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WHY
STRESS MATTERS

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WHY STRESS MATTERS

Let's start this section with a quick question.

What would you do?

What would you do if you knew there was a condition going around your neighbourhood that was considered by experts to contribute to over three-quarters of all trips to the doctor? [1]

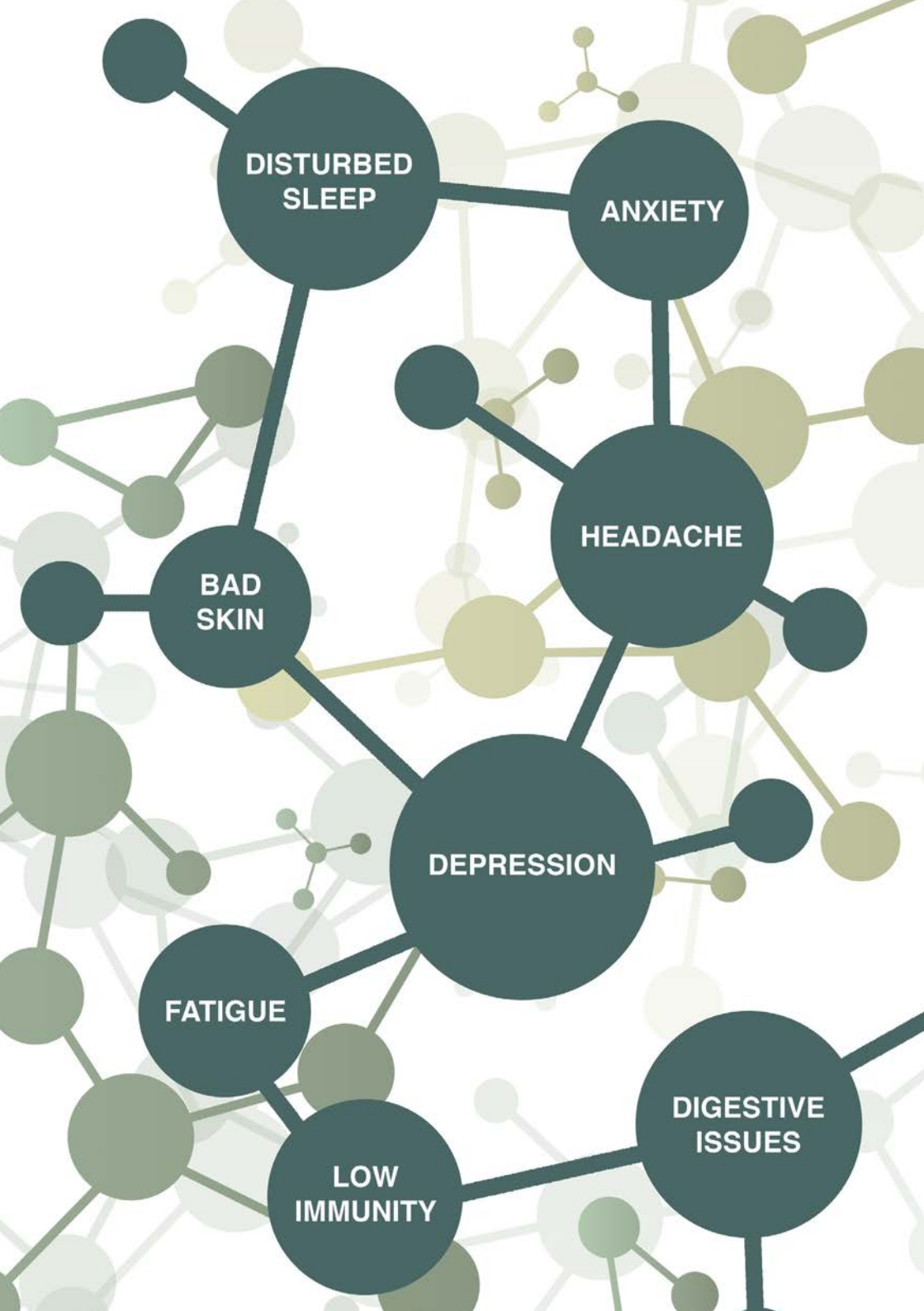
Would you do nothing and hope that you were lucky enough to avoid it? Or, would you try to learn about this epidemic so you could protect your health and wellbeing?

While it's sometimes nice to feel like you're a part of the crowd, it's unlikely you'd choose to simply stick your head in the sand. In fact, if you are reading this, we can tell that you're no ostrich!

It's not a stretch at all to classify stress as a health issue of epidemic proportion.

The American Psychological Association recently reported that almost seven out of ten people surveyed viewed stress to have a noticeable impact on their physical health. That's more than two thirds of all respondents. In fact, a significant majority reported their stress levels to be rising while one in five ranked their stress levels as extreme. [2] This is not just an American problem.

The symptoms of stress that are most often reported worldwide are illustrated on the next page.


DISTURBED SLEEP
ANXIETY
HEADACHE
BAD SKIN
DEPRESSION
FATIGUE
DIGESTIVE ISSUES
LOW IMMUNITY

These are all symptoms of a body living in a subconscious state of 'red alert,' and are just the tip of a concerning iceberg.

The physiological effects of living in a state of stress are significant.

- As we now know, the stress response is well designed to help us deal, in short spurts, with immediate threats and challenges.
- Leaving the stress tap open more consistently, however, can result in major challenges to the body's homeostasis, or balance.

In this section, we discuss how stress can potentially affect a range of systems and processes critical to your general health, wellbeing and performance.

- We have tried to keep the discussion clear, simple and to the point.
- Where possible, we've included references to appropriate materials and clinical studies to add further support to the points under discussion.

The intent is not to alarm, but rather to support the proposition that a clear mind and calm body can be a powerful force against imbalance and disease.

We trust that the following pages will provide a clear answer to the important question **"Why should I address my stress?"**

While this is the most detailed booklet in the module, it is neatly summarised in table form in the following few pages

Start by reading the summary tables. You can then progress to a more detailed explanation of those sections you find most interesting by turning to the page indicated.

