what chiropractic is all about, and how it works, then we briefly explore the evidence informed effects of chiropractic care.

[View video >](#)

## How the Brain Perceives the World

Did you know that your brain and central nervous system are constantly changing? It's quite amazing – from one day to the next your brain is not the same.

[View video >](#)

# The Beginners Guide to Chiropractic

## The Beginners Guide to Chiropractic

The word chiropractic derives from the Greek words "cheir", meaning hand, and "praktikos" meaning skilled in or concerned with. The origin of the word chiropractic can be traced back to [D.D. Palmer](#) who coined it in 1895 when he founded chiropractic.

Chiropractic care is really about total health and wellbeing

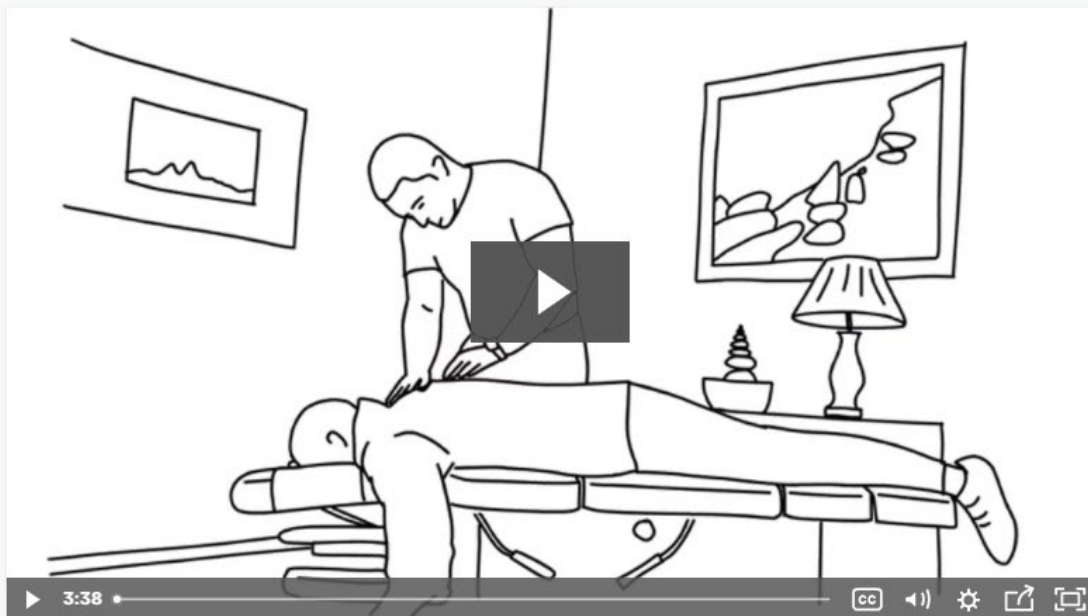
### What does a Chiropractor do?

A chiropractor is a healthcare professional who specializes in the health and [function of the spine](#) and nervous system. Because of this focus on the spine, many people think chiropractors can only help with problems such as back pain, [neck pain](#) and [headaches](#). They can often help with these issues but there is much more to chiropractic than just pain.

This is the first video in our animated series "Introduction to Chiropractic". In this video, we outline what a chiropractor does, then we briefly explore the effects of care. It is a perfect one to watch for anyone that is curious about chiropractic care, and how it can help their family.

### Video References

1. Rosner AL. Chiropractic Identity: A Neurological, Professional, and Political Assessment. *J Chiropr Humanit* 2016;23(1):35-45.
2. de Souza R, Ebrall P. Understanding wellness in a contemporary context of chiropractic practice. *Chiropr J Aust* 2008;38(1):12-16.
3. Schuster TL, Dobson M, Jauregui M, et al. Wellness lifestyles II: Modeling the dynamic of wellness, health lifestyle practices, and Network Spinal Analysis. *J Altern Complement Med* 2004;10(2):357-67.
4. Henderson CN. The basis for spinal manipulation: Chiropractic perspective of indications and theory. *J Electromyogr Kinesiol* 2012.
5. Haavik H, Murphy B. The role of spinal manipulation in addressing disordered sensorimotor integration and altered motor control. *J Electromyogr Kinesiol* 2012;22(5):760-76.
6. Haavik Taylor H, Holt K, Murphy B. Exploring the neuromodulatory effects of the vertebral subluxation and chiropractic care. *Chiropr J Aust* 2010;40(1):37-44.
7. Herzog W, Zhang YT, Conway PJ, et al. Cavitation sounds during spinal manipulative treatments. *Journal of Manipulative & Physiological Therapeutics* 1993;16(8):523-6.

