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The Vascular System: A Roundtable

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Peripheral Vascular System

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Annotated Bibliography

Bickley, L., & Szilagy, P. G. (2012). *Bates' Guide To Physical Examination And History-Taking*. Lippincott Williams & Wilkins.

This is a chapter in Bates' guide to physical examination that speaks on the anatomical aspects of the cardiovascular system. The resource also contains many diagrams and pictures to show the technical positions and orientation of all of the system. The section also focuses mainly on the limbs (arms, and the legs) and the circulation within them.

Forni, D., Pozzoli, U., Cagliani, R., Tresoldi, C., Menozzi, G., Riva, S., ... & Clerici, M. (2014).

Genetic adaptation of the human circadian clock to day-length latitudinal variations and relevance for affective disorders.

Genome Biology, 15(10), 499.

The coordination of biological processes is present in many living organisms, as a representation of its functioning. This article can help us gain perspective on the regular functionings of the human body, and different examples of how a dysfunction may be manifested in a number of diseases, illnesses and syndromes

Halaris, A. (2013). Psychocardiology: moving toward a new subspecialty. *Future*

Cardiology, 9(5), 635-640..

Mainly talks about how stress, mood, and the cardiovascular system are all connected to each other and what makes them interact as they do. It also connects the cardiovascular system and the brain using the term 'psychocardiology'. This also talks about "mental

stress and its consequences” through the various mental stress disorders and what they effect within the heart

Hickie, I. B., Naismith, S. L., Robillard, R., Scott, E. M., & Hermens, D. F. (2013).

Manipulating the sleep-wake cycle and circadian rhythms to improve clinical management of major depression.

BMC Medicine, 11(1), 79.

This article shows the correlation between various links between circadian rhythm and the sleep wake cycle. It will also aid in bridging the gap between the heart and its relation to sleep cycles and rhythms. The article also talks about how you are able to manipulate your sleep cycle in order to positively help and manage depression.

Koch, H. J. (2013). Psychocardiology: The spectrum of stress in the genesis of heart disease: A point of view. *Research Reports in Clinical Cardiology*, 4, 153-159.

This article specifically focuses on the effects of depression, and other stress and the long term and short term effects on the cardiovascular system. This also talks about the risks and things associated that are directly seen as a result from various conditions or “states of mind”. Most, if not all, of the effects mentioned are negative and are very detrimental to the human body.

Magomedova, S. A., & Damadaeva, A. S. (2016). Medico-Social and Psychological Aspects of Cardiovascular Diseases. *Biology and Medicine*, 8(6), 1.

The article mentions research by foreign and domestic scientists that regard the well being of patients with various types of heart disease. It also talks about various rehabilitation processes for people with cardiovascular disease. It also mentions the prevention and necessary choices in order to stay safe or to control cardiovascular complications to their bodies.

Pritchett, D., Wulff, K., Oliver, P. L., Bannerman, D. M., Davies, K. E., Harrison, P. J., ... & Foster, R. G. (2012).

Evaluating the links between schizophrenia and sleep and circadian rhythm disruption.

Journal Of Neural Transmission, 119(10), 1061-1075.

An article describing the malfunctioning of the body in terms of sleep cycle and quality of brain processing.

Plante, D. T. (2015). Hypersomnia in mood disorders: a rapidly changing landscape. *Current Sleep Medicine Reports*, 1(2), 122-130

Defines the correlation of hypersomnia and depressive illness symptoms, another example of how the brain malfunctions when certain needs are not met. Can be related to the loss of sleep in high school student and what symptoms can be acquired when this continues for long periods of time.

Salavaty, A. (2015). Carcinogenic effects of circadian disruption: an epigenetic viewpoint. *Chinese Journal Of Cancer*, 34(3), 38.

Explains changing of moods related to sleep and other psychological disorders.
Also mentions carcinogenic (causing cancer) effects of sleep disruption and having a poor cycle and routine for sleep.

de Tommaso, M., Delussi, M., Vecchio, E., Scirucchio, V., Invitto, S., & Livrea, P. (2014).

Sleep features and central sensitization symptoms in primary headache patients.

The Journal Of Headache And Pain, 15(1), 64.

This article provides new viewpoints on hypersomnia and on other various sleep related disorders. It talks about new views and potential directions to take future research in this field. It also will talk about ways that researchers and scientists will try to figure out new and promising finds in this field of research. It also shows the bridge between hypersomnia and individuals moods.

All systems of the human body are interconnected while working together to maintain homeostasis. When there is a malfunction in one area of the body, this affects other less apparently connected systems; this holds true for the peripheral vascular system and normal mental functioning. Stress can lead to many negative degenerative effects on the body and the peripheral vascular system. This may manifest through a variety of symptoms or disorders, such as mental illness or sleep disorders. When alternative methods to medication are practiced, stress will be relieved, healthy sleep will return to the patient and the body will gradually return to homeostasis.