BODY FUNCTION

	LINK TO STRESS	RESULTING EFFECTS
HYPER-TENSION	• When stressed, certain blood vessels constrict to direct blood flow away from the extremities and to areas key to fight and flight. • This can combine with a faster heartbeat to increase blood pressure.	Repeated blood pressure elevations can contribute to: • Hypertension • Increased risk of stroke • Damaged blood vessels • Reduced kidney function • Heart damage
HOW WE DIGEST	In a state of 'red alert' digestion is put on hold to conserve valuable energy. This is achieved by: • Diverting blood away from the digestive system • Disrupting the contractions of digestive muscles • Decreasing secretions needed to digest food	• Disruption of digestive acids • Reduced absorption of nutrients • Disrupted bowel movements • Inflammation of the gastrointestinal system • Muscular spasms
IMMUNE SYSTEM	• Persistent exposure to stress hormones can affect immune system efficiency. • Immune system efficiency can fall by more than 50% after sustained periods of major stress.	• Increased inflammation • Compromised immune system results in greater susceptibility to disease. • Potential for the immune system to turn on itself (auto-immune disease)
CHOLES-TEROL	• Studies show that stress can raise levels of LDL cholesterol (so-called bad cholesterol), and suppress levels of HDL cholesterol (so-called good cholesterol). • Stress lowers the rate at which Triglycerides (fats) are cleared from the bloodstream.	• Unhealthy cholesterol and triglyceride levels are potentially an indicator for heart disease.

BODY FUNCTION

	LINK TO STRESS	RESULTING EFFECTS
SLEEP	• The stress response can place the body in a state of hyper-arousal, making restful sleep hard to achieve. • Frequent stress episodes can disturb the circadian rhythms governing the body's sleep cycle. • Elevated stress hormone levels can prevent restful sleep, which in turn further elevates stress hormone levels (damaging cycle).	• Insomnia • Impaired reflexes and thought processes • Fatigue • Gastrointestinal symptoms • Tension headaches • Depression, irritability and anxiety
BONE HEALTH	• High levels of stress have been associated with lower bone density and reduced calcium intake.	• Weaker bone structure • Osteoporosis risk • Weaker teeth
MUSCLE HEALTH	• Under persistent stress the body begins to extract energy from proteins, the building blocks of your muscles.	• Weakening and breakdown of muscles • Poor muscle recovery after exercise
MUSCLE TENSION	• Muscle tension is one of the first physical symptoms of the stress response. • Stress hormones alert muscles to be primed for fight or flight. A shortened tense state is the sign they are ready to spring into action.	• Tension in shoulders and neck • Tension headaches • Compromised posture • Back pain • Tendonitis from joints under stress • Grinding teeth and aching jaw

BODY FUNCTION

	LINK TO STRESS	RESULTING EFFECTS
WEIGHT	• The stress response directs the body to procure greater amounts of fuel for energy. • This results in increased blood sugar levels and appetite swings. • This energy is only actually used in the rare event that our stress actually precedes robust physical activity.	• Increased stores of fat often in the most problematic areas • Secondary appetite increase particularly for high energy foods • Persistently high blood sugar levels may contribute to Type 2 diabetes onset
MOOD	• Studies have linked high levels of stress hormones to mood disorders including depression. • Hormones regulating mood and stress share the same internal transport systems.	• Transport of serotonin (feel good hormone) may be impeded under chronic stress • Genes linked to depression can be 'triggered' by stress • High levels of stress hormones can disrupt the body's chemical messaging system
ANXIETY	• Persistent stress can cause the areas of the brain associated with fear and anxiety to grow in size and activity. • High levels of stress hormones may shrink the hippocampus (area of the brain responsible for memory and regulation of the stress response).	• Increased tendency towards anxiety • Temporary memory loss may occur when under stress • Permanent memory loss may occur if stress becomes chronic • Reduction in the number of communication circuits in parts of the brain and nervous system
SKIN	• Stress can affect your appearance by making your skin more sensitive and reactive. • Stress-induced inflammation can result in a number of serious skin conditions.	• Increased oil production • Aggravation of conditions like psoriasis, rosacea, hives, eczema and acne • Reduced healing properties • Loss of collagen

BODY FUNCTION

	LINK TO STRESS	RESULTING EFFECTS
AGEING	• Chronic stress may shorten telomeres, the structures in our cells which dictate cell longevity. • High levels of stress hormones may shrink the hippocampus (area of the brain responsible for memory and regulation of the stress response).	• Shortened telomeres may cause cells to die prematurely, resulting in symptoms of ageing. • Chronic stress may result in a degenerative cycle affecting memory and resilience.
HAIR LOSS	• Hair growth may slow or stop temporarily in response to stress. • Stress may affect the cells that add colour to hair.	• Hair may be lost up to 3 months after a major stress event or period. • Stress may cause premature greying of hair.
HEART DISEASE	• Chronic stress is a good predictor of heart disease. • Anxiety patients may be 3-4 times more likely to succumb to heart disease. • Stress is linked to hypertension, cholesterol and obesity levels, all indicators for heart disease.	• Damage to blood vessels • Enlargement of the heart's left ventricle • Heart attack • Arrhythmias
DENTAL HEALTH	• Stress-related muscle contractions can cause grinding and clenching motions in the jaw. • Conditions in the mouth may be adversely altered by reduced saliva production. • Stress can cause weakening in the bone structures of the body and inhibit calcium absorption.	• Tooth wear and breakage • Dry mouth syndrome • Pain and limited movement of the jaw • Headache • Earache • Periodontal disease

BLOOD PRESSURE AND CIRCULATION

The essentials of life are transported in your blood. Stress can play havoc with the deliveryman.

A raised heart rate is one of the body's first responses to stress.

