

College Guild

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Health and Disease

Unit 3 of 5

The Nervous System

The only system arguably more important than the **circulatory system** is the **nervous system**. Composed of the brain, spinal cord, and all the body's nerves, it not only controls everything we do, but regulates many of our bodily functions. For example, it is the nervous system that regulates our heart rate — so it is impossible to become tachycardic (remember what this means?) without the nervous system. The nervous system is divided into two parts: The **central nervous system (CNS)**, containing the brain and spinal cord, and the **peripheral nervous system (PNS)**, consisting of all other nerves in the body, which send signals to the **CNS**. Over 40% of all humans on Earth have a neurological condition. This course will break that number down and explore some interventions that can prevent such issues.

DISCLAIMER: Under many prison regulations and restrictions, inmates are *not* allowed to provide medical care under the direction of organizations or educational resources such as College Guild. This curriculum therefore serves as a purely educational resource to those interested in learning (a) more about their health and (b) some of the interventions that medical professionals use, NOT as instructions to provide that medical care or directions to make treatment decisions.

Glossary of Terms

1. **Circulatory System** (also **Cardiovascular System**): The network (including the heart, blood, and blood vessels) that transports oxygen and nutrients to the body.
2. The **Nervous System**: The complex network of nerves and structures that control the body's functions.
 - a. **Central Nervous System (CNS)**: The brain and spinal cord. It controls most of the body's functions.
 - b. **Peripheral Nervous System (PNS)**: All the nerves in the body that branch out from the CNS. It relays information from the body to the brain.
3. **Neurons**: The cells that make up the nervous system. They receive and send information through electrical and chemical signals (like the release of dopamine).
4. **Blood vessels**: The tubular structures that transport blood. **Arteries** carry oxygenated blood away from the heart, while **veins** carry deoxygenated blood (containing carbon dioxide) to the lungs and heart.
5. **TBI (traumatic brain injury)**: Brain injury from an external impact or force, ranging from mild to severe.
6. **Concussion**: A type of **traumatic brain injury** that is caused from a blow or jarring (e.g., whiplash) to the head.
7. **Risk factor**: Factors or habits that increase the likelihood of developing a disease or other health problem.

Neurological Diseases

8. **Stroke**: When oxygen and other nutrients can't reach parts of the brain due to a blockage or brain bleed. It will likely permanently damage the brain.
9. **Multiple sclerosis (MS)**: When the body's own immune system injures parts of neurons, leading to fatigue and other problems.
10. **Dementia**: Progressive deterioration of brain structures that can result in severe deficits in functioning.
11. **Alzheimer's disease**: A form of **dementia**; characterized by severe memory loss and cognitive decline.

12. Parkinson's disease: Deterioration of neurons; associated with tremors and loss of motor functions.

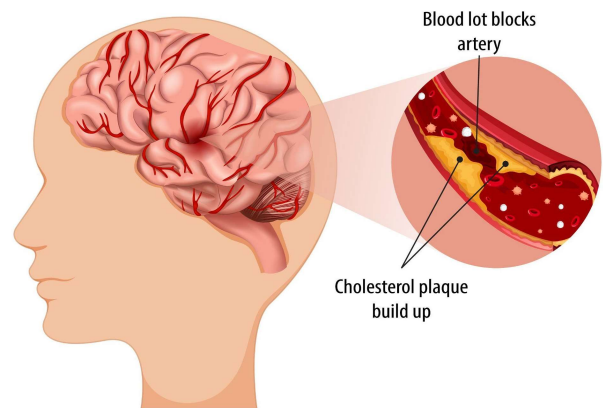
13. Amyotrophic Lateral Sclerosis (ALS): Deterioration of motor neurons. The subject of 2014's "ALS Ice Bucket Challenge."