The peripheral vascular system consists of the arteries, veins and capillary beds which provide circulation to the arms and legs along with the lymphatic system, which helps protect and maintain a healthy fluid environment by filtering and draining lymph away from each section of the body. When the peripheral vascular system is functioning correctly, it provides oxygenated blood to all systems of the body. The arteries of the body carry oxygenated blood from the heart to the rest of the body in contrast to the veins that carry previously oxygenated and now deoxygenated blood back into the heart from the body. There are tiny vessels, called capillaries, between arteries and veins that distribute oxygen-rich blood to all tissues of the body. Because of this the vascular system plays an important role in all systems that contribute to a metabolically stable functioning system. Within the respiratory system, the capillaries commit an exchange of gases such as oxygen and carbon dioxide. Carbon dioxide is released from the body through the lungs and oxygen is taken into the body through the blood. Within the digestive system blood serves as a vessel for picking up and transporting nutrients received during digestion, such as sugar, vitamins and minerals. The blood then delivers these nutrients to the necessary body tissues. Within the excretory system waste materials from the body tissues are

filtered out from the blood with the help of the kidneys, this waste material then leaves the body in the form of urine. The peripheral vascular system also partakes in the regulation of the body's temperature, helping it maintain homeostasis, since heat is a byproduct of the lysis of nutrients which occurs within the body's tissues (Hopkins 2017).

There are several reasons why the peripheral vascular system wouldn't be at it's highest functioning level, such as blockage, damage or strain. When this occurs, nutrients and minerals can not be delivered to all necessary parts of the body resulting in a slow decrease in homeostasis within other systems. During sleep, autonomic cardiovascular levels can change due to poor sleep quality, which can be caused by an excessive use of technology, stress, or other circadian rhythm, disrupters (Hershner & Chervin 2014). Poor sleep quality leads to an increase in blood pressure, heart rate and peripheral vascular resistance. In people who have normal quality of sleep these values gradually decrease, but as the quality of sleep decreases the cardiovascular values increase or remain the same. This increase in nocturnal blood pressure is commonly seen in patients with sleep apnea and other sleep disorders (Pepin, Borel, Tamisier, Baguet, Levy, & Dauvilliers 2014). Insufficient sleep can also be correlated with poor attention and performance deficiencies, in addition to affecting a person's metabolism, hormonal regulation and immune system (Mullington., Haack, Toth, Serrador, & Meier-Ewert 2009).

Sleep disorders are defined as disruptions or changes in the way that you sleep (Mayo Clinic 1), which are usually one of three categories; lack of sleep, disturbed sleep, or excessive sleep.

As a commonly known complaint to the general population of the United States, the National Institute of Neurological Disorders and Stroke says that around 60 million people suffer from some form of sleep disorder nationwide. These conditions are extremely detrimental to

one's health in ways such as an increase of an individual's blood pressure, an increase in their stress level, poor nutritional habits, and even directly related to diseases which can cause a shortened life expectancy, such as heart disease, and diabetes. These conditions are very taxing to your health and have shown to be in direct correlation with various sleep disorders.

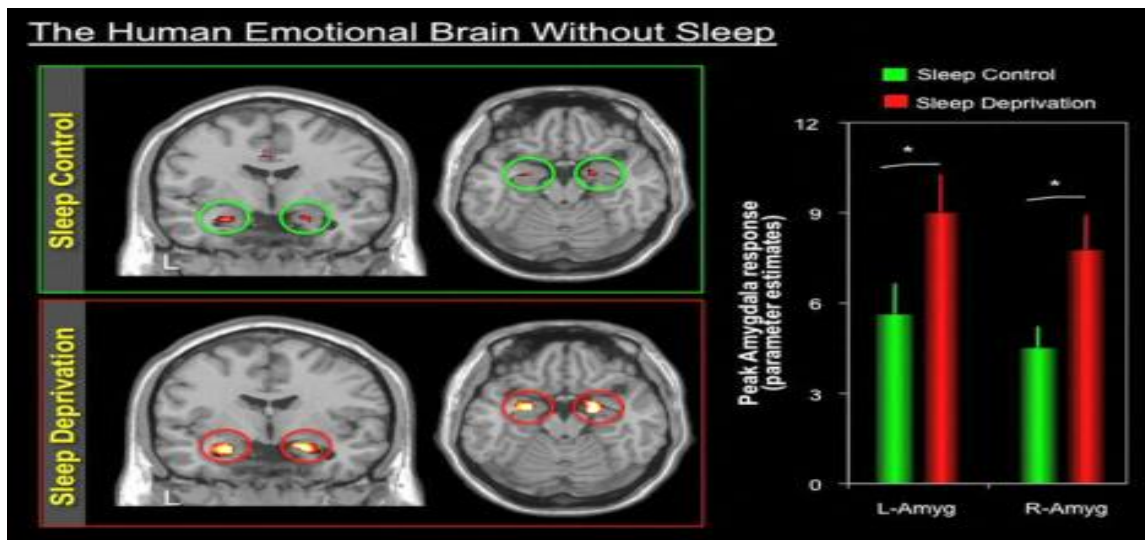
On the specificity of not receiving enough sleep at night, 9 hours a night is an important number for maintaining a healthy sleep schedule. According to the Mayo Clinic, there is a very distinct link between sleep deprivation (lack of sleep) and an increase in an individual's blood pressure which is caused by the body's tendency to poorly regulate stress hormones which would then have the effect of an increased blood pressure. This reasoning is where the magic number of 9 hours of sleep for having a healthy wellbeing comes into fruition. This bridge of body systems is a good example of what happens when the body is not recharged and things begin to fall out of homeostasis. Though these are some fairly direct correlations between sleep and your body system, there are a few ways that healthy and unhealthy sleeping habits negatively affect your health, specifically your vascular system.