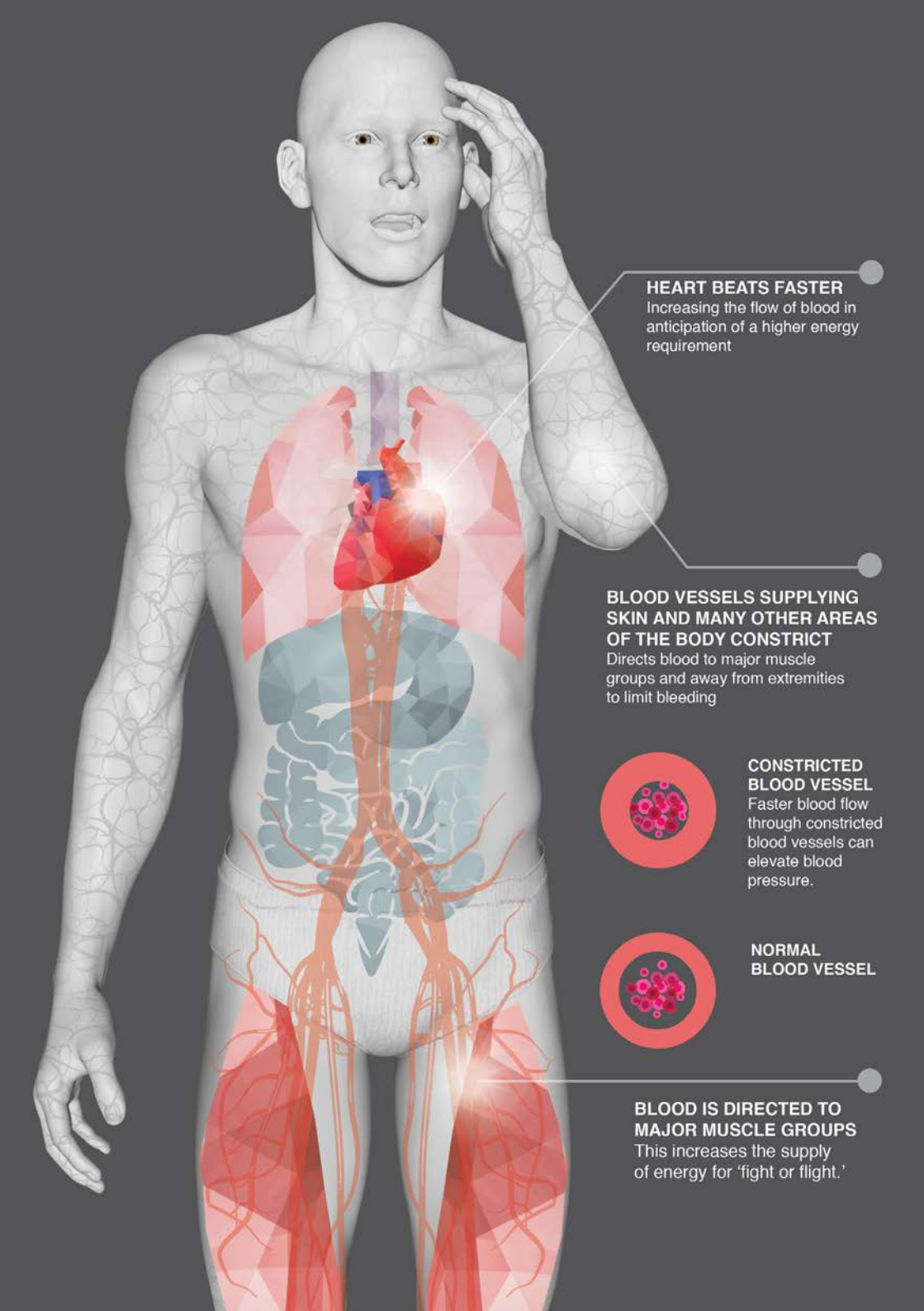
"She saw the big crowd and her heart started racing."

"His heart began to pound when they read out his name."

- The faster your heart beats, the quicker blood circulates around your body delivering the fuel and oxygen you need to respond to a perceived threat.
- Normally a faster heartbeat may only have a limited effect on increasing blood pressure, but when you are under stress, there are more factors at play.

Stress hormones direct blood flow by constricting certain blood vessels.

- Pumping blood around the body faster is one thing, but to get it to the right places is also important.
- When you are stressed, your body will direct blood towards the necessary areas to prepare you for action. This is achieved by the constriction of certain blood vessels, which diverts flow to the muscles in your legs, for example.
- This constriction can further increase blood pressure in the same way as squeezing a hose might do. [1]
- In a similar manner, blood is cleverly directed away from your extremities, restricting blood loss in case of injury.


HEART BEATS FASTER
Increasing the flow of blood in anticipation of a higher energy requirement
BLOOD VESSELS SUPPLYING SKIN AND MANY OTHER AREAS OF THE BODY CONSTRICT
Directs blood to major muscle groups and away from extremities to limit bleeding
CONSTRICTED BLOOD VESSEL
Faster blood flow through constricted blood vessels can elevate blood pressure.
NORMAL BLOOD VESSEL
BLOOD IS DIRECTED TO MAJOR MUSCLE GROUPS
This increases the supply of energy for 'fight or flight.'

Ever wondered why people go pale when they get a fright? Well, that would be the stress response directing blood away from the skin's surface.

Clever, isn't it?

Well yes, but it's only clever if you really are in physical danger. If you're sitting at your desk worrying about a deadline, all it does is put your system under unnecessary pressure.

High blood pressure becomes problematic mainly when it is persistent. This may contribute to the medical condition known as hypertension.

- Our bodies are capable of dealing with short bursts of higher blood pressure, in fact, this is essential to our design.
- However, stress can contribute to hypertension via repeated blood pressure elevations.

High blood pressure may be a primary contributor to a number of serious conditions including: [2]

- Stroke
- Burst blood vessels
- Atherosclerosis (hardening of arteries)
- Kidney failure
- Heart attack

A variety of treatments are considered effective in reducing blood pressure and the development of hypertension.

Learning to effectively address stress is one of them.

Reviewed March 2014 by:
Dr Ross Walker (Preventative Cardiologist and media presenter)

"There is no doubting the link between all forms of cardiovascular disease, high blood pressure and stress. Stress management techniques are a vital part of the long term management of cardiovascular disease and hypertension and should be incorporated into every preventative cardiovascular program." - R. Walker

DIGESTION

Eating properly is essential to good health. Digesting properly is just as important.

Poor digestion may mean the nutrients we consume are less accessible and not properly absorbed by the body.