Part One: Functioning and Diseases of the Nervous System

When we first think of the **nervous system** we think of the brain, but it also contains the spinal cord and all the nerves in your body, all interconnected into one, large, complex network. The cells of your **nervous system**, called **neurons**, send electrical and chemical signals to the brain and the body that control our *involuntary* bodily functions like our heart rate or even sneezing — and our conscious, *voluntary* functions like moving our bodies.

1. **Think about your breathing. Most of the time, you breathe without thinking about it — but now *you* are controlling it voluntarily! How does it make you feel that your brain is in "control", much of the time? Can you think of any other bodily functions that can be both voluntary and involuntary?**

While the brain is only about 2% of our body, it requires nearly 20% of all the oxygen we breathe in. This means that the nervous system and the **cardiovascular system** you learned about in the last unit rely on each other. If the brain doesn't receive the oxygen (carried by blood) it needs, irreversible damage can be done. This event is called **stroke**, and is the second leading cause of death in the world.¹ Strokes usually happen when a blood clot or plaque blocks an **artery** (see right) leading to part of your brain, resulting in the death of **neurons**. They can also occur if a weak blood vessel in the brain ruptures, although this is more rare.



Designed by Freepik¹²

2. **Try to remember what you learned about plaque buildup and its relationship to the heart in unit #1. Name ways in which strokes and heart attacks are similar.**
3. **Similarly, because heart disease and stroke share causes, they also share risk factors. Consider what a risk factor is and brainstorm a way you might be able to lower your risk of stroke.**

Act F.A.S.T.: Recognizing the Signs of Stroke²

If someone is having a stroke, they need to get to a healthcare facility as soon as possible. Therefore, the 'F.A.S.T.' acronym is used to quickly assess if someone might be having a stroke.

F - Face: Is one side of their face drooping?

A - Arms: If you raise both of their arms up (like a zombie), does one drift downward?

S - Speech: Is their speech slurred, incomprehensible, or garbled?

T - Time: Get help immediately if you recognize any of these signs.

4. **Strokes often happen in one hemisphere of the brain. Knowing this, if face drooping on one side of the face is a sign of stroke, what does this tell us about how the brain controls our muscles?**
5. **Imagine that you believe your cellmate is having a stroke. Do you know who you would call to get them medical attention as quickly as possible?**

Since **neurons** are the units of the brain and nervous system that facilitate nearly everything we do, diseases that degrade neurons, like **multiple sclerosis (MS)** or **Alzheimer's disease**, are extremely dangerous and often fatal. Some diseases only target certain types of neurons: **Parkinson's disease** is caused by the deterioration of neurons that produce dopamine, and **Amyotrophic Lateral Sclerosis (ALS)** is caused by the deterioration of motor neurons — which is why progressive muscle weakness is a symptom of the disease. **ALS** became well known through the 2014 "**ALS Ice Bucket Challenge**": participants were challenged to dump a bucket of ice water over their heads, donate to **ALS** research (and then challenge their friends to do the same). \$115 million was raised in six weeks!³

6. **Why do you think the "ALS Ice Bucket Challenge" was so effective at raising awareness of the disease and fundraising for research?**

Since the nervous system is so interconnected and necessary for our emotional, behavioral, and physical functioning, neurological diseases can be painful and frustrating for the people *around* the victim. You may know someone with **Alzheimer's disease**, a type of **dementia** often associated with aging. It is a progressive disease, meaning it starts with symptoms like difficulty concentrating, but will lead to the inability to hold a conversation and understand the world.

