Human Physiology – the Nervous System
Autonomous Nervous System: Sympathetic and Parasympathetic
Physiology of Anxiety
Triune Brains
Sensation Thermometer
Self-Regulation Skills:
Abdominal breathing
Straw breathing
Progressive muscle relaxation
Differential relaxation
The autonomic nervous system (ANS) is part of the peripheral nervous system.

- Autonomic nervous system acts to maintain normal internal functions and conserve energy.
- It regulates heart rate, digestion, respiratory rate, salivation, perspiration, pupillary dilation, urination, muscle tension and sexual arousal.
- Functions largely below the level of consciousness. For example, we do not notice when blood vessels change size or when our heart beats faster.
- It maintain body homeostasis, which goal is to maintain body in balance with less energy (spend less energy) and survival states.
- Most autonomous functions are involuntary but a number of ANS actions can work alongside some degree of conscious control. Everyday examples include breathing, swallowing, and sexual arousal, and in some cases functions such as heart rate.
- Imagine what life would be like if we had to remember to breathe, and remember to keep our hearts beating. We wouldn’t be able to do much else!

The autonomic nervous system is kept in balance by two systems called the 'sympathetic' and the 'parasympathetic' systems.

The sympathetic nervous system (SNS) is one of major part of the autonomic nervous system. Its general action is to mobilize the body's nervous system fight-or-flight response. It is, however, constantly active at a basic level to maintain homeostasis.

The parasympathetic system (PNS) conserves energy as it slows the heart rate, increases intestinal and gland activity, and relaxes muscles. The parasympathetic system is responsible for stimulation of “rest-and-digest” activities that occur when the body is at rest, especially after eating, including sexual arousal, salivation, lacrimation (tears), urination, digestion and defecation.

The natural opposition of sympathetic and parasympathetic nervous system is better understood as complementary rather than antagonistic. The sympathetic division typically functions in actions requiring quick responses. The parasympathetic division functions with actions that do not require immediate reaction. These two systems act as a kind of balance to one another, creating body homeostasis.

Healthy Nervous System
How emergency zone feels like?

**Crisis mode:** Anxious or agitated, fidgeting; easily frazzled; running on empty; cranky; anxious, panic, hyperactivity, high BP, inability to relax, restlessness, hyper-vigilance, digestive problems, emotional flooding, chronic pain, sleep problems, hostility, rage.

**Freeze mode:** Blah; burned out; collapsed; can’t be bothered; Is that all there is? Depression, exhaustion, chronic fatigue, disconnection, pain. Frozen, numb.

**Common to both:** You can’t think straight. It’s hard to focus on one specific thing.
Physiological Functioning

<table>
<thead>
<tr>
<th>Sympathetic NS (fight or flight)</th>
<th>Parasympathetic NS (rest and digest)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promotes a “fight or flight” response, corresponds with arousal and energy generation, and inhibits digestion.</td>
<td>Promotes a &quot;rest and digest&quot; response, promotes calming of the nerves return to regular function, and enhances digestion.</td>
</tr>
<tr>
<td>Heart rate and force increased</td>
<td>Heart rate and force decreased</td>
</tr>
<tr>
<td>Pupil dilation</td>
<td>Pupil constriction</td>
</tr>
<tr>
<td>Bronchial muscle relaxed - Dilates bronchioles of the lung, which allows for greater alveolar oxygen exchange.</td>
<td>Bronchial muscle contracted - Constrict the bronchiolar diameter when the need for oxygen has diminished.</td>
</tr>
<tr>
<td>Peristalsis reduced - Diverts blood flow away from the gastro-intestinal (GI) tract and skin via vasoconstriction.</td>
<td>Gastric juice secreted; motility increased - Dilate blood vessels leading to the GI tract, increasing blood flow. This is important following the consumption of food, due to the greater metabolic demands placed on the body by the gut.</td>
</tr>
<tr>
<td>Blood flow to skeletal muscles and the lungs is enhanced (by as much as 1200% in the case of skeletal muscles).</td>
<td></td>
</tr>
</tbody>
</table>

