



# HORIZON

*The*

VOLUME 1, ISSUE 8, AUGUST 2023

LIFESTYLE, PRODUCTIVITY, CULTURE & SO MUCH MORE.....

Adopting a vegetarian diet/vegan diet

'Early bird' or 'Night owl'? Who are you?

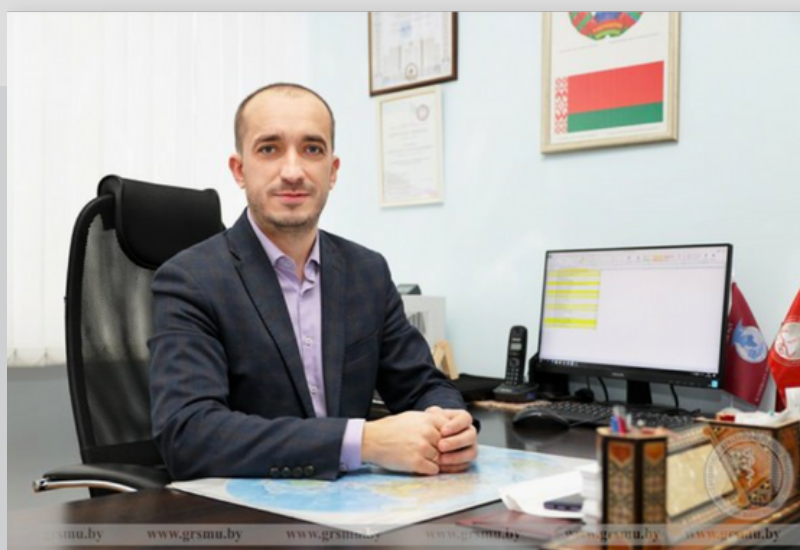
Parsonage Turner Syndrome

Unleashing the Brain's Hidden Superpower: Neuroplasticity

# DEAN'S DESK



Dear students, we at Grodno State Medical University strive to provide students with top-quality education, but that's not it. GRSMU is also a hub for Scientific, Cultural, and Sports related activities. We wholeheartedly acknowledge that International students are an integral part of our university, and we take immense pride in that. Grodno State Medical University is glad to work with students from different countries and provide them with a stage to represent their nation and culture.



**DEAN OF FACULTY OF INTERNATIONAL STUDENTS  
DR. ALEKSANDER ALEKSANDEROVICH STENKO**

GRSMU celebrates its uniqueness in diversity, for in its true essence our university is a junction where students from various backgrounds and cultures come together as one big family. GRSMU has always encouraged students to explore further and beyond in every field they try their hands at. I hope that you like the novel concept of 'The Horizon' - a magazine that serves as a platform for the students to voice their opinions, share their takes and present their points of view.

'**The Horizon**' is a medium of extended communication where we can learn a lot from one another. I highly appreciate this initiative and personally support it. I look forward to reading the interesting blogs written by you.

# WELCOME TO THE HORIZON



“We all have fascinating stories to share!” For the longest time, I have had this idea of starting a magazine. But not just any conventional magazine, one that shall serve as a platform for the students and alumni of International faculty at Grodno State Medical University to share their stories. A platform that enables students to share their takes on various curricular and extracurricular aspects of medicine. Thus, the idea of **‘The Horizon’**, came to life.



**DR. MEHUL H. SADADIWALA, FOUNDER,  
CLASS OF 2023**

**‘The Horizon’** will be a creative intersection where students can freely give commentaries about Lifestyle, Culture, Productivity tips, and more. Throughout the years, many individuals at GrSMU have inculcated valuable skills and gained experience with a fair share of success in various disciplines. Maybe you run a successful YouTube channel or an educational website, or maybe you are a successful student-researcher or an educator, and so much more. 'The Horizon' enables students to share their personal experiences. The insights that you share will encourage other students to take further strides and explore future possibilities.

**‘The Horizon’** is supported directly by the Dean of the International Faculty, and it will operate under the supervision of the International Students' Scientific Committee. Students from 1st to 6th year, and even graduates, can submit their blogs to this magazine. The articles should directly or indirectly revolve around student life to share knowledge and the collective growth of students.

For inquiries and submissions.

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# EDITOR'S DESK



“ Reading consistently and voraciously helps build knowledge, improve one's language, vocabulary and is a crucial driver of success. Accordingly, books, journals magazines etc plays a major role in moulding who we are. Whilst magazines are a mirror of our society “the Horizon” is tailored to give the reader a glimpse of artistry, wisdom and eloquence of the GrSMU students and alumni.

As a person who enjoys the world of words, I am indeed enthused to be the Editor-in-Chief of this magazine for Jul-Sep, 2023 and to read and fine-tune blogs authored by my fellow university students and alumni and publish an engaging series of informative and entertaining content, further raising the profile of the magazine. ”



**ZAAKIYA GANEM ZAMZAM,  
EDITOR-IN-CHIEF (JUL-SEP, 2023)**



**DR. HARDIK B. MEVAWALA,  
EDITOR-IN-CHIEF (JUL-SEP, 2023)**

“ Dear readers, it is with great pleasure that I introduce myself as the new Editor-in-Chief of our magazine. As a medical graduate, I have always been passionate about reading, and I am thrilled to have the opportunity to share my insights with all of you. The Horizon aims to provide content not only for medical professionals but to individuals from all backgrounds, including those who do not have formal medical education and it makes me glad to be a part of it.