Stress can have a profound effect on almost every part of the digestive system. [1]

Why? Because digestion is regulated by the nervous system, the same system that helps govern your stress response.

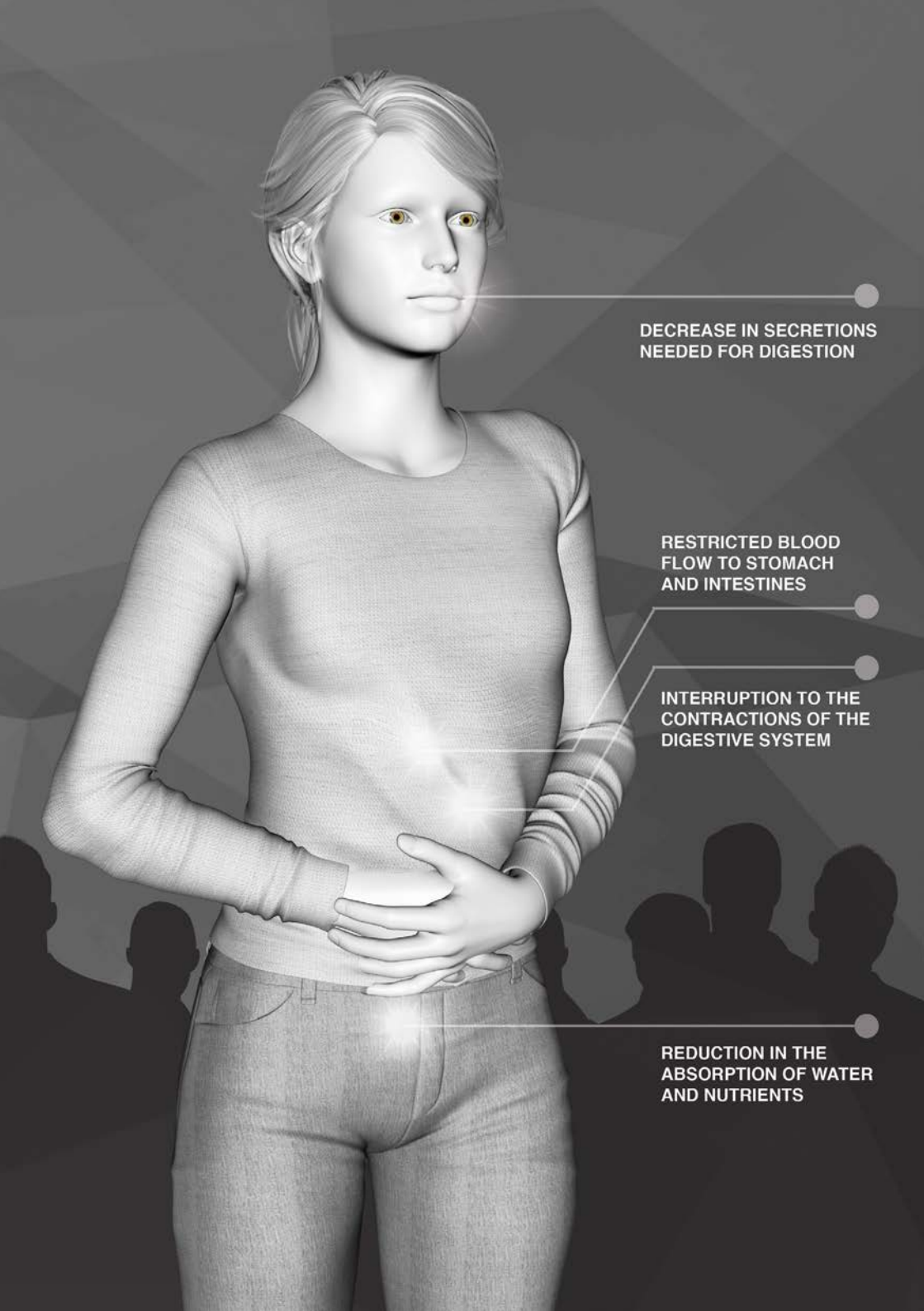
- When the stress response is invoked, digestion is not seen as one of the critical functions to 'fight or flight.' In fact, it is perceived as an energy intensive process that can wait until your brain considers you to be 'out of danger.'
- When stressed, your body is all about prioritising the short-term. Lunch will keep in your stomach for a few minutes while you race to make that important meeting across town. All perfectly sensible. Clever design.

But what if that stress response is never fully turned off? What if your mind gets stuck in a state of alert, never quite getting back to the focus of digesting that sandwich in your belly?

Well, that's when your stomach starts talking back!

Stress can cause your body to shut down digestion by:

- Restricting blood flow to the stomach and intestines
- Interrupting contractions of the digestive system
- Decreasing the secretions needed for digestion
- Reducing absorption of water and nutrients [2,3]


DECREASE IN SECRETIONS NEEDED FOR DIGESTION
RESTRICTED BLOOD FLOW TO STOMACH AND INTESTINES
INTERRUPTION TO THE CONTRACTIONS OF THE DIGESTIVE SYSTEM
REDUCTION IN THE ABSORPTION OF WATER AND NUTRIENTS

In fact, digestive disruption starts at the very beginning of the whole process.

Have you ever had a dry mouth before speaking in public?

- That can be caused by the suspension of saliva production, which is stage one of your digestive process.

Have you ever experienced an unsettled, growling stomach while making an important decision?

- Well, you can often thank reduced gastrointestinal blood flow and interrupted digestion for that excess gas in your intestine.
- Digestive contractions, designed to move things along, complete the growling symphony. There's a lovely name for this whole performance ... borborygmus. [4] Funny name for an embarrassing and uncomfortable affliction.

Have you ever wondered why you often feel the need to run to the bathroom before an exam or important engagement?

- Most likely it's due to abnormal digestive contractions and interrupted absorption in your intestines.
- Some physiologists believe 'lightening the load' is all part of your body's 'fight or flight' strategy.
- Either way, this inconvenience is likely caused by a stress response that's focused on preparing you for far more than just arithmetic.