Psychological Functioning

<table>
<thead>
<tr>
<th>Sympathetic Dominance (fight or flight)</th>
<th>Parasympathetic Dominance (rest and digest)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compromised cognitive and motor functioning</td>
<td>Maximal cognitive and motor functioning</td>
</tr>
<tr>
<td>Reactive</td>
<td>Intentional (internal locus of control)</td>
</tr>
<tr>
<td>Repeating same mistakes</td>
<td>Creative problem solving</td>
</tr>
<tr>
<td>Coercive or hesitant leader</td>
<td>Transformative leader</td>
</tr>
<tr>
<td>Learned through pain, trauma and fear</td>
<td>No trauma or resolved trauma</td>
</tr>
<tr>
<td>Obsession / compulsion</td>
<td>Mobility and decision-making capacity</td>
</tr>
<tr>
<td>Chronic muscle tension</td>
<td>Muscle relaxation – comfort</td>
</tr>
<tr>
<td>Increased threat perception (hyper-vigilance)</td>
<td>Problems=challenge</td>
</tr>
<tr>
<td>Diminished brain functioning (poor attention, concentration, memory)</td>
<td>Peak performance (motor and cognitive)</td>
</tr>
<tr>
<td>Loss of language and speech (loss of intentional thought)</td>
<td>Self-regulatory</td>
</tr>
<tr>
<td>Intimacy intolerance</td>
<td>Intimacy tolerance</td>
</tr>
</tbody>
</table>
Physiology of anxiety

Anxiety is the body's way of responding to being in danger. Adrenaline is rushed into our bloodstream to enable us to run away or fight. This happens whether the danger is real, or whether we believe the danger is there when actually there is none. It is the body's alarm and survival mechanism. Primitive man wouldn't have survived for long without this life-saving response. It works so well, that it often kicks in when it's not needed - when the danger is in our heads rather than in reality. We think we're in danger, so that's enough to trigger the system to go, go, go! People who get anxious tend to get into scanning mode - where they're constantly on the lookout for danger, hyper-alert to any of the signals, and make it more likely that the alarm system will be activated.

The fight or flight response is a normal and useful response to external threats, especially those that can be avoided by physical exertion. However, it may not be helpful or appropriate in stressful situations that do not involve external physical danger. It is important to realise that all humans have had the fight or flight response for hundreds of generations. Humans share this response with many other species, because it has very real survival value. The main purpose of the fight or flight response is to activate the organism and protect it from harm when confronted with threat.

Physical Sensations - The Adrenaline Response
When there is real, or we believe there is a real, threat or danger, our bodies' automatic survival mechanism kicks in very quickly. This helps energise us to fight or run away (‘fight or flight response’). The action urge associated with anxiety is to escape or avoid. We will therefore notice lots of physical sensations, which might include:

- **Heart racing** - This helps to take the blood to where it is most needed – the legs so that we can run faster (flight); the arms so that we can hit out (FIGHT); the lungs to increase stamina. At the same time blood is taken from the places it is not needed for example fingers, toes and skin. These changes cause tingling coldness and numbness.
- **Breathing gets faster** - This helps the bloodstream to carry oxygen to the arms, legs and lungs. This will give us more power. The side effects may include chest pain, breathlessness and a choking feeling. As there is a slight drop in the blood and oxygen being sent to the brain we may feel dizzy or light headed, he may experience blurred vision.
- **Muscles tense and prepare** - The large skeletal muscles tense and create power, this may cause pain, aching and shaking.
- **Sweating** - Sweating helps to cool the muscles and the body. It helps to stop them from overheating. Sweating can also make us more slippery to our enemies!
- **Pupils dilate** - This lets more light into his eyes so that overall vision improves. Side effects may include sensitivity to light or spots before our eyes.
- **Digestive system slows down** - These are not important while in danger and so are slowed down then the saved energy goes to where it is most needed. Side effects may include nausea, butterflies and a dry mouth.
- **More alert** - We will be concentrating on looking for danger, much less able to concentrate on anything else. We're waiting for something to happen.