I am excited to take on this role and work with our talented writers and editors to bring you engaging and informative content. I am committed to delivering high-quality blogs that will inform, entertain, and inspire our readers. I encourage you to share your thoughts with us and our readers through our magazine. Thank you for your support, and I can't wait to see what we will accomplish together! ”

And a message to our dearest readers, we would like to invite you all, students and alumni, to share with us the blogs that directly or indirectly revolve around student life, to share knowledge and experiences that has had an impact on your growth within and outside the bounds of our university.

Concluding, let us alter the limitations of our individual efforts and collectively explore limitless Horizons.

## Cover Credits

Fathima Hasheena Hassan

For enquiries and submissions.

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# ADOPTING A VEGETARIAN DIET/VEGAN DIET

The blog discusses the adoption of vegetarian and vegan diets for various reasons, including availability, religious beliefs, animal welfare concerns, and health considerations. It highlights scientific studies that support these claims and stresses the importance of planning a well-balanced vegetarian diet to ensure adequate intake of essential nutrients.

WRITTEN BY

KHILAN RAJESHBHAI  
KHETANI

CLASS OF 2024

## INTRODUCTION

People choose a vegetarian or vegan diet for a number of reasons, some because meat is not readily available or affordable, others because of religious convictions or concerns about animal welfare. Health has become another reason why people are moving to plant-based diets.

Research supports the idea that plant-based diets, including vegan diets, provide health benefits. Dietary guidelines and recommendations from nutrition experts reflect this, encouraging the adoption of diets (such as DASH diet) that are heavy on fruits and vegetables and restrict consumption of red meat. In this article we will explore how adopting vegetarian food helps to improve our health.

## WHAT IS A VEGAN DIET?

Vegetarian diet focuses on plants for food. These include vegetables, fruits, dried beans and peas, grains, seeds and nuts. There is no single type of vegetarian diet.

Popular plant-based diets include:

- Vegetarian diet, which includes no meat.



- Vegan diet, a type of vegetarian diet that excludes not just meat but also animal products, such as milk or eggs.
- Lacto vegetarian diet, which includes plant foods plus dairy products. It is a less restrictive diet with more food choices than a vegan diet and more calorie-dense, so it is considered as the best diet for optimal child growth.
- Lacto-ovo vegetarian diet, which includes both dairy products and eggs.
- Ovo vegetarian, Eat no meat, poultry, fish, or dairy products, but do eat eggs.
- Partial vegetarian diet. Avoid meat but may eat fish (pesco-vegetarian, pescatarian) or poultry (pollo-vegetarian).

## CAN BECOMING A VEGETARIAN PROTECT YOU AGAINST MAJOR DISEASES?

According to recent studies, it has shown those who are having a vegetarian diet they have significant changes in human body which had impacted in day to day work.

The significant changes seen are :

Heart disease. There's some evidence that vegetarians have a lower risk for cardiac events (such as a heart attack) and death from cardiac causes. In one of the largest studies, a combined analysis of data from five prospective studies involving more than 76,000 participants published several years ago — vegetarians were, on average, 25% less likely to die of heart disease.

Vegetarians consume smaller amounts of total fat and saturated fat and larger amounts of unsaturated fats and fiber than non-vegetarians. There is convincing evidence that vegetarians have lower rates of coronary heart disease (largely explained by low LDL cholesterol). In the Adventist Health Study-2 of 73,308 Seventh-day Adventists, researchers found that vegetarians had a 13 and 19% decreased risk for developing CVD and ischemic heart Disease.

Cancer. Hundreds of studies suggest that eating lots of fruits and vegetables can reduce the risk of developing certain cancers, and there's evidence that vegetarians have a lower incidence of cancer than nonvegetarians do. For example, in a pooled analysis of data from the Oxford Vegetarian Study and EPIC-Oxford, fish-eaters had a lower risk of certain cancers than vegetarians. In a 2016 study published in the American Journal of Clinical Nutrition, researchers analyzed the diets of over 26,000 men for nearly eight years. They found that vegan diets were linked with a 35% lower risk of prostate cancer compared to non-vegetarian diets.



Type 2 diabetes. Vegetarian diet is an effective method in glycemic control and that this diet control plasma glucose to a greater level than do control diet. Research suggests that a predominantly plant-based diet can reduce the risk for type 2 diabetes. In studies of Seventh-day Adventists, vegetarians' risk of developing diabetes was half that of nonvegetarians, even after taking BMI into account.



A recent meta-analysis, published in JAMA Internal Medicine, looked at nine observational studies totaling over 300,000 participants to see how plant-based diets (both vegan and vegetarian) relate to type 2 diabetes risk. Vegetarians had 23% lower risk of developing type 2 diabetes. Lipid profile and vegetarian diet. Plasma total cholesterol is lower in vegetarians as compared to non-vegetarians, primarily due to a reduction in LDL cholesterol, with little difference in HDL cholesterol.