In a Japanese study done that tested a variety of individuals (5000) with different sleeping habits and type 2 diabetes which showed that people who were on the end of the spectrum of sleeping more hours per night, had a lower A1C value which is a three month data collection of one's blood sugar. The people with poor sleeping habits had high A1C levels compared to the normal range, which meant higher blood sugar, which means that they most likely have more problems with the communication and control of blood sugar, than the ones who get adequate sleep. This correlation could also potentially have an effect on a person's BMI and their weight which, if in poor health, is an indirect and negative effect of a poor sleep cycle putting stress on the vascular system. This can usually be inferred because if someone's diet is poor, then there is

a much higher potential for accumulation of plaque buildup in vessels due to excessive fat and cholesterol in their diets. These negative health effects are in direct relation to the amount of sleep a person gets on a nightly basis and can also explain some of the bidirectional symptoms of sleep disorders and wellbeing such as if you eat poorly and don't exercise you could lack in getting enough sleep, which would make your eating habits and health worsen, which would make you sleep even less, and the cycle continues until one aspect (normally their diet or activity level) is changed and the person's overall wellbeing will change substantially then after.

Sleep disorders not only negatively affect your physical health, but they affect your mental health as well. Absence of a proper sleep cycle in one's life has been shown to directly and negatively affect your memory, comprehension, and even cause symptoms such as depression. The absence of sleep causes one to feel sluggish, unmotivated, and just continuously low in terms of levels of energy. The stress that is put on your body from being outside of normal functioning can put further stress on other body systems as well as your mental state. People who have depression are normally on edge and can be very unstable, indicating that their wellbeing is out of homeostasis, which causes problems. This altered mental state can also be bidirectional as it becomes a very self-fulfilling cycle. Many of the symptoms of depression correlate directly to the causes for sleep deprivation and insomnia, such as stress, anxiety, and negative or obsessive thoughts. It goes the other way too however, many of the things that result from a lack of adequate sleep can play a great role in someone developing depressive symptoms, therefore this relation can be defined as a positive feedback loop, for some. Using insomnia as a specific example, depression develops in people suffering from this disorder at a rate of 15-20 percent (Healthy Sleep 1). Another thing that this very exaggerated lack of sleep can cause is an increased level of stress and irritability. If you look at the diagram below you will see that there

are very specific parts of the brain that are affected by the amount of sleep one gets per day. This area of the brain is called the amygdala and it is located inside the grey matter of each cerebral hemisphere. These almond sized organs are actually one of the key factors that play into one's emotion.



This diagram shows that without a proper amount of sleep each day, someone's brain and emotional center may be experiencing up to almost a 200% increase of activity compared to what normal levels would be. This shows an almost hyper-sensitivity which explains the irritability, stress, depression, and other emotional symptoms that are quite often caused by not getting enough sleep at night.

Elevated stress levels will not only negatively impact your stress and mental functioning; it also affects your nutritional tendencies. When stressed people tend to eat without being conscious of the nutritional value of foods which is going to have a very negative effect on your body and many of its systems, especially if eating dopamine producing foods becomes a long term habit, as these foods are not usually considered nutritionally beneficial.