Understanding how to treat someone with dementia is important for everyone's sake:

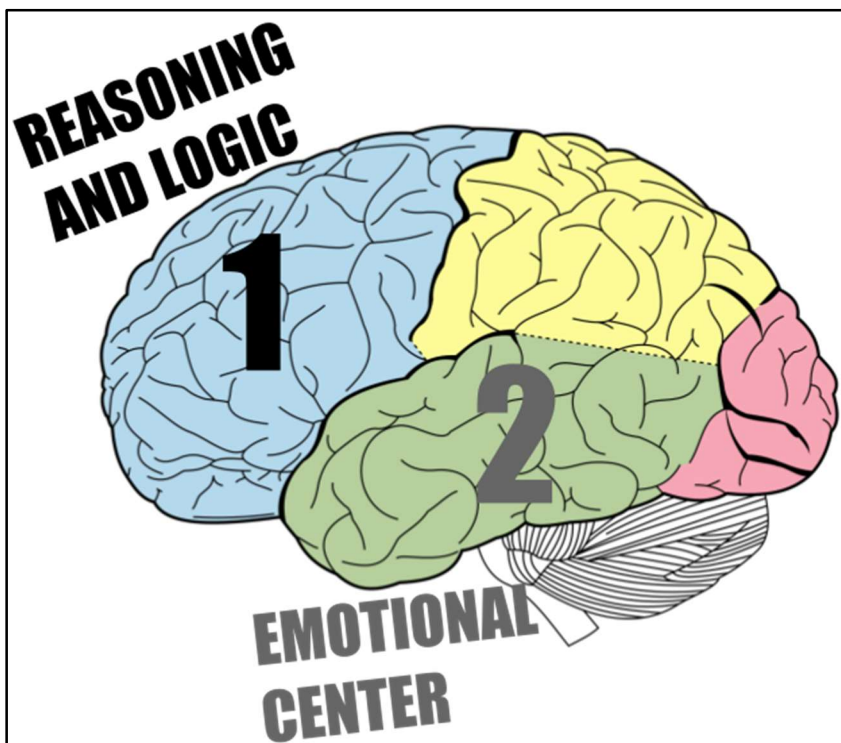
- First and foremost: be gentle, compassionate, and patient. Use simple language.
- For someone who is confused or out of touch with reality, it is always better to focus on relieving distress or redirecting a situation rather than trying to convince them they are having a delusion.
 - You can *acknowledge* their feelings without needing to *agree* with their delusion, such as: "I can see that you're feeling scared. I'm here for you, and I'll make sure you're safe."
- If they are distressed, you can redirect their attention to a familiar or favorite activity.
- Encourage their independence. Give them a sense of control by giving them choices, instead of doing everything for them.

7. Think about a time that you woke up in a confused state — maybe you were sleepwalking and temporarily out of touch with reality. How would you like a friend or loved one to handle the situation causing you the least distress? If you've never experienced this, how might you handle it for a friend/loved one experiencing this confusion?
8. Imagine a loved one with dementia has exclaimed that there is a stranger in the house, when in actuality it is just really their own reflection in the mirror that they can no longer recognize. Following the above principles, how could you respond to them compassionately?

How The Brain-Mind Connection Works: Dreaming

When you enter into a stage of sleep called REM, a part of your brain called the Thalamus sends random signals to your cortex (shown below); the

interpretation of these signals is what creates dreams. However, some areas of the brain, including the prefrontal cortex (1) — the center for logic, reasoning, and cognitive control — are not active. In other words, when you dream, your logical centers (1) are shut off, leaving your emotional processing centers (2) dominant.⁴



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9. Briefly recount the craziest dream you can remember having. What part of the brain do you think was (and was not) active during this time?

10. There are many different theories of why dreaming is an important process. Many scientists think it is important for forming memories. Hypothesize another reason. If you're stuck, think about why nightmares might be helpful for

Part Two: TBIs and Brain Injury

It seems surprising that 40% of humans will have a neurological disorder — but over *half* of all people on Earth will experience some sort of **traumatic brain injury**, or **TBI**. Most simply, a **TBI** is a head injury usually caused by an external force that causes a disruption in brain function. You may or may not be surprised to find out that **concussions** are actually considered TBIs, and can have great consequences. For example, while the headache and dizziness you experience after hitting your head might be bearable and easy to brush off, it's a sign that your **neurons** have been stretched and damaged. **Concussions**, of course, are very common — it's more likely than not that you have had a

concussion yourself. This information is not meant to scare you, but educate you — and give you the best tools to recover from one.