This difference in plasma cholesterol is likely to be largely due to differences in animal fat intake since meat is a rich source of saturated fatty acid whereas some plant foods such as vegetable oils, nuts and seeds are rich sources of polyunsaturated fatty acid. Inflammatory biomarkers and vegetarian diet. The vegetarian diet contains different anti-inflammatory components. Lower serum concentrations of inflammatory biomarkers among vegetarians compared to non-vegetarians. Fruits and vegetables are known as dietary sources of salicylic acid which is considered an active ingredient of anti-inflammatory medications. Further, fruits and vegetables may modulate gut microbiota via dietary fiber. The ratio of the anti-inflammatory bacterium, Faecalibacterium prausnitzii, is higher in vegetarian diets.



## WHAT DOES SCIENCE SAY?

According to the American Dietetic Association, "appropriately planned vegetarian diets including total vegetarian or vegan diets, are healthful, nutritionally adequate, and may provide health benefits in the prevention and treatment of certain diseases.

"Appropriately planned" is the operative term. Unless you follow recommended guidelines on nutrition, fat consumption, and weight control, becoming a vegetarian won't necessarily be good for you. The most important thing for vegetarians of all kinds to remember is to make sure they are getting key nutrients, including protein, fatty acids, iron, zinc, iodine, calcium and vitamins D and B-12. Protein is essential for building muscle mass, amino function, fighting disease and healing, vegans must eat soy protein the only vegetable protein which is as complete as animal protein.

Conclusion : Vegetarian diets are usually low in fat, particularly saturated fat and high in fiber. They are also likely to include more legumes, whole grains, nuts and fruits and vegetables and lack of most types of meat, which may provide many benefits for the prevention and treatment of obesity and chronic health problems, including diabetes and cardiovascular disease. Pursuing a well-planned vegetarian diet can meet all the nutritional needs of an individual. Additionally, the vegetarian diet and plant-based eating pattern exert a beneficial effect on lipid profile, blood glucose and other biochemical parameters.

So a simple act of becoming a vegetarian will make a difference in benefitting your health. Give it a try and you will feel the change.

### References:

- [1. <https://www.health.harvard.edu/staying-healthy/becoming-a-vegetarian#:~:text=Vegetarians%20usually%20have%20lower%20levels,ri sk%20for%20type%20%20diabetes>](https://www.health.harvard.edu/staying-healthy/becoming-a-vegetarian#:~:text=Vegetarians%20usually%20have%20lower%20levels,ri sk%20for%20type%20%20diabetes)
- [2. <https://www.health.harvard.edu/blog/plant-based-diets-are-best-or-are-they-2019103118122>](https://www.health.harvard.edu/blog/plant-based-diets-are-best-or-are-they-2019103118122)
- [3. <https://scialert.net/fulltext/?doi=pjn.2020.468.476>](https://scialert.net/fulltext/?doi=pjn.2020.468.476)

# 'EARLY BIRD' OR 'NIGHT OWL' ? WHO ARE YOU?

The article discusses the chronotypes, determined by individuals' natural tendencies to wake up early or stay up late due to their circadian rhythms. The article advises taking a chronotype quiz to identify one's inclination and offers practical tips for improving sleep quality and energy levels based on these tendencies.

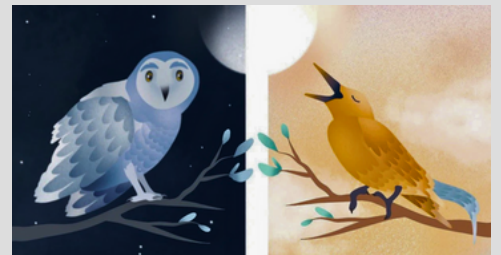
WRITTEN BY  
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Have a hard time waking up early? Or do you prefer to stay up late into the night? The reason for such a tendency is that our energy levels vary differently among individuals. This has led to the division of two types of people. The Morning Larks or the early birds; those who tend to wake up with the earliest rays of the sun and delight in hearing the sweet birdsongs of dawn. There are also those who wish to mute their alarm and snuggle into the blanket in the morning but stay up late into the night reveling in the quite stillness of the dark, the Night Owls.

### Why is there such a difference?

In reality there is a much deeper science at work with regard to when we want to wake up. This is called the Circadian Rhythm. The Circadian Rhythm is a hormone driven internal clock that regulate the energy levels throughout the day. There are two hormones that regulate the Circadian Rhythm, Melatonin secreted by the pineal gland and Cortisol in plasma.

During the daytime light exposure causes the internal clock to generate signals for alertness and help us to keep active. This is done by the increase in the level of Cortisol. In a similar way, as night falls the production of Melatonin is increased to promote sleep and to keep us asleep through the night.



### What are Morning Larks and Night Owls?

Morning Larks tend to be early-to-be-early-to-rise , as well as feeling the best in the morning. But they tend to have less energy in the late afternoon and evening as well as have a hard time staying awake past their usual bedtime. Night Owls tend to stay awake late into the night as well as enjoy sleeping in and feel the best later in the day. But they have a hard time staying alert during the day and feel tired after waking early in the morning.

In recent times the study of the sleep-wake cycle and individual levels of activity and alertness has given rise to the term Chronotype.

