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Health and Disease

Unit 4 of 5

The Peripheral Nervous System from Mind to Gut

In the last unit we examined the **central nervous system**, some of its diseases, and **traumatic brain injury** (**TBI**). However, the discussion wouldn't be complete without discussing *the mind*. It's important to reflect that all mental states (including emotions like anger, states like depression, or actions like searching for a memory) are not just "in your head" — there's a complex network of brain cells called **neurons** that communicate with our bodies to make us feel all the ways we do. In other words, your feelings correspond with your brain — and your brain corresponds with your body. In understanding this brain-body connection, this unit will discuss the *other* part of the nervous system, the **peripheral nervous system**, giving you the tools to recognize and manage a common crisis of the mind: a **panic attack**. It will also discuss the gut — something that we don't often associate with our brains, but actually have a lot more in common with our mental health than you might think.

Glossary of Terms

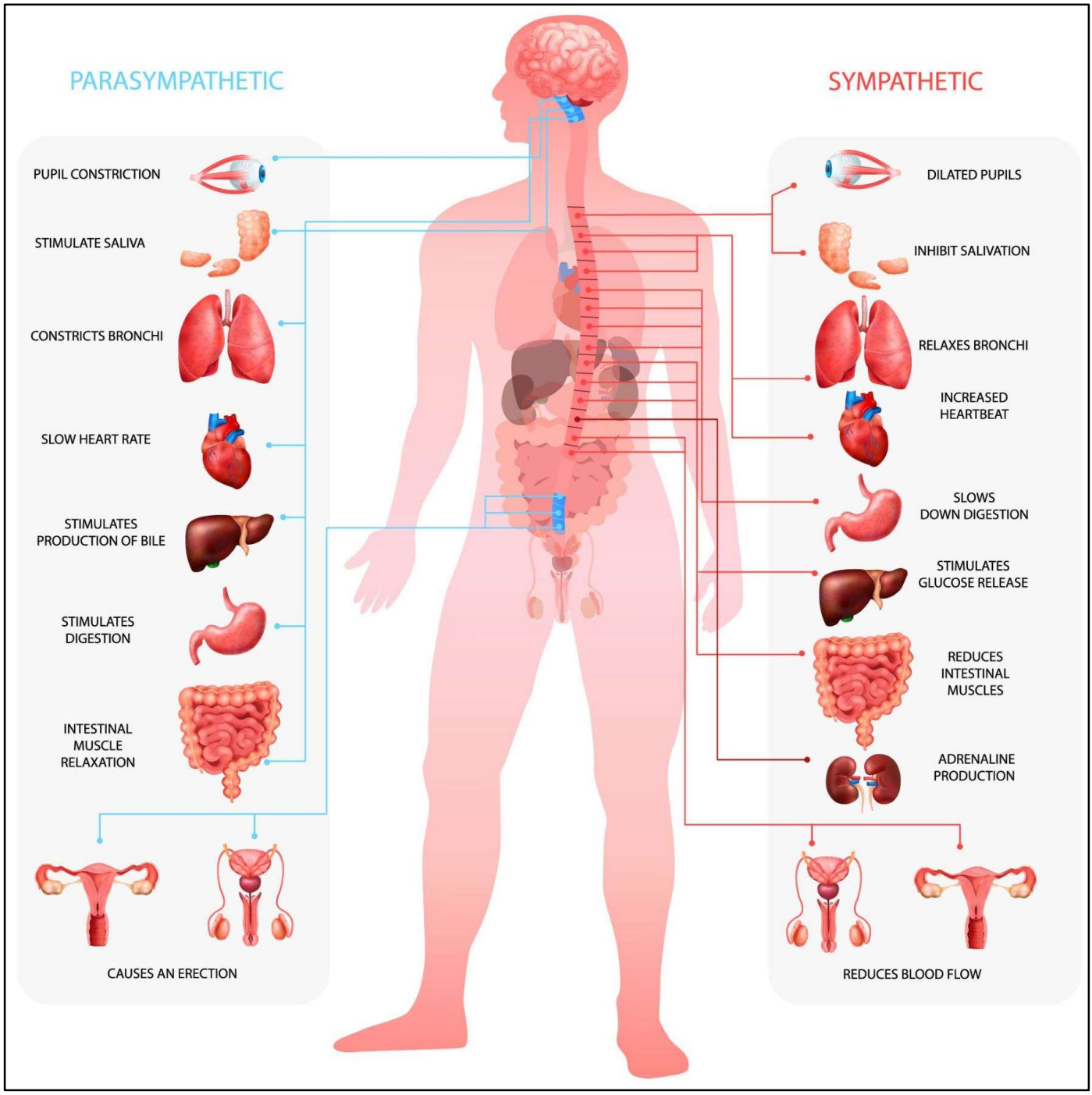
1. **Anxiety**: Dread, fear, or uneasiness. A natural reaction to stress. Excessive amounts may be a sign of a mental illness.
2. **Panic attack** (**anxiety attack**): An onset of intense anxiety that happens when your nervous system reacts as if there's danger present, even if it's not.
3. **Post-traumatic stress disorder** (**PTSD**): A mental condition that develops after exposure to a traumatic event.
4. **Mindfulness**: The intrinsic ability to focus non-judgmentally on the present moment or activity.
5. The **gut** (or **gastrointestinal system**): The collection of organs that work together to digest food.
6. **Irritable bowel syndrome** (**IBS**): Recurring gut pain, cramping, bloating that is associated with mental health.
7. **Appendicitis**: The inflammation of the appendix, a tube-shaped organ in the gut. Requires surgery.
8. **Lactose**: A type of milk sugar found in most dairy products.
    a. **Lactose intolerance**: The natural inability to digest lactose without discomfort.
    b. **Lactose persistence**: The evolved ability to digest lactose. Prevalent in northern Europe.