The crux of the matter is rather straightforward. When you are stressed, your brain is putting digestion and absorption on hold, and giving priority to those functions that are more immediately necessary in a state of alert.

Failing to manage your stress can cause these digestive issues to be both consistent and persistent.

The resulting health issues can be significant, ranging from mild indigestion to gastrointestinal spasms and the inflammation of large areas of the digestive tract.

A calmer, less stressed mind can give the digestive system the ‘all clear’ to resume its critical duties.

IMMUNE SYSTEM HEALTH

Your immune system stands between you and a host of potential afflictions. Persistent stress can cause it to break down, taking your health and vitality with it.

A broad range of clinical studies have concluded that stress has a measurable negative effect on your immune system.

- In 2004, two PhD students from the University of British Columbia and the University of Kentucky embarked on an analysis of nearly 300 studies on stress. Their research concluded that extended periods of stress can be seen to have a clear negative effect on the immune system. [1]

Well, perhaps it takes a detailed study by two pros to bring to our full attention what we probably all suspected by the time we turned twelve.

The more stressed we are … the more often we get sick!

Stress hormones have a love-hate relationship with your immune system.

- The presence of the stress hormone cortisol initially gives a short-term boost to the immune system. This is useful to help us deal with an immediate threat.
- But if the stress is persistent, it may eventually result in a deregulation of the immune system, leaving us vulnerable to infectious disease and an inflammatory state in the body.
- Studies show that after sustained major stress, the activity of the immune system can operate at less than 50% of its base level. [2]

An immune system under persistent stress may expose us to more than just a few extra infections each season.

Inflammation is one of the ways the body protects and repairs. As such, it's certainly useful. The problem is that prolonged exposure to high levels of the stress hormone cortisol may cause the immune cells that regulate inflammation to lose some of their efficiency.

Studies have linked chronic psychological stress to the body's loss of ability to regulate inflammation. [3]

The resulting state of runaway inflammation may lead to more chronic and serious conditions, such as:

- Atherosclerosis [4]
- Some types of cancer [5]
- Osteoporosis [6]
- HIV progression [7]
- Autoimmune disorders such as rheumatoid arthritis [8]

The power of stress hormones to affect our immune system, and subsequently our health, was recently evidenced in a study at UCLA (University of California Los Angeles).

- The researchers found that exposure to the stress hormone cortisol suppressed the immune cells that are responsible for activating an enzyme that affects cell ageing.[9]
- This has major implications for the regulation of the ageing process in general. See page 64 for more detail.

Reviewed March 2014 by:
Dr Will Shepperd (BM MRCS MRCGP FRACGP)

"In all respects the article uses reasonable sources of reference and reads without contradiction." - W.Shepperd

CHOLESTEROL AND TRIGLYCERIDE LEVELS

Just as the food you eat may affect your fat and cholesterol levels, so too does the stress you carry.

Persistent stress can raise your cholesterol levels.

This is the conclusion of a number of studies including a 2005 research article reported in one of the American Psychological Association's publications.[1]

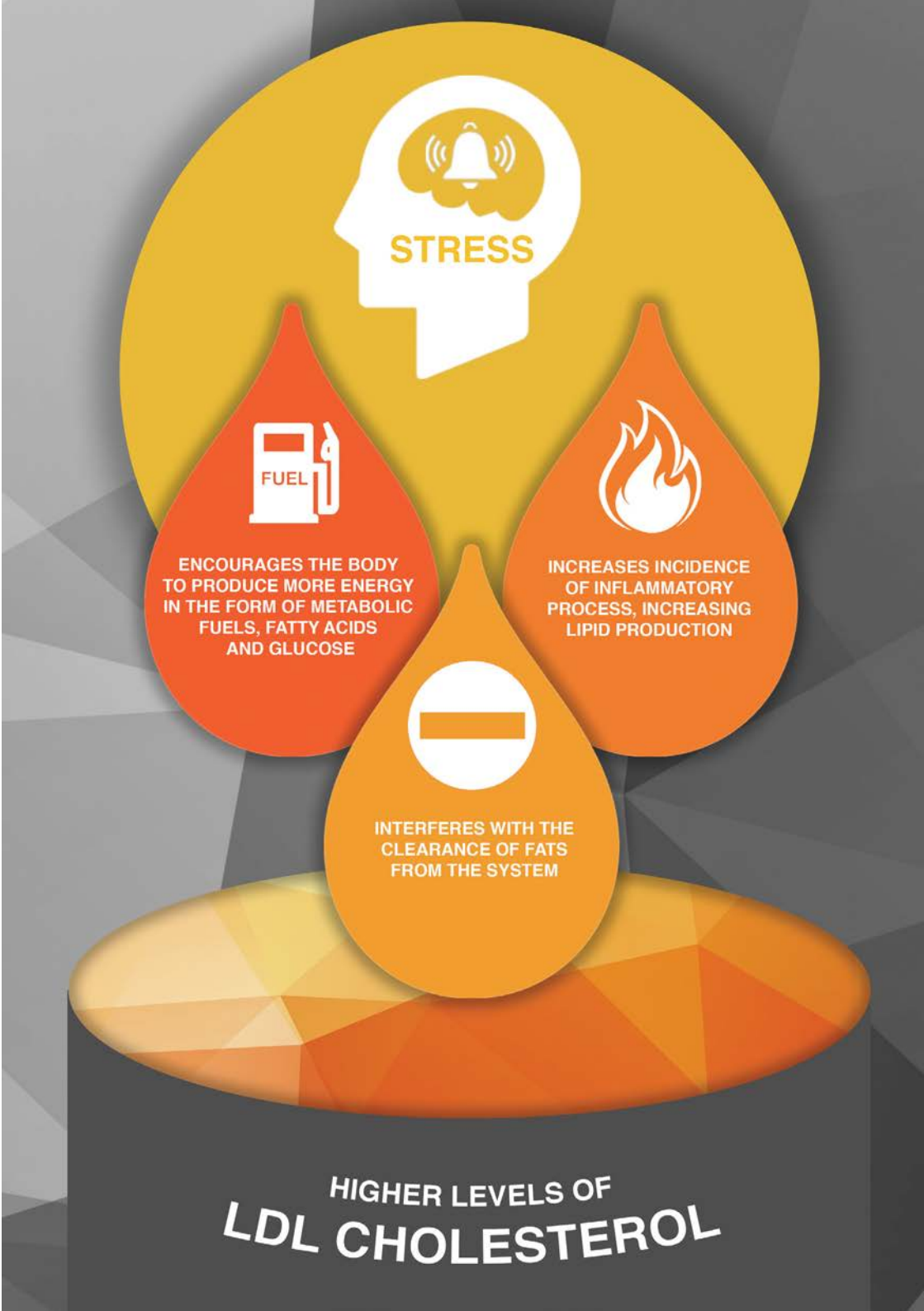
The researchers examined 199 healthy adults.