### Chronotypes

A chronotype is the behavioral inclination of the body to be active and awake at certain times which is governed by the Circadian Cycle. Eva Cohen, a certified sleep science coach from Kansas says that knowing your chronotype may help with understanding how your internal clock works and how you

can synchronize it with your daily activities and duties use your time efficiently.

Dr. Michael Breus, Ph.D., psychologist and certified clinical sleep specialist has stated that people typically fall into one of four chronotype categories ; the bear, the wolf, the lion and the dolphin.

## The bear

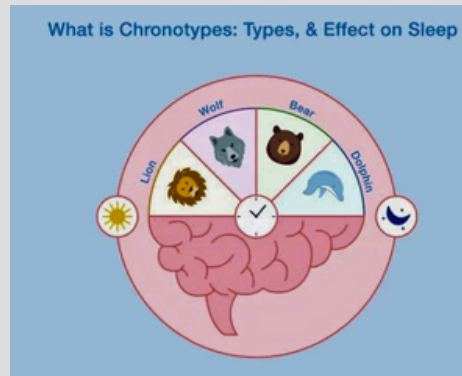
About 55 percent of people fall into the bear chronotype and is the most common chronotype. This chronotype is most productive before noon and struggle with an afternoon slump after lunch, typically around 2-4pm. Eight hours of sleep is typical and normal sleep hours tend to be between 11pm and 7am.

The bear has a happy-go-lucky attitude and has a continuous flow of mellow energy to engage with people. The ideal schedule for a bear will include waking up from 7-8am, doing work that require focus between 10am to 2 pm and relaxing after 4pm. If a bear does not get enough sleep at night, they may feel lethargic throughout the day and go to bed earlier than normal. If you are a bear, make sure to get enough sleep to maintain your energy levels.

## The wolf

The wolf is not a morning person and tend to be most energetic waking up later in the day. They get two bursts of creative energy, first around noon and the second coming around 6pm when other have finished their workday. Wolves are happy to go to bed around midnight or well past it.

The wolf is highly creative and introspective but their energy tend to be reserved during social interactions leading them to be introverted at most times. The ideal schedule for a wolf is to wake around 7.30 – 9am and engage in deep focus work between 12-2pm, engaging in creative tasks between 5-9pm.



## The lion

The lion is the epitome of “Early to bed, early to rise” with their energy levels peaking before noon and is typically able to complete massive amounts of work before lunch. But the afternoon slump hits this type hard and often will need a power nap to recharge and by evening they feel drained.

The lions are natural leaders and are charismatic. They are usually seen exercising early and the first in the office. Their ideal schedule is to wake up around 6-7pm and to focus on deep work between 8-12pm, they can continue light tasks till 4pm. It is important for lions to have an evening wind-down routine to help decompress from the day and calling an early night around 10pm. Lions generally need around eight hours of sleep to sustain their energy levels.

## The dolphin

The dolphin also known as the insomniac of the water, have a hard time waking up in the morning but once awake their productivity reaches its peak around mid-morning. Similar to their namesake, they have anxious sleeping behaviors including having a hard time falling asleep each night. A power nap during the day can give them a boost of energy to combat the ongoing daily tiredness.

The dolphin is the hardest to create a set schedule since they tend to have sporadic sleeping habits. Dolphins tend to be highly intelligent and have bursts of creative energy but their peers tend to find them scatterbrained due to their flowing thoughts, can be seen as distant and uninterested during social interactions. They tend to ruminate about the day’s successes and failures while in bed.

## What if you don't fit in with just one chronotype?

Realistically most of us will fall in the range between two chronotypes. Researchers have identified these individuals as ‘humming birds’.

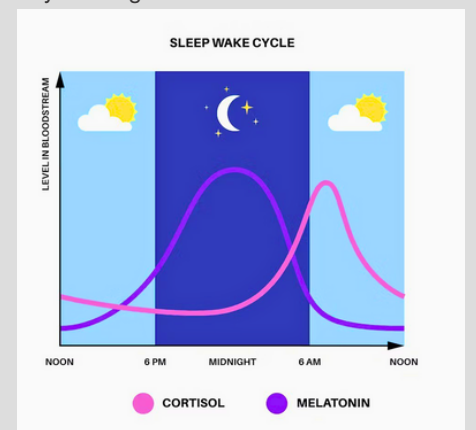
If you feel like you are in-between chronotypes or struggle to follow your chronotype schedule, you can follow the following steps to help you increase your sleep quality and quantity.

- ▶ Eat at the right times – A high protein breakfast will get your bodily cycles running and help metabolic functions work smoothly. An early, carb-heavy dinner is ideal to help the body prepare for sleep. Also be mindful not to overeat and to avoid food at least 2 hours before bed time.

- ▶ Avoid caffeine in the afternoon – Caffeine has a stimulant effect and therefore has to be avoided within six hours of bedtime. You can also consider drinking caffeine-free alternatives. For example, milk or chai, as well as different fruit juices.

- ▶ Follow a consistent sleep schedule – going to bed and sticking to a set bedtime can help. Also an evening routine can help falling asleep. A screen-free routine like reading a book or listening to music can be a good option.

Following these steps will allow you to ease yourself into a good night sleep and help you regain energy to tackle the new day with vigor.