Organization of the nervous system as discussed in this unit *(Other related systems are not listed for simplicity's sake)*

1. **Central nervous system** (**CNS**): Brain and spinal cord. Responsible for most processing and control (*Unit #3*)
2. **Peripheral nervous system** (**PNS**): All the nerves that send information to the CNS and includes the:
    a. **Autonomic nervous system** (see next page): regulates many involuntary processes through the:
        I. **Sympathetic nervous system**: Activates when the body detects a stressful situation.
            i. **Fight-or-flight response**: The survival mechanism that helps humans/animals respond to stressful or dangerous systems quickly.

II. **Parasympathetic nervous system**: Helps the body relax when a threat is not perceived.

Some of the functions of the Autonomic Nervous System, visualized:



Part One: From Physiology to Mind

The "inside world" of being a human is complicated: we're tasked with understanding emotions, others' perceptions of us, and our own identities — all things so complex that it's hard to pinpoint *exactly* how they work. However, it is a common misbelief that the mind and body are separate from each other. In fact, most mental processes also affect the body. Take **anxiety**, for example.

1. **While only some people experience anxiety disorders, everyone experiences *some* anxiety. Think of a time you experienced anxiety — can you describe how your body felt during the time?**

Anxiety is the feeling of fear or uneasiness in a situation, and is a natural reaction to stress. However, having **anxiety** is often misrepresented as "being weak" or something that people can just "get over." And while it can be debilitating to some individuals, **anxiety** in moderation is actually a very important natural process that everyone experiences.

2. **Why do you think anxiety might be useful for humans (or other species)?**

3. **Mental illnesses are often stigmatized, but people who have anxiety don't have a "weak mind." Why might these misrepresentations be untrue and harmful to our collective understanding of mental illnesses and mutual respect?**

An example of excessive **anxiety** is a **panic attack** (or "**anxiety attack**"), one of the most common crises of the mind. They can happen to anybody (about ⅓ of people will have one), often unexpectedly — a reason why it's especially scary for someone who doesn't know what's going on. Therefore, it is especially important to know how to recognize one. **Panic attacks** happen when your body's "fight-or-flight" response is triggered. You may experience an increase in breathing, heart rate, tingling sensations, blurred vision, or even a sense of losing control. Not to fear — **panic attacks** are not physically damaging to your body, but knowing how to end one will certainly relieve discomfort.

4. **Draw a representation of a panic attack. Be creative!**

5. **Panic attacks happen when there's (usually) no danger present, but your brain reacts as if there is. Why might these physical symptoms (eg., increase in breathing and heart rate) be important if there *was* danger?** *Thinking back to unit one (about the heart) might be helpful.*

One of the best things you can do for someone having a panic attack is help them take slower, deeper breaths instead of rapid shallow ones. While "taking a breath" can potentially be an annoying response or a jab at someone getting angry or overwhelmed, it exists for a reason: breathing deeply provokes a direct physiological response within the body.

Via Wikimedia/FrozenMan[8]

Why Do Panic Attacks Happen?

The system that controls your **fight-or-flight response** is called your **autonomic nervous system**, a component of your **peripheral nervous system** that includes *these* two parts:

1. The **sympathetic nervous system** activates when your brain senses a threat, causing an increase in blood pressure, heart rate, and respiratory rate. Associated with "fight-or-flight" responses.
2. The **para**sympathetic nervous system helps the body relax, working oppositely to the sympathetic nervous system. Associated with "rest-and-digest" responses.