In your body, you may experience one or a number of the following sensations:

- trembling or shaking
- restlessness
- muscle tension
- sweating
- shortness of breath
- pounding or racing heart
- cold and clammy hands
- fast breathing
- dry mouth
- hot flushes or chills
- feeling sick or nauseated
- “butterflies” in the stomach
Triune brains and its languages: sensations, emotions, logic

<table>
<thead>
<tr>
<th>Reptile Brain - Brain stem</th>
<th>Mammal Brain - Limbic system - amygdala / hippocampus</th>
<th>Frontal -cortex – Rational Brain</th>
</tr>
</thead>
<tbody>
<tr>
<td>-Instinctive / somatic</td>
<td>-Non-verbal (image; sensation based)</td>
<td>-Problem solving</td>
</tr>
<tr>
<td>-Basic instincts</td>
<td>-Long term memory</td>
<td>-Verbal (word based)</td>
</tr>
<tr>
<td>-Primal desires</td>
<td>-Pain</td>
<td>-Logic; high intellectual</td>
</tr>
<tr>
<td>-Impulses, Reflexes</td>
<td>-Fear</td>
<td>functions</td>
</tr>
<tr>
<td>-Survival</td>
<td>-Anger</td>
<td>Emotions – verbal</td>
</tr>
<tr>
<td>-Freeze response</td>
<td>-Attachment</td>
<td>Working memory</td>
</tr>
<tr>
<td></td>
<td>-Passive learning</td>
<td>- Active learning</td>
</tr>
<tr>
<td></td>
<td>-Fight / flight response</td>
<td>-Regulation of body systems</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Attuning to others</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Balancing emotions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Modulating fear</td>
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<td></td>
<td></td>
<td>-Responding flexibly</td>
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<td>-Exhibiting insight and empathy</td>
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<td>-Paying attention to the body’s</td>
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<td></td>
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<td>wisdom</td>
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<td></td>
<td></td>
<td>-Morality</td>
</tr>
</tbody>
</table>

- Problem solving
- Verbal (word based)
- Logic; high intellectual functions
- Emotions – verbal
- Working memory
- Active learning
- Regulation of body systems
- Attuning to others
- Balancing emotions
- Modulating fear
- Responding flexibly
- Exhibiting insight and empathy
- Paying attention to the body’s wisdom
- Morality
Sensation Thermometer

<table>
<thead>
<tr>
<th>Unpleasant</th>
<th>Activation</th>
<th>Pleasant</th>
</tr>
</thead>
<tbody>
<tr>
<td>About to explode</td>
<td>Red</td>
<td>Feeling exited</td>
</tr>
<tr>
<td>Feeling tense</td>
<td>Orange</td>
<td>Feeling elated</td>
</tr>
<tr>
<td>Beginning to sense irritation, upset, nervous</td>
<td>Yellow</td>
<td>Beginning to sense excitement</td>
</tr>
<tr>
<td>Neutral</td>
<td>Green</td>
<td>Grounded, neutral, “ok”, present, focused,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>safe, calm and alert / comfort zone</td>
</tr>
<tr>
<td>Beginning to feel tired, bored</td>
<td>Light Blue</td>
<td>Beginning to feel tired or content</td>
</tr>
<tr>
<td>Tired, sad, down, depressed</td>
<td>Blue</td>
<td>Tired, quite, relaxed</td>
</tr>
<tr>
<td>Numb, freeze</td>
<td>Dark Blue</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Purple</td>
<td>Relaxed and comfortable / resource state</td>
</tr>
<tr>
<td></td>
<td>Deactivation</td>
<td></td>
</tr>
</tbody>
</table>
Self – Regulation Skills

Abdominal / Diaphragmatic breathing:

The diaphragm is the most efficient muscle of breathing. It is a large, dome-shaped muscle located at the base of the lungs. Your abdominal muscles help move the diaphragm and give you more power to empty your lungs.