### References:

1. <https://casper.com/blog/chronotype/#~:text=Sleeping%20patterns%2C%20behaviors%2C%20and%20characteristics,and%20activity%20throughout%20the%20day>
2. <https://www.sleepfoundation.org/how-sleep-works/chronotypes>
3. [https://www.nature.com/articles/s41467-018-08259-7?utm\\_medium=affiliate&utm\\_source=commission\\_1junction&utm\\_campaign=CONR\\_PF018\\_ECOM\\_GL\\_PHSS\\_ALWAYS\\_D EEPLINK&utm\\_content=textlink&utm\\_term=PID1000900718 CJEVENT=7c2a833336a411ee817ca3b30a18b8f9](https://www.nature.com/articles/s41467-018-08259-7?utm_medium=affiliate&utm_source=commission_1junction&utm_campaign=CONR_PF018_ECOM_GL_PHSS_ALWAYS_D EEPLINK&utm_content=textlink&utm_term=PID1000900718 CJEVENT=7c2a833336a411ee817ca3b30a18b8f9)
4. <https://www.cdc.gov/hiosh/emres/longhourstraining/clock.html>
5. <https://sleepdoctor.com/how-sleep-works/chronotypes/>



# PARSONAGE TURNER SYNDROME

This blog addresses PTS, which is a rare neurological condition that causes pain and loss of muscle control in the shoulder or arm. Medicines and therapies help in reducing the pain and in improving the condition. It is mostly a curable syndrome where recovery can take from 1 to 3 years.

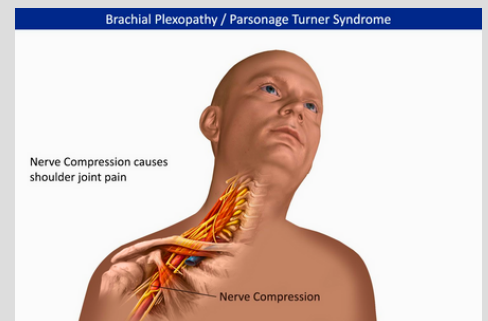
WRITTEN BY  
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Let's begin with a simple question, What is a syndrome? Simply, a syndrome can be defined as a group of signs and symptoms that occur together and characterize a particular abnormality or condition. Syndromes are differentiated from diseases on the basis of where, disease is a health condition having a clear reason (established condition) behind it where syndromes as mentioned above refers to a group of symptoms. In this article we'll be looking into a rare neurological syndrome called the Parsonage Turner Syndrome.

## What is Parsonage Turner Syndrome?

Parsonage Turner Syndrome, also known as Brachial neuritis is a form of peripheral neuropathy that affects the nerves going to the chest, shoulder, arm and hand. It is a neurological condition characterized by a rapid onset of severe pain in your shoulder and upper arm due to weakening of muscles. The pain can last from a few days to several months. Most people (70% to 90%) make a good recovery over two to three years. This condition is due to damaging of brachial plexus, which is a network of nerves that go from your spine through your neck, into both of your armpits and then down the arms.

Parsonage Turner Syndrome mainly affects motor nerves and axons that are responsible for controlling movement and thus leading to muscle weakness. PTS is a rare condition where up to 3 people per 100,000 get PTS each year.



## Phases of Parsonage Turner Syndrome.

PTS comprises of three phases.

Phase 1: This is the acute pain phase. This phase involves severe and sudden pain that affects the shoulder. This phase can last from a few days to few weeks. Longer this phase, longer it takes to recover.

Phase 2: Once the pain starts to ease, weakening of muscles develop leading to muscle atrophy. This phase typically lasts 6 to 18 months, but can last longer too.

Phase 3: After a period, muscles regain strength and functionality.

## What are the symptoms of Parsonage Turner Syndrome?

As mentioned above, sudden pain and subsequent muscle weakness happens to be the main symptoms of PTS. In 80% of cases it only affects one arm (unilateral), whereas in the remaining 20%, it affects both the arms (bilateral). PTS can also affect our lower trunk. Weakening of shoulder muscles can also affect the function of chest or diaphragm.

Although muscle pain happens to be the common symptom here, severity of symptoms can vary from one individual to another due to the specific nerves affected by this syndrome. Some of those symptoms are: Lack of muscle control in the shoulder or arm, Numbness, Swelling of hand, Red or spotted hands due to poor circulation, Partial shoulder dislocation and Shortening of muscles or tendons in the affected arm.

## What causes Parsonage Turner Syndrome?

Even though the exact cause of PTS is not known yet, scientists believe that an abnormal reaction of our immune system happens to be the main cause. The following 2 reasons were put forward by scientists for causing PTS: 1) Parasitic, bacterial or viral infections directly affecting the brachial plexus. 2) Immune system directly attacking antigens causing the damage of brachial plexus.

And also recent viral infections due to viruses like HIV, Coxsackie B virus and Parvovirus B19 can trigger PTS in human body.

Diagnosing PTS: First, a physical exam is conducted.

Later on electromyography (EMG) is recommended by the doctor to the patient, if the doctor believes that the patient might be suffering from PTS. Electromyography is a test conducted to figure out the functioning of skeletal muscles and nerves supplying them. Other tests include Nerve Ultrasound, Computed tomography scan and Magnetic Resonance Imaging (MRI).