In addition to insomnia, many other sleep disorders can also have a malignant effect on your body, such as sleep apnea. It is known that if you have sleep apnea, the chance that it will

lead to hypertension in the future increases significantly (National Sleep Foundation 2017). There is also a high comorbidity rate between mental illness and cardiovascular disease. Patients with sleep disorders such as sleep apnea have had an increase in symptoms paralleled with mild depression such as fatigue, irritability, clumsiness, excessive worry and negative thoughts (Ohlethorpe 2017). This has led scientists to believe that the relationship between sleep apnea and mental illness such as depression or insomnia is bidirectional, meaning the symptoms of sleep apnea and the symptoms of depression or insomnia work as a positive feedback loop, no matter which manifests primarily, a display of the other is very popular and commonly seen; Symptoms that are present often positively impact the symptoms of the other to continue developing or increase in intensity. Patients with sleep apnea have also exhibited an over activity of the parasympathetic system which leads to an elevated blood pressure and the release of two hormones, norepinephrine and angiotensin- ii, these hormones involve vascular growth promoting factors. The hormones released then lead to an altering in structure and function of the vascular pathways which affects the ability of the vascular pathways to function as they should (Fletcher 2003).

There are hundreds of sleep disorders, one study done on mice looked at their functioning level when experiencing symptoms of chronic restrictive sleep (CSR), and observed the effect of CSR on the brain blood barriers of these organisms. After six days of CSR, the brain blood barrier, which is a large regulatory exchange interface between the brain and peripheral circulatory system, micro vascular functioning was recognizably compromised. CSR diminished the excretion of a number of hormones and the dioxy-glucose uptake volume by the brain (He, Hsuchou, He, Kastin, Wang & Pan 2014). This was after only six days of chronic restrictive sleep, which can be defined as receiving less than the usual amount of sleep. This data can be

used to estimate what effect chronic restrictive sleep has on people suffering from it for lengthy periods of time, diminished hormones and a decrease of nutrients received by the brain can also worsen a person's mental functioning.

Although some aspects of sleep disorders are not preventable, many of them are. Sleep disorders that are induced by stress, low sleep quality or obesity can be prevented by partaking in preventative measures. Getting enough sleep at night is a good idea and can help prevent many bad health problems and improve your overall wellbeing. An alternative to getting the recommended amount of sleep per night if you are already getting the advised number would be to practice certain preventative and relaxation methods such as yoga or acupuncture. There are many things that you can do to help improve your wellbeing that will have the added benefit of improving your vascular system. Yoga is very good for meditation and relaxing, in fact, the breathing exercises used in yoga mixed with the ergonomic body positions actually help slow respiration rate and lower your blood pressure which is extremely good for the health of your vascular system. Some subgenres of yoga practice mindfulness as well, which are focused on changing a person's mindset to a more calm and accepting one. In terms of practicing yoga and mindfulness long term this can help improve the way you approach situations, problems at home or mishaps at work. Mindfulness helps people keep a calm, collective mentality, which decreases a person's tendency to jump to irritation and anger, and to logically approach the situation instead. Mindfulness, yoga and acupuncture will also help you lower your stress levels and help decrease your chances of developing insomnia related symptoms, and help to improve the quality of sleep.

A healthy diet and regular exercise regimen should be adapted to ensure the offset of weight gain and as a byproduct of long term weight gain- obesity, which can also lead to sleep

disorders such as sleep apnea. In terms of creating a healthy lifestyle, by incorporating an exercise regimen and nutritionally beneficial choices, routine is key. Going to the gym for an hour twice a week is not going to be as effective and good for you if you were to go for 20 minutes, five days a week. Consistency helps to instill habits and practice these methods long term. Your body's natural state of homeostasis should also be in a routine that is constant and never changing. Another preventative measure that will prove very useful is simply regulation of your nutritional intake and to eat healthy. Just by simply eating healthy you can increase life expectancy, reduce the level of plaque buildup in vascular pathways, and easily have a better sleep schedule, which is not determined by the highs and lows of eating overly caffeinated or sodium containing foods. Foods with higher sugar levels and ones that contain simple carbs as opposed to complex ones will tend to not provide any energy throughout the day and can cause excessive sleepiness which will cause disruptions in your circadian cycle. It is important to be tired at the end of the day when you can relax and sleep will come freely, you do not want this in daily life because you become unproductive and irritable. A lot of this could be prevented simply by eating better and doing so consistently. Cardio work like running or any intense physical activity, can directly improve your vascular health as well. These activities help your heart work harder and keep it healthy as well as all of the connected vessels, veins, arteries, and more, which comprise the peripheral vascular system.

Not only are many of these techniques, routines and practices for maintenance of your body and regulation of your internal homeostasis, but they are also effective preventative measures for the diseases and disorders that are indirectly or more severely linked by things like sleep deprivation and adopting a poor diet.

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