- Those participants showing a high tendency towards stress reported significantly higher cholesterol levels as the study progressed than their calmer counterparts.
- Those in the top third of stress responders were three times more likely to have elevated LDL cholesterol levels (often described as bad cholesterol) than those in the bottom third.

These findings are both fascinating and concerning. They also help explain why avoiding cheeseburgers may not be enough to beat persistently high cholesterol levels in the modern world. While the factors responsible for these results are still being researched, potential reasons for these outcomes may include: [1]

- Stress encourages the body to produce more energy in the form of metabolic fuels like fatty acids and glucose. These substances require the liver to produce more LDL*, which is the principal carrier of cholesterol in the blood.
- Stress drives a number of inflammatory responses that may increase lipid production, and potentially LDL cholesterol.

The study found different individuals responded in different ways, but the overall results were compelling.


STRESS
FUEL
ENCOURAGES THE BODY TO PRODUCE MORE ENERGY IN THE FORM OF METABOLIC FUELS, FATTY ACIDS AND GLUCOSE
INCREASES INCIDENCE OF INFLAMMATORY PROCESS, INCREASING LIPID PRODUCTION
INTERFERES WITH THE CLEARANCE OF FATS FROM THE SYSTEM
HIGHER LEVELS OF
LDL CHOLESTEROL

There is also evidence that stress may reduce levels of HDL* cholesterol (commonly known as good cholesterol). [2]

These findings are concerning. The combination of increased LDL cholesterol and reduced HDL cholesterol is considered a particularly strong indicator for cardiovascular disease.

Last, but certainly not least, stress may interfere with the clearance of fats from your system.

Researchers at Ohio State University conducted tests on how quickly triglycerides (a type of fat) cleared out of the bloodstream during a stress-inducing test compared to a session in which the studied volunteers rested. [3]

The results showed that, in all cases, stress caused triglycerides to stay in the bloodstream longer.

The co-author of the study had this to say about the results:

"During stress people are not metabolizing fat as rapidly or efficiently. If a person has a high-fat snack or meal during a time of stress, that fat is going to be circulating in the blood for a longer period of time. That means it may be more likely to be deposited in the arteries where it can contribute to heart disease.[2]"

Now that is food for thought!

**LDL and HDL are molecules called lipoproteins. Their role is to transport molecules through the body that can't dissolve into the blood, such as cholesterol.*

SLEEP

The stress response is like an alarm system for your body. Leaving it on affects your ability to sleep well.

It's been another manic day at work. You've just hung up on the second telemarketer for the evening and you have a pile of bills to pay before crawling into bed. The red ink on your credit card statement flashes before your eyes as you turn out the lights. Good night. Ha! Yeah, right.

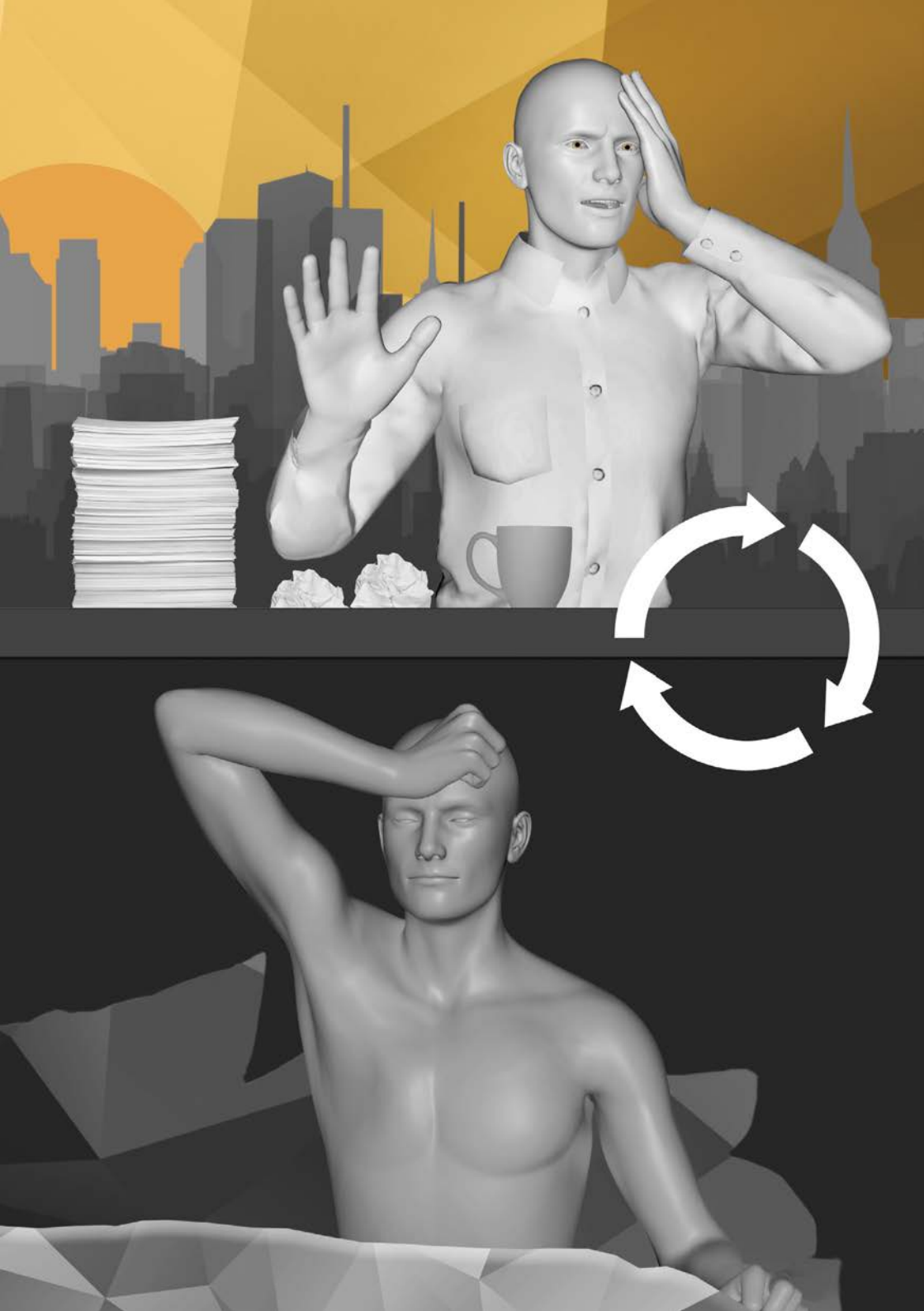
There's not much chance of a restful sleep while your brain still has your body in a state of alert.