MRI is pretty much sensitive in detecting signal abnormalities in the muscles of the shoulder girdle of patients with PTS. In a study conducted between the years of 1997 and 2005, 26 patients affected by PTS were diagnosed by the help of MRI. In the study it was concluded that brachial plexus and shoulder in patients showed intramuscular denervation changes involving one or more muscles of the shoulder girdle, with supraspinatus and infraspinatus muscles to be affected the most. And thus it was concluded that MRI could be used in accurately diagnosing the syndrome.

Risk factors for developing PTS: Risk factors for developing PTS include: Vaccines, Radiation therapy, Pregnancy, Shoulder injury, Anesthesia and Autoimmune conditions like Lupus and Polyarteritis Nodosa.

## Treatment

Even though there is no any specific treatment for this syndrome yet, early diagnosis and care by a group of specialists including Neurologists, Physical therapists, Orthopaedists, Primary care physicians and Neuromuscular disease specialists can help in recovering from this syndrome as early as possible.

Before physical therapy is recommended to patients, doctors evaluate the pain levels, shoulder strength and nerve function of the patient. Once the above mentioned factors are accessed, a physical therapy program is designed for the patient.

Therapies for phase 1 of PTS include: Acupuncture, Oral corticosteroids (Glucocorticoids can be given to reduce inflammation of the nerve), Transcutaneous electrical nerve stimulation and immobilizing arm by limiting use of it or using a shoulder stabilizer. Pain medications (pregabalin, gabapentin), antidepressant medicines and anti-seizure medicines can be used for relief from nerve related pain.

Therapies for phase 2 and 3 of PTS include: Physical therapy and Co-analgesics.

In case of severe cases, surgical methods such as nerve grafting or tendon transfers may include.

## How to prevent Parsonage Turner Syndrome?

Since the exact cause of PTS is not known, there is nothing that can be done to prevent it. Staying as healthy as possible by protecting our immune system, avoiding arm and shoulder injuries may help lower the chances of getting PTS.

## References:

1. <http://rarediseases.org>
2. <https://my.clevelandclinic.org/health/diseases/15390-parsonage-turner-syndrome>
3. <https://pubmed.ncbi.nlm.nih.gov>



# UNLEASHING THE BRAIN'S HIDDEN SUPERPOWER: NEUROPLASTICITY

The blog discusses the concept of neuroplasticity, the brain's remarkable ability to adapt and rewire itself in response to experiences, learning, and challenges. The blog underscores the significance of neuroplasticity in revolutionizing therapeutic approaches for neurological and psychological disorders, offering hope for enhanced cognitive function and personal growth.

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The complex and intricate human brain holds a secret superpower that has captivated scientists, educators, and individuals seeking personal growth: neuroplasticity. This phenomenon reveals the brain's astonishing ability to rewire itself in response to experiences, learning, and even adversity. In this blog, we will embark on a journey through the world of neuroplasticity, uncovering its mechanisms, applications, and the profound implications it holds for human potential.

plasticity, axonal sprouting, and cortical remapping. Changes in synaptic transmission can lead to long-term potentiation or long-term depression, resulting in physical modifications to dendritic spines and neuronal circuits. Notably, the brain's plasticity is most prominent during early development, wherein the overproduction of synapses enables enhanced plasticity, later pruned during adolescence.

## 1. Unraveling the Neuroplasticity Puzzle

Neuroplasticity, often referred to as the brain's hidden superpower, challenges the traditional notion of the brain as a static entity. It is the brain's innate capacity to adapt, reorganize, and form new neural connections throughout life. This capacity extends from infancy to old age, allowing us to continuously learn, recover from injuries, and adapt to changing environments causing structural and functional changes to the brain. Neuroplasticity refers to the nervous system's capacity to alter its activity in response to intrinsic or extrinsic stimuli by reorganizing its structure, functions, or connections. This adaptability occurs through mechanisms such as synaptic

**10 PRINCIPLES OF NEUROPLASTICITY**

Neuroplasticity is the brain's remarkable ability to form new pathways and strengthen connections – even following injury. Use these principles to make the most of your rehabilitation and create positive changes in your brain.