Diaphragmatic breathing technique

1. Lie on your back on a flat surface or in bed, with your knees bent and your head supported. You can use a pillow under your knees to support your legs. Place one hand on your upper chest and the other just below your rib cage. This will allow you to feel your diaphragm move as you breathe.

2. Breathe in slowly through your nose so that your stomach moves out against your hand. The hand on your chest should remain as still as possible.

3. Tighten your stomach muscles, letting them fall inward as you exhale through pursed lips (see "Pursed Lip Breathing Technique"). The hand on your upper chest must remain as still as possible.

When you first learn the diaphragmatic breathing technique, it may be easier for you to follow the instructions lying down, as shown on the first page. As you gain more practice, you can try the diaphragmatic breathing technique while sitting in a chair, as shown below.

To perform this exercise while sitting in a chair:

1. Sit comfortably, with your knees bent and your shoulders, head and neck relaxed.
2. Breathe in slowly through your nose so that your stomach moves out against your hand. The hand on your chest should remain as still as possible.
3. Place one hand on your upper chest and the other just below your rib cage. This will allow you to feel your diaphragm move as you breathe.
4. Tighten your stomach muscles, letting them fall inward as you exhale through pursed lips. The hand on your upper chest remains as still as possible.
**Counting:**
After following your breaths try to lengthen your exhalation until it eventually becomes twice as long as the inhalation. To start with, we focus on inhaling to the count of three (you can count silently in your mind) and exhale to the count of six, pausing at the end to let your body relax. For most people, you will lengthen the exhalation over time starting with a count of three on the inhalation and reaching four, five, or six on the exhalation. The idea is not to try too hard but to let the exhalation lengthen over time with a pause to relax before taking the next breath. Continue by inhaling slowly fully and deeply into the belly to the count of three and release slowly and completely to the count of four, five or six, while staying focused on the slow full rhythm of inhalation and exhalation.

**Straw breathing technique:**

- Relax your neck and shoulder muscles.
- Breathe in (inhale) slowly through your nose for two or three counts, keeping your mouth closed. Don't take a deep breath; a normal breath will do. It may help to count to yourself: inhale, one, two.
- Pucker or “purse” your lips as if you were going to exhale through a straw or whistle or gently flicker the flame of a candle.
- Breathe out (exhale) slowly and gently through your pursed lips while counting to four or six. It may help to count to yourself: exhale, one, two, three, four.
- Do not hold your breath on inhalation.
- Do not force the air out.
- Try to breathe out for longer than you breathe in.
- Breathe slowly, easily, and relaxed ... in and out ... until you are in complete control.

![Inhale Pucker or purse Exhale](image)

**How often should I practice?**

**Dedicated practice:** start small, for example from 5 minute of sitting practice, once or twice a day. Gradually, increase your time till 15-20 minutes. You can use alarm clock, set to your desired amount of time that will indicate the end of practice.

**Mindfulness practice:** You can practice this breathing technique often throughout the day. You might choose to take a nice slow breath every time you answer the phone, when you get into the car, when you visit the bathroom, before you eat, and certainly if you are feeling stressed. Pick a few times that work best for you to help you get in the habit of doing one to three deep breaths in through your nose to the count of three and out through your mouth to the count of six.
Relaxation

The three aims of relaxation:
- To help protect the body from unnecessary wear and tear
- To help reduce stress, high blood pressure, tension headaches, sleeplessness and panic
- To help calm the mind, so our thinking becomes clearer and more effective

Progressive muscle relaxation

Progressive Muscle Relaxation teaches you how to relax your muscles through a two step process. First, you systematically tense particular muscle groups in your body, such as your neck and shoulders. Next, you release the tension and notice how your muscles feel when you relax them.