In fact, elevated stress may cause a state of hyper-arousal that can directly affect sleep patterns.[1]

- In a recent clinical review, researchers found that insomnia is related to the type of arousal associated with stress. [2]
- This makes sense. A defence system that allowed you to sleep when 'on watch' wouldn't be worth much, would it?

Release of the stress hormone cortisol may help regulate sleep patterns.

- Stress hormone levels are at their lowest at around midnight and peak at around 6am - 8am.[3] This 'circadian rhythm' helps us to fall asleep and wake up at the right time of the day.
- If your adrenal system is still producing high levels of stress hormones when it's time to go to bed, the most likely result will be disturbed sleep.
- Importantly, it's been shown that stress particularly affects the stage of sleep (slow wave sleep) that is most conducive to rest and restoration.



For those who deal with chronic stress, this can cause a vicious circle.

Elevated levels of stress hormones prevent restful sleep. And a lack of restful sleep causes elevated levels of stress hormones.[4]

The British Journal of Health Psychology published a study in 2010 that assessed the effects of stress on the sleep patterns of 816 employees with no history of sleep issues.

The study, performed over a year, found:

Employees who experience stress episodes are twice as likely to develop sleep problems. [5]

General symptoms associated with lack of restful sleep include:

- Fatigue
- Irritability, depression and anxiety
- Difficulty paying attention or focusing on tasks
- Increased errors or accidents
- Tension headaches
- Gastrointestinal symptoms [6]

In a recent article published by the U.S. Center for Disease Control and Prevention, insufficient sleep is linked to a number of chronic diseases including: [7]

- Diabetes
- Cardiovascular disease
- Obesity
- Depression

Given the observed cycle between lack of sleep and stress, it is perhaps not surprising that these diseases are also commonly associated with chronic stress.

Learning how to manage our body's alarm system (the stress response) may help to improve the quality of our sleep. Given the importance of a good night's sleep to our general health, this is certainly worthy of attention.

Reviewed March 2014 by:
Rochelle Zozula, PhD - Behavioral Sleep Specialist

"Sleep disorders are multi-faceted conditions potentially involving physiological, psychological and even genetic factors. There is credible evidence, however, that stress, particularly when chronic in nature, can play a major role in sleep loss and insomnia. "
- R. Zozula

BONE STRENGTH

Your skeleton will always be your biggest supporter. But it too can be stressed to the bone.

Persistent levels of stress can cause bone weakness.

- One of the primary hormones produced during the stress response, cortisol, may interfere with the production and function of osteoblast cells (the cells that deposit new bone tissue).
- Over time, this leads to a reduction in bone density and a higher risk of diseases such as osteoporosis.

This effect has been highlighted in many studies [1,2,3,4,] making stress an important concern for practitioners specialising in bone disorders.

There is also evidence that cortisol can prevent the intestines from properly absorbing the calcium needed to strengthen bones. This could increase the damaging effect of stress on your bones [1,5]

Persistent stress may be a significant factor in the health of your bones and teeth. Learning to manage it may help support you in more ways than one.

STRESS AND BONE STRENGTH

STRESS RESPONSE

ELEVATED STRESS HORMONES (CORTISOL)

HIGH CORTISOL LEVELS INHIBIT THE ABSORPTION OF CALCIUM AND LIMIT THE CREATION OF OSTEOBLASTS

THE RESULT IS WEAKER BONES AND TEETH

MUSCLE HEALTH AND RECOVERY

Strong and healthy muscles are the engine room of an active body. Persistent stress can cause them to break down.

When the stress response is activated, your body assumes that you are going to need a lot of energy quickly.

- Your body's traditional energy sources are carbohydrates and fats.
- These are the primary fuels your system will reach for to meet your daily energy requirements.
- Availability of carbohydrates and fats depends on the foods available to you today and the energy you have stored from previous consumption.

These days, most of us have more than enough access to these traditional energy sources, but over the many years of human development, this hasn't always been the case.

- In times of famine or extreme challenge the human body learned that having access to a third energy source was an extremely useful survival tool.
- This third source would be far more reliable if its availability was always guaranteed.

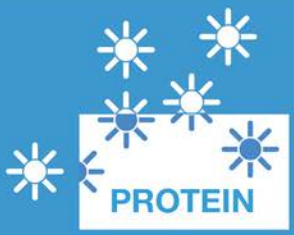
When under stress, your system has learned how to extract energy from proteins, the building blocks of the body.

- The process of breaking down proteins (as well as other non-carbohydrates) into 'fuel' is called gluconeogenesis. [1] It provides fast access to an energy source that is available even when our traditional fuels may be limited or spent.
- When stressed, your body reaches speculatively for all the energy sources available to it.

STRESS AND MUSCLE HEALTH

STRESS RESPONSE

TOO MUCH STRESS CAN ELEVATE LEVELS OF THE STRESS HORMONE (CORTISOL).