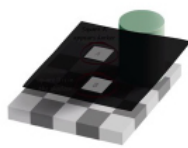




### The Beginners Guide to Chiropractic

In this first introductory video we explore what chiropractic is all about, and how it works, then we briefly explore the evidence informed effects of chiropractic care.

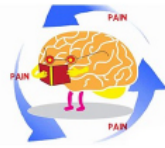
[View video](#)



### How the Brain Perceives the World

Did you know that your brain and central nervous system are constantly changing? It's quite amazing – from one day to the next your brain is not the same.

[View video](#)



### Break the Pain Cycle

Did you know that pain is created in your brain to let you know that something is not ok within your body? Feeling pain is good because it is actually helpful and informative.

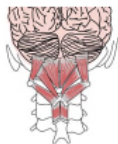
[View video](#)



### Chiropractic Care and Migraines

Did you know that 1 in 6 people in the world experience migraines regularly? The World Health Organisation consider them to be the most debilitating of all neurological disorders.

[View video](#)



### Chiropractic Affects your Brain

Your brain receives information about your body from the environment and your organs. Did you know that the muscles in your body are also sensory organs?

[View video](#)



### What is that Pop?

If you have been adjusted before by a chiropractor you may have noticed a strange popping sound. Don't worry – it is just the formation of gas within a joint.

[View video](#)



### Lower Back Pain

Scientists have worked out that at any one time, over 500,000,000 people around the world are suffering from low back pain and it is now the leading cause of disability worldwide.

[View video](#)



### Growing Pains

We've all heard of growing pains right? But did you know that what we call growing pains aren't associated with growing? So they're not actually growing pains at all.

[View video](#)



### Pain and the Immune System

Research studies have shown that the way you feel pain all depends on what's going on for you – and most importantly – what you think and feel about the situation.

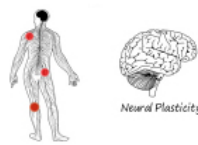
[View video](#)



### Chiropractic and Headaches

Headaches are a sign that something is not right. Your brain will create for you the sensation of pain if it thinks there is something wrong or if there is a potential problem.

[View video](#)



### Pain is Created in Your Brain

Did you know that the scientists now know that the feeling of pain is something your brain decides that you should experience – if it believes that there is a problem?

[View video](#)



### Chronic Pain

Chronic pain is the second-most common reason people see a doctor and miss work. More than one-third of people with chronic pain become disabled by their pain to some degree.

[View video](#)


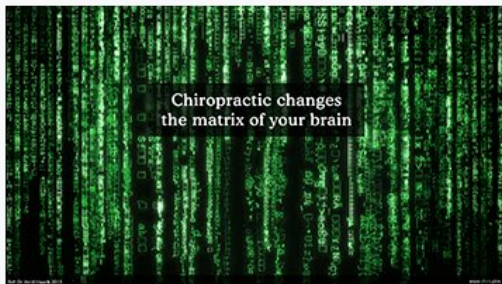



## Print & Digital Assets

High-resolution images, A4 print brochures and A3 sized posters for you to download and share.






To download the digital assets, simply click on the corresponding button below the image.



1.

 Screensaver Image Facebook Instagram A4 Print A3 Poster

2.

 Screensaver Image Facebook Instagram A4 Print A3 Poster

3.

 Screensaver Image Facebook Instagram A4 Print A3 Poster

## Trykte og digitale ressurser

Bilder med høy oppløsning, A4-trykte brosjyrer og plakater i A3-størrelse som du kan laste ned og dele.

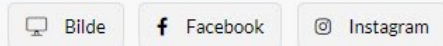


For å laste ned de digitale eiendelene, klikker du bare på den aktuelle knappen under bildet.

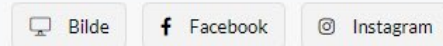
1.



2.



3.





# Chiropractic Research

Research summary articles to read, download and print (members only) all backed by the latest scientific research studies.



## Chronic Pain

Chronic pain that has persisted for more than 3 months is no longer protective, nor informative. So, what is chronic pain and what can you do about it?

[Read more »](#)

## Pain is in the Brain

Sometimes pain persists long after tissue damage has actually healed. When pain persists for more than three months we call this chronic pain.

[Read more »](#)

## Neck Pain

Up to half the world's population suffers from neck pain at some stage. For some, one big problem is that it just keeps coming back, or becomes chronic.