This exercise will help you to lower your overall tension and stress levels, and help you relax when you are feeling anxious. It can also help reduce physical problems such as stomach aches and headaches, as well as improve your sleep.

People are often so tense throughout the day that they don't even recognize what being relaxed feels like. Through practice you can learn to distinguish between the feelings of a tensed muscle and a completely relaxed muscle. Then, you can begin to “cue” this relaxed state at the first sign of the muscle tension that accompanies your feelings of anxiety. By tensing and releasing, you learn not only what relaxation feels like, but also to recognize when you are starting to get tense during the day.

HELPFUL HINTS:
Set aside about 15 minutes to complete this exercise.
Find a place where you can complete this exercise without being disturbed.
For the first week or two, practise this exercise twice a day until you get the hang of it. The better you become at it, the quicker the relaxation response will “kick in” when you really need it!
You do not need to be feeling anxious when you practise this exercise. In fact, it is better to first practice it when you are calm. That way, it will be easier to do when feeling anxious.

Getting ready:
Find a quiet, comfortable place to sit, then close your eyes and let your body go loose. A reclining armchair is ideal. You can lie down, but this will increase your chances of falling asleep. Although relaxing before bed can improve your sleep, the goal of this exercise is to learn to relax while awake. Wear loose, comfortable clothing, and don’t forget to remove your shoes. Take about five slow, deep breaths before you begin.
**STEP ONE: Tension**

The first step is applying muscle tension to a specific part of the body. This step is essentially the same regardless of which muscle group you are targeting. First, focus on the target muscle group, for example, your left hand. Next, take a slow, deep breath and squeeze the muscles as hard as you can for about 5 seconds.

It is important to really feel the tension in the muscles, which may even cause a bit of discomfort or shaking. In this instance, you would be making a tight fist with your left hand.

It is easy to accidentally tense other surrounding muscles (for example, the shoulder or arm), so try to ONLY tense the muscles you are targeting. Isolating muscle groups gets easier with practice.

Be Careful!

Take care not to hurt yourself while tensing your muscles. You should never feel intense or shooting pain while completing this exercise. Make the muscle tension deliberate, yet gentle. If you have problems with pulled muscles, broken bones, or any medical issues that would hinder physical activity, consult your doctor first.

**STEP TWO: Relaxing the Tense Muscles**

This step involves quickly relaxing the tensed muscles. After about 5 seconds, let all the tightness flow out of the tensed muscles. Exhale as you do this step. You should feel the muscles become loose and limp, as the tension flows out.

It is important to very deliberately focus on and notice the difference between the tension and relaxation. This is the most important part of the whole exercise.

Remain in this relaxed state for about 15 seconds, and then move on to the next muscle group. Repeat the tension - relaxation steps. After completing all of the muscle groups, take some time to enjoy the deep state of relaxation.

**The Different Muscle Groups**

During this exercise, you will be working with almost all the major muscle groups in your body. To make it easier to remember, start with your feet and systematically move up (or if you prefer, you can do it in the reverse order, from your forehead down to your feet).

For example:

- Foot (curl your toes downward)
- Lower leg and foot (tighten your calf muscle by pulling toes towards you)
- Entire leg (squeeze thigh muscles while doing above) - (Repeat on other side of body)
- Hand (clench your fist)
- Entire right arm (tighten your biceps by drawing your forearm up towards your shoulder and “make a muscle”, while clenching fist) (Repeat on other side of body)
- Buttocks (tighten by pulling your buttocks together)
- Stomach (suck your stomach in)
- Chest (tighten by taking a deep breath)
- Neck and shoulders (raise your shoulders up to touch your ears)
- Mouth (open your mouth wide enough to stretch the hinges of your jaw)
- Eyes (clench your eyelids tightly shut)

Quick Tense & Relax!
Note:
It can take time to learn to relax the body and notice the difference between tension and relaxation. At first, it can feel uncomfortable to be focusing on your body, but this can become quite enjoyable over time.