|  |  |
|--|--|
| <p><b>USE IT OR LOSE IT</b><br/>Every thought, action, movement, and skill has a specific set of connections in your brain. When you don't practice something for an extended period of time, the pathways for that task start to weaken, and they get weaker over time.</p> | <p><b>SPECIFICITY</b><br/>You have to train your brain in very specific ways. Learning something new or re-training an old skill (rather than going through the motions of something you already know) helps increase connections in the brain.</p>                        |
| <p><b>USE IT &amp; IMPROVE IT</b><br/>However, if you practice something a lot, these connections can grow and become stronger. Training a thought or a behavior (and doing it regularly) can lead to improved speed and performance.</p>                                    | <p><b>AGE</b><br/>Our brains are the most flexible and adaptive when we are young. But brains can grow and change at any age! Effects are generally better in individuals with greater physical and mental activity.</p>   |
| <p><b>SALIENCE</b><br/>Emotions can affect the strength of memory consolidation. If therapy is made interesting or important to you (e.g. incorporating hobbies or interests), you can more easily remember new skills or pieces of information.</p>                         | <p><b>TIME</b><br/>If therapy targets changing, increasing, and strengthening the pathways in your brain (using these principles), it should work any time. However, there may be windows of time where progress happens at a faster rate.</p>                             |
| <p><b>REPETITION</b><br/>Repetition of a learned (or re-learned) behavior is required for long-term changes in the brain. You need thousands of repetitions to master a skill. The more time you've spent practicing, the better you perform.</p>                            | <p><b>TRANSFERENCE</b><br/>Learning in one situation (like therapy) can generalize to other situations (like social settings). Similarly, training one specific skill can sometimes activate the pathways of nearby, untrained items and improve those skills as well.</p> |
| <p><b>INTENSITY</b><br/>If you do something that doesn't challenge you, you won't see much of a difference. Intensity can be the number of times you do an exercise or how difficult it is. Try to find an intensity that is one step above your current level.</p>          | <p><b>INTERFERENCE</b><br/>Neuroplasticity means the brain is always learning. But it doesn't know the difference between good and bad. Maladaptive habits or practicing the wrong things might interfere with the changes you want to make.</p>                           |

Source: Klein JA, Jones TA. Principles of experience-dependent neural plasticity: implications for rehabilitation after brain damage. *Journal Speech Lang Hear Res*. 2008;46(2):1-1225-39. doi: 10.1044/1092-4388(2008)0018

**ATLAS APHASIA CENTER**  
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## 2. Mechanisms Driving Neuroplasticity

A. Synaptic Plasticity: Synaptic plasticity lies within the heart of neuroplasticity, where neural connections (synapses) between neurons strengthen or weaken based on experience and use. Long-term potentiation (LTP) and long-term depression (LTD) are fundamental processes in synaptic plasticity.

- Synaptic plasticity can be positively influenced by several things, including, but not exclusively, exercise, the environment, repetition of tasks, motivation, neuromodulators (such as dopamine), and medications/drugs. Ageing and neurodegenerative diseases have been associated with a decrease in neuromodulators and may contribute to a reduction in the ability of synaptic plasticity.
- Spike-timing-dependent plasticity (STDP): This incorporates the timing of action potentials generated by presynaptic and postsynaptic neurons to explain how some synapses are strengthened and others are weakened.
- Metaplasticity: This broadens the concept to include networks and involves the activity-dependent changes in synapses and how they respond.
- Homeostatic plasticity: Mechanisms that maintain homeostasis of the synaptic network over time.

Adult neurogenesis: Adult neurogenesis is the concept that the brain continues to make new neurons. There have been two proposed sites of adult neurogenesis in humans, one in the olfactory bulb and the other in the hippocampus.

B. Structural Plasticity: The brain's structure can also change through the growth of new dendrites, the formation of new synapses, and the rewiring of neural pathways. This structural flexibility contributes to learning and adaptation.

C. Functional reorganization: This refers to the brain's ability to rearrange its neural connections and functions in response to changes such as injury, learning, or environmental factors,

demonstrating its inherent neuroplasticity; which is well described in terms of Equipotentiality and vicariation. Equipotentiality is the concept that when one area of the brain is damaged, the opposing side of the brain would be able to sustain the lost function. This concept morphed into equipotentiality, meaning that if the damage occurred very early, then the brain has the potential to be able to overtake lost functions. This is slightly different from the thought of variation, which is that the brain can reorganize other portions of the brain to overtake functions that they were not intended to.

D. Cross-Modal Plasticity: In cases of sensory deprivation, such as blindness or deafness, the brain may redistribute resources to enhance other senses, demonstrating the brain's adaptability.

## 3. Applications of Neuroplasticity

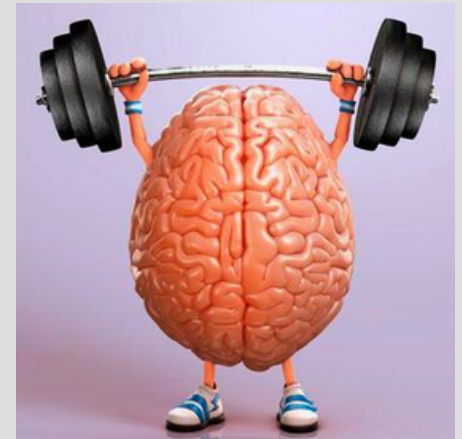
A. Learning and Skill Acquisition: Neuroplasticity enables us to learn new skills, acquire knowledge, and adapt to novel situations. It underscores the potential for lifelong learning and personal development.

B. Recovery from Brain Injury: Neuroplasticity plays a vital role in rehabilitation after brain injuries, allowing the brain to reroute functions from damaged areas to healthier ones.

C. Overcoming Neurological Conditions: The brain's adaptability offers hope in treating neurological conditions such as stroke, traumatic brain injuries, and neurodegenerative diseases through targeted interventions such as:

Task-Specific Training: Customized exercises target deficits and retraining functions.

- Constraint-Induced Movement Therapy (CIMT): Constraining limbs encourages use and recovery.
- Virtual Reality (VR) and Gaming: Immersive technologies enhance motivation and engagement.
- Transcranial Magnetic Stimulation (TMS): Non-invasive stimulation fosters recovery.
- Cognitive Rehabilitation: Exercises address cognitive deficits, promoting adaptation.