When you breathe deeply, you are activating the **parasympathetic nervous system**, counteracting the **fight-or-flight** response of the **sympathetic nervous system.** This causes your heart rate to slow down, lowering your blood pressure, and reducing the stress-causing hormones in your body like cortisol, having a calming effect.

6. **There's a lot of vocabulary here, but it's important to understand that there are two systems that work together to balance our bodily responses to processes like anxiety, rest, and sexual arousal. Name a situation where your sympathetic nervous system would be active, and a situation when our parasympathetic nervous system would be active.**

7. **Insomnia, or the inability to sleep, can be caused by imbalances between these systems. Why do you think that is?**

8. **Imagine that you recognize a friend is having a panic attack. How would you guide them through this?** Think how you can be gentle and compassionate with them. For example, telling them: "You're having a panic attack!" might not be the best first action…

Many other conditions and illnesses are also involved with the **peripheral nervous system**, such as **post-traumatic stress disorder**, or **PTSD**. **PTSD** can happen after someone experiences or witness a traumatic event — usually actual or threatened death, serious injury, or sexual violence. Individuals with PTSD may become sensitized or ultra-aware of events or stimuli related to their trauma. For example, a soldier traumatized by war might experience distress (maybe a **panic attack**) when they hear fireworks, which sounds similar to gunfire.

9. **Imagine an individual has PTSD resulting from being traumatized by a car crash. What could act as a "trigger" for this individual?**

10. **PTSD may often appear to the onlooker as someone "overreacting." How might knowing about the automatic functions of the nervous system provide insight about these behaviors?**

Understanding such things *about* conditions like **PTSD** — such as that one's unusual sensitivity to loud sounds is explainable, or that you know how to recognize a **panic attack** — can be really important first steps in treatment. The next step would be seeking treatment from a medical professional who knows a lot about the condition.

11. **While some medication can be used to treat mental conditions such as PTSD, talk therapy is often the first intervention. Why might the act of talking be so useful for someone with a mental illness?**

12. **What would you say to someone who believes that getting help from a therapist, "shrink", or medical provider is "weak"?**

This doesn't mean you should try to provide therapy without proper training, but it does mean that your compassion, patience, kindness, and trust is incredibly valuable for those with mental illness. However, a practice that anyone can do is **mindfulness**, a rapidly growing promising treatment for mental illnesses from PTSD to depression to eating disorders. It is so successful for so many populations because **mindfulness** can be thought of as an intuitive ability, rather than a treatment. Jon Kabat-Zinn, an early advocate, describes **mindfulness** as the "awareness that emerges through paying attention on purpose, in the present moment, and nonjudgmentally to the unfolding of experience moment by moment"[1].

Read this quote from Vietnamese Buddhist monk Thích Nhất Hạnh:

"The present moment is filled with joy and happiness. If you are attentive, you will see it"

13. Whether you're familiar with mindfulness or not, how does this quote characterize the practice? What does mindfulness value?

A mindful practice can be as simple as paying awareness to your thoughts, and being nonjudgmental and noncritical to whatever they might be. There are also various traditions that incorporate the principles of mindfulness, such as yoga, meditation, Kyūdō — a "contemplative archery" practice from Japan, or mindful eating. They all incorporate a "slowing down" to focus on your physical (sensual) and emotional experiences during the practices..

14. How can something such as archery or eating be turned into a mindful practice? Can you name another activity that can incorporate mindfulness?

We don't have enough time to lead you through your first mindfulness exercise, but many organizations have made that their mission, and will send you resources about mindfulness *for free*. Learn more at the end of this unit in the "More Resources" section.

Because the mind and body are so interconnected, mindfulness has a positive impact on your body. For example, reducing stress with mindfulness can lower blood pressure. This fact alone means that practicing mindfulness is actively reducing your risk of heart disease or stroke. There may be more resources available on mindfulness through your prison chapel, online, or by mail.

Part Two: From Mind to Gut

The connection between the mind and body extends beyond our stress, breathing, and circulatory system. In fact, many people don't realize how connected the **gut** (or **gastrointestinal system**) and brain actually are. You may have heard of the neurotransmitter serotonin, heavily involved in regulating your mood — but did you know that 95% of your body's serotonin is produced in the gut?[2]

15. Just as you can feel emotions (like anxiety) in your heart, you can also "feel" some emotions in your gut! Name a feeling or emotion you've experienced in your gut — what did it feel like?

The gut-brain connection extends beyond emotional experiences. Studies have shown that people with **irritable bowel syndrome** (**IBS**) are much more likely to *also* have a mental illness like anxiety or depression. Recent research suggests that this correlation is bi-directional, meaning that mental illness can cause GI issues — but GI issues can also cause mental illnesses.