Once you have become familiar with the “tension and relaxation” technique, and have been practicing it for a couple weeks, you can begin to practise a very short version of progressive muscle relaxation. In this approach, you learn how to tense larger groups of muscles, which takes even less time. These muscle groups are:

1. Lower limbs (feet and legs)
2. Stomach and chest
3. Arms, shoulders, and neck
4. Face

So instead of working with just one specific muscle group at a time (e.g., your stomach), you can focus on the complete group (your stomach AND chest). You can start by focusing on your breathing during the tension and relaxation.

When doing this shortened version, it can be helpful to say a certain word or phrase to yourself as you slowly exhale (such as “relax”, “let go”, “stay calm”, “peace” “it will pass” etc...). This word or phrase will become associated with a relaxed state; eventually, saying this word alone can bring on a calm feeling. This can be handy during times when it would be hard to take the time to go through all the steps of progressive muscle relaxation.

Release Only
A good way to even further shorten the time you take to relax your muscles is to become familiar with the “release only” technique. One of the benefits of tensing and releasing muscles is that you learn to recognize what tense muscles feel like and what relaxed muscles feel like.

Once you feel comfortable with the tension and relaxation techniques, you can start doing “release only”, which involves removing the “tension” part of the exercise.

For example, instead of tensing your stomach and chest before relaxing them, try just relaxing the muscles. At first, the feeling of relaxation might feel less intense then when you tensed the muscles beforehand, but with practice, the release-only technique can be just as relaxing.

Final Note:
Remember to practise progressive muscle relaxation often, whether you are feeling anxious or not. This will make the exercise even more effective when you really do need to relax! Though it may feel a bit tedious at first, ultimately you will gain a skill that will probably become a very important part of managing your stress and anxiety in your daily life.
Differential relaxation

Differential relaxation is about economy of energy – about using just the minimum amount of energy required to get the job done.

For example: Use a pencil and paper to write your name, but use too little pressure to make a mark on the paper.

Do this again, using just a little more force. Continue using slightly more effort, until you reach a point where you’re able to write in a way which you recognise as your usual style, while staying as relaxed as possible.

You’re now doing a good job with economy of effort! Keep the idea of differential relaxation in mind and check the amount of effort you’re putting into things during the day.

One way to do this is to use a ‘call to relaxation.’

Call to relaxation

Think of a common event in your life such as the ringing of a doorbell or of a telephone.

Use that ringing as a reminder to check your levels of relaxation.

When the ‘phone or doorbell rings, breathe out deeply and relax.

Get into the habit of using these ‘reminders’ to help you relax.

Relaxation isn’t a ‘quick fix’

- The effects of relaxation get stronger over time, so don’t be disappointed if you don’t get a quick result!
- Learning to relax takes time – we may be talking weeks and months, not hours and days.
- Remember not to use relaxation exercises as a way of avoiding the things you’re afraid of - at some point, overcoming anxiety means facing up to our fears!
- As we’ve already seen, anxiety affects both our mind (thoughts) and our body (physical responses).
- So learning to manage the symptoms of anxiety more effectively involves both mental and physical exercises.
- By relaxing the body, the mind will start to become calmer, and by relaxing the mind, the body will also start to become calmer.

Practice, practice, practice!

At first it’s necessary to take time over the relaxation exercises in order to ‘train’ the body and the mind to do things differently.

But in the same way that eating just one healthy meal each week has little impact on our overall health; relaxation brings about very few improvements unless it’s practised regularly.

Although many people find relaxation difficult at first, if you devote enough time and effort to learning relaxation techniques they become simple, and you’ll eventually be able to switch on the relaxation response in your body and mind with very little effort at all.