11. Did you ever consider a concussion to be a “brain injury” before taking this course? Do you feel like you know enough about concussions to be able to recognize if one happened to you?

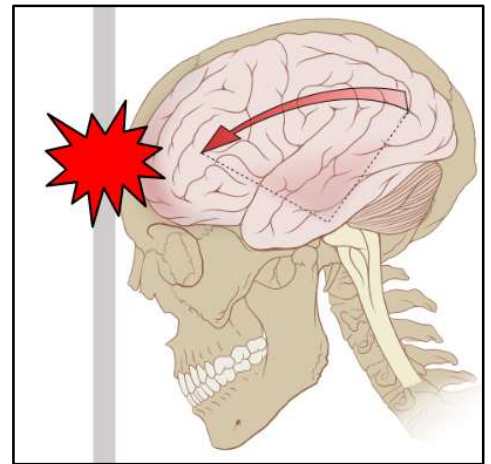
The most dangerous part about having a concussion is the recovery process — getting a second concussion before you’ve recovered from the first is what can lead to severe brain damage. This fact makes certain activities, such as high-impact sports like tackle football, quite dangerous. This fact also means that children and adolescents are at great risk to experience **TBIs**, as many choose to play sports with high incidences of concussion, such as tackle football or rugby.

In the U.S., roughly 90% of non-fatal football-related TBIs resulting in an emergency room visit are by adolescents under 18⁵. The CDC estimates that up to 3.8 million sports-related TBIs occur every year — with many of them going undiagnosed.⁶

12. Can you think of other scenarios where people would be likely to obtain multiple concussions in a short period of time? You can write a short story about this, if you want.

13. Would you allow your (hypothetical) child to play a sport like football or rugby, taking the risk that they will likely experience a TBI?

14. One of the greatest risks of brain damage is not knowing that you or your child has suffered a concussion and not taking the proper steps to recover. What would you tell or suggest to a football coach to educate them about the dangers of concussions?



Via Wikimedia Commons¹¹

Signs of a Concussion⁷

You should see a healthcare professional if you suspect one. Some symptoms are:

- Headache or head “pressure”
- Dizziness or nausea
- Sensitivities to noise and light
- Confusion or mood changes (e.g., anxiety)

Recovering from One⁸

Always follow your medical provider’s directions first.

- Limit activities for the first 48 hours
 - Get physical *and* mental rest.
- Get plenty of rest, but don’t *only* lie in a quiet dark room. You’ll want *some* mental stimulation — just try not to multitask.

TBI, Homelessness, and the Prison System

It has long been known that a homeless person is statistically more likely to have a **TBI** than a member of the general population. In 2022, Stephanie Chassman interviewed 115 unhoused individuals to understand *why* this was: does getting a TBI increase your risk of homelessness less? Or does homelessness lead to factors that increase chances of getting a TBI?⁹

Of the unhoused population with **TBIs** (which is over 70%!), Chassman found that 74% had experienced a **TBI** *before* they became homeless.⁹ This suggests that TBI is likely a **risk factor** of homelessness. TBI can cause or lead to emotional and physical challenges (such as the fact that difficulty with emotional regulation can lead to conflicts), as well

as other life difficulties (such as the fact that those with TBI may find it harder to stay employed).

15. Notice that 26% of these individuals, while still a minority, experienced TBIs after becoming homeless. These results suggest that the relationship between homelessness and TBI is a bi-directional relationship. What does this mean?

TBI is considered to be a **risk factor** for homelessness — but it's also a **risk factor** of becoming incarcerated. One study estimated that individuals who have sustained a TBI are 2.5 times more likely to go to prison than individuals without a TBI!¹⁰

16. With what you now know about TBI, why might an interaction with law enforcement be more likely to result in an arrest for individuals with a severe TBI compared to individuals without one?

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