16. Imagine someone is struggling with gastrointestinal issues *and* anxiety. If they've only tried medications that focus on the gut, what other interventions would you suggest they try? *(Including the ones we've discussed).*

17. Hypothesize why someone who is suffering from both gut issues *and* anxiety might experience more stomach pain.

There are of course some gut emergencies that don't have as strong a tie to the brain. One of the most common emergencies of the gut is **appendicitis** — when the appendix (a small organ attached to your intestines) becomes diseased and swollen.[3] It is a medical emergency; you must seek out medical help if you believe you have it, as it requires surgery to remove the appendix. The most common sign of **appendicitis** is an intense pain in your lower right belly, potentially accompanied with loss of appetite, nausea, and vomiting.

What Causes Lactose Intolerance?

It is safe to say that you or someone you know is **lactose intolerant**, meaning that their **gut** cannot digest **lactose**, a type of "milk sugar" found in most dairy products. However, did you know that nearly 65% of the world population is **lactose intolerant**?[4] This number might seem high to you — and that's because the prevalence is *much* lower in the United States. Interestingly, one might notice that **lactose intolerance** *seems* to differ by ethnicity: individuals with African or Asian descent are much more likely to be **lactose** intolerant than those with European descent.

Percent Of Population With Lactose Intolerance
Via Wikimedia Commons[5]

This causes the impression that one's race determines their tolerance of **lactose**. However, this isn't the case at all. Study the map — do you notice any trends between lactose intolerance rates and the climate?

As experts have discovered, the story of dairy consumption isn't one of race, but one of geography.
In fact, just 5,000 years ago, *everybody* was **lactose intolerant**![6] The ability to digest lactose, called **lactose persistence**, actually evolved via a random mutation. In cultures where dairy consumption was important in ancient societies — such as in northern Europe — this mutation persisted, further driving the culture of milk consumption.

Professor Davey Smith of the University College London explains that the prevalence of **lactase persistence** is stronger when there are indications of more famine and more pathogens. In other words, we can hypothesize that the ancient Europeans were forced to drink cow milk during times of famine. Because the colder climates of the North contributed to better storage of milk, it slowly became a part of their culture.

18. **Hypothesize why ancient northern European peoples might have experienced famine for different reasons than peoples in Southern Africa might have.** Hint: Think about the climate!

19. **Why could it potentially be damaging to understand lactose merely on the basis of race, instead of understanding its long relationship to geography and the climate?**

In almost all cases, lactose intolerance is not life-threatening. However, it may cause stomach pain, cramps, nausea, bloating, gas, or diarrhea. If you suspect you might have developed lactose intolerance (which can happen, even later in life), you can try cutting dairy out of your diet to see if the bad symptoms subside. You can always reach out to a health profession, as well.

References

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4. StatPearls Publishing (2023). https://www.ncbi.nlm.nih.gov/books/NBK532285/#:~:text=On%20average%2C%2065%25%20of%20the,to%20date
5. *IMAGE*: Wikimedia Commons/NmiPortal (https://commons.wikimedia.org/wiki/File:Worldwide_prevalence_of_lactose_intolerance_in_recent_populations.jpg)
6. Nature (2022). https://www.nature.com/articles/s41586-022-05010-7
7. *IMAGE*: Freepik/Macrovector https://www.freepik.com/free-vector/human-body-nervous-system-sympathetic-parasympathetic-charts-with-realistic-organs-depiction-anatomical-terminology-vector-illustration_26762666.htm#fromView=keyword&page=1&position=0&uuid=2a96ba2e-97b8-409c-8542-327f03f0982a
8. *IMAGE*: Wikimedia/FrozenMan https://commons.wikimedia.org/wiki/File:Panic_attack.jpg

More Resources: Free Materials to Learn Mindfulness

1. **Human Kindness Foundation**: provides free books and newsletters to the incarcerated.
    a. To request free books for yourself or others, please send the complete name and mailing address to hkf@humankindness.org.
    b. Their book *We're All Doing Time* has been referenced as the "convicts' bible"
    c. Mail address: P.O. Box 61619, Durham NC 27715
    d. Website: https://www.humankindness.org/
2. **Prison Mindfulness Institute** (**PMI**): Provides free training, resources, and books to the incarcerated.
    a. Mail address: Prison Mindfulness Institute, PO Box 206, South Deerfield, MA 01373
        i. Write and ask to be sent a book on mindfulness
    b. Website: prisonmindfulness.org
3. **Prison Yoga Project**: Facilitates in-person yoga programs and will send you a free book about yoga via mail.
    a. Mail address: Prison Yoga Project, P.O. Box 415, Bolinas, CA 94924

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Remember: First names only & please let us know if your address changes