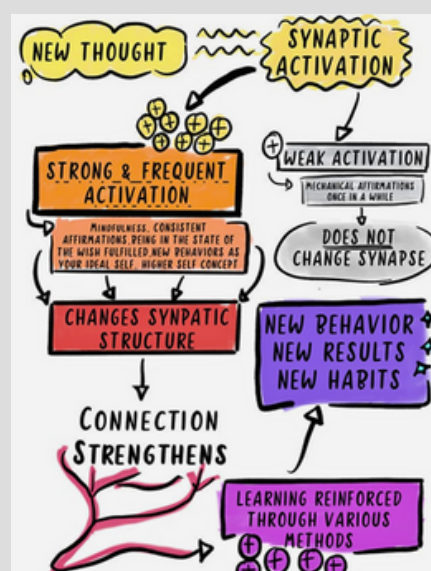


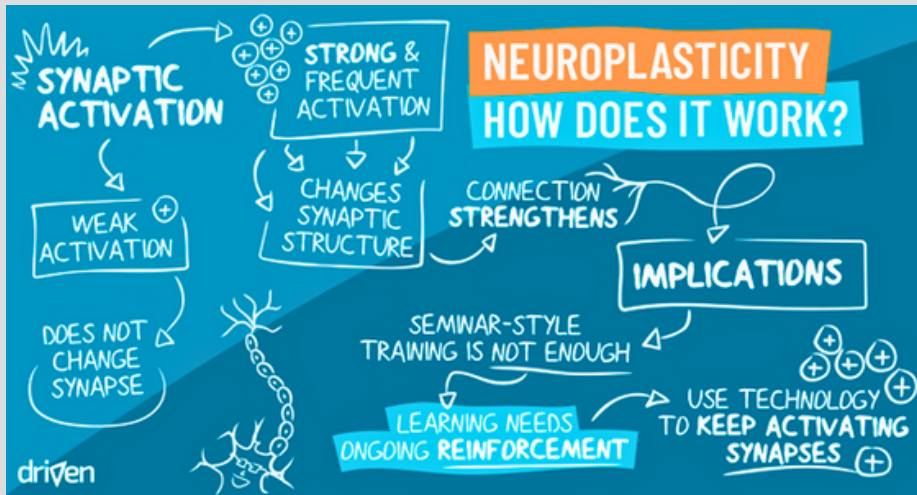
## 4. Strategies to Unleash Neuroplasticity's Potential

A. Feed your brain: Diet and nutrition significantly impact brain health and plasticity. Diets rich in omega-3 fatty acids, antioxidants, and other essential nutrients, such as the Mediterranean diet, support brain health and promote neuroplasticity. Conversely, diets high in processed foods and sugar may negatively impact brain health.

B. Take naps: Sleep is another critical factor in neuroplasticity. During sleep, the brain undergoes several restorative processes, including the consolidation of memory and learning, which involve neuroplastic changes. Chronic sleep deprivation can impair these processes, negatively affecting neuroplasticity and cognitive function.

C. Exercise: Physical exercise is another powerful modulator of neuroplasticity. Aerobic exercise, in particular, appears to have the most significant impact on brain function, promoting neurogenesis, angiogenesis, and the release of neurotrophic factors such as brain-derived neurotrophic factor (or BDNF for





short), thus enhancing cognitive function and potentially mitigating cognitive decline associated with ageing or neurodegenerative diseases.

D.Practice mindfulness: Mindfulness-based practices, such as meditation, have been linked to enhanced neuroplasticity. Regular meditation promotes changes in brain regions associated with attention, emotion regulation, and self-awareness. These practices may contribute to improved cognitive performance and emotional well-being, making them a valuable tool for promoting neuroplasticity.

E.Use the “wrong” hand: Using the non-dominant hand for forming new neural pathways as well as strengthening the connections between existing neurons. These changes may arise from increased access by the non-dominant (right) hemisphere to dominant (left) hemisphere mechanisms specialized for end-point precision control.

F.Lifelong Learning: Engaging in continuous learning and exploring new challenges keeps the brain engaged and encourages the formation of new neural connections.

G.Cognitive Training: Targeted brain exercises and cognitive training programs can stimulate specific brain regions, enhancing their plasticity and optimizing cognitive function. Engaging in cognitively stimulating activities, such as puzzles, chess, or language learning, challenges the brain and fosters synaptic plasticity. These activities are especially beneficial in ageing populations.

H.Environmental Enrichment and Neuroplasticity: An enriched environment with novel and stimulating stimuli supports neuroplasticity. Creating an environment with varied sensory experiences and opportunities for learning can enhance brain adaptability.

I.Social Engagement: Meaningful social interactions stimulate neural connections, contributing to cognitive vitality and emotional well-being.

References:

1. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4960264/#B4>
2. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5193480/#R28>
3. <https://www.ncbi.nlm.nih.gov/books/NBK557811/?report=reader#|po=67.6471>
4. <https://pubmed.ncbi.nlm.nih.gov/19489084/>
5. <https://pubmed.ncbi.nlm.nih.gov/26583189/>

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