[Read more »](#)



# UNDERSTANDING PAIN

Dr. Kelly Holt

BSc, BSc(Chiro), PGDipHSc, PhD

Dr. Heidi Haavik

BSc(Physiol), BSc(Chiro) PhD



Experiencing pain is normal. Everyone experiences pain now and then.<sup>1</sup> Pain is supposed to be protective to make you stop doing things that may be dangerous.<sup>2</sup> But chronic pain that has persisted for more than 3 months is no longer protective, nor is it helpful.<sup>3</sup> So, what is chronic pain and how can you deal with it if you suffer from it?

## PAIN IS CREATED IN THE BRAIN

Dr. Kelly Holt

BSc, BSc(Chiro), PGDipHSc, PhD

Dr. Heidi Haavik

BSc(Physiol), BSc(Chiro) PhD



Did you know that scientists now know the feeling of pain is something your brain decides you should experience if it believes there is some tissue damage in your body?<sup>1</sup> In fact, your brain can decide that you should feel pain even if it only thinks there is a potential threat of tissue damage!!!!<sup>2-5</sup>

It may seem strange, but it's totally up to your brain to decide whether you should feel pain or not. Your brain may decide you should experience pain even if you have no actual tissue damage yet,<sup>6</sup> or your brain may not create the feeling of pain for you when tissue damage has actually occurred!<sup>7,8</sup>

heals the problem.<sup>1</sup> This pain is helpful and informative.<sup>1</sup> If we listen to our body these pain experiences can be a good thing.

But for some people, pain can persist even after the initial injury that caused it has healed.<sup>9,11,12</sup> And for some people, the pain in these areas that are not injured at all become non-



brain  
anger  
that  
sue  
are  
ll,



types of pain is the  
100% of the time,  
not mean it's not  
itself is created in  
you can get rid of  
on what you thi  
important you u

Your pain exp  
as decided y  
reating the  
ce.<sup>5</sup> It can

## NECK PAIN AND FALLS RISK

Dr. Kelly Holt

BSc, BSc(Chiro), PGDipHSc, PhD

Dr. Heidi Haavik

BSc(Physiol), BSc(Chiro) PhD

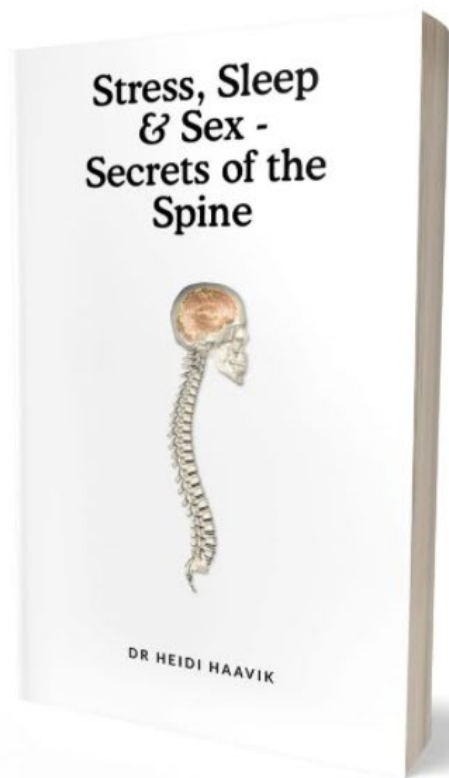


Neck pain is very common throughout the world.<sup>1</sup> Up to half of all people around the world suffer from neck pain at some stage each year.<sup>2-5</sup> For some people, one big problem with neck pain is that it just keeps coming back, or becomes chronic, and may even increase their risk of suffering from a fall.<sup>2,4,6,7</sup>

Scientists know that your brain uses sensory information from your muscles and joints around your spine to help control your balance and posture and to make sure you're moving properly.<sup>1,2</sup> When your brain takes sensory information and uses it to help guide movements and control muscles we call this sensorimotor function.<sup>8</sup> One particular study looked at whether neck pain has an impact on proper sensorimotor function in older people.<sup>3</sup> In this study, the researchers ran a whole lot of tests of sensorimotor function, like how well the study participants controlled the movement of their eyes and how good their balance was, and they took into account their age and other conditions that they suffered from.







## Get notified when this book is published!

Notify me when Dr Haavik's new book is published. Simply enter your details in the form below:

\* indicates required

Email Address \*

First Name

Last Name

Notify Me

# www.secretsofthespine.com