HIGH CORTISOL LEVELS STIMULATE THE CONVERSION OF PROTEINS INTO ENERGY (GLUCONEOGENESIS).

THIS RESULTS IN THE BREAKDOWN OF MUSCLE AND TISSUE AND INHIBITS MUSCLE GROWTH AND RECOVERY.

Muscles and other tissues are major sources of protein.

- When the hormone cortisol prompts your body to access energy from all available sources, muscles and tissues can actually become 'food' for your system.
- This is one of the reasons elite athletes are careful not to over-train (or place too much stress on the body).

So stress hormones produced under physical stress can affect the growth and recovery of muscle and tissue. Is this also the case for hormones produced under psychological stress?

A study done at Yale University in 2012 found that it is. [2]

- A team of researchers showed that 'life event' stress slowed down the recovery of muscle function after exercise.

A similar process may occur in patients suffering from the stress of chronic illness. This can be a further contributor to related muscle wasting and injury. It follows that reducing your stress is something your muscles will thank you for over time.

Reviewed February 2014 by:
Martin McCawley (B.App.Sc (Phty) - Physiotherapist)

"Stress has many forms and it can have a profound effect on our physiology, and therefore our daily functioning. I see this in my practice on a daily basis, where I work with people to reverse the effects of stress in a range of rehabilitation settings. To address the problems caused by stress the first step is understanding the power stress has to affect our health. The second step is being aware of how it affects you personally. The third step is actively addressing it." - M. McCawley

MUSCLE TENSION

Being 'tense' and being 'stressed' have come to mean the same thing. When the terms for a symptom and a cause become interchangeable, it indicates more than a passing relationship.

That stress and muscle tension are linked is hardly surprising.

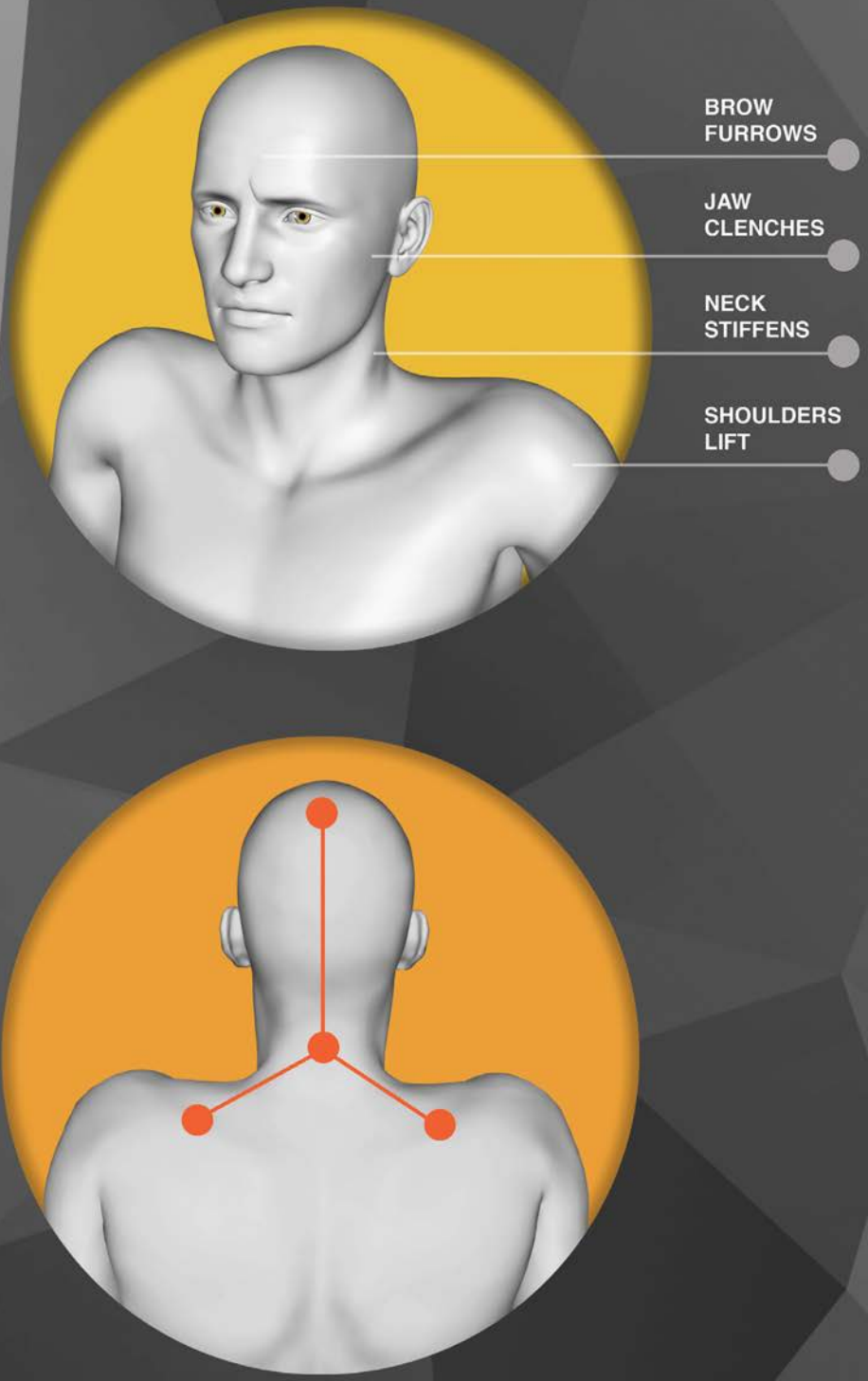
- Increased muscle tension is one of the very first physical symptoms you will experience when stressed.
- The stress hormone noradrenaline alerts the muscles to be primed for 'fight or flight', and a shortened tense state is the sign they are ready to spring into action.

As discussed earlier, 21st century stressors rarely require such a physical response. Despite this fact, when under persistent psychological stress we can remain 'on physical alert' for hours on end. It's no great wonder that after a short time, this muscle tension can start to become uncomfortable.

- Tension in the shoulders and neck
- Tension headaches
- Poor posture
- Back pain
- Tendonitis
- Grinding teeth and aching jaw.

Specialists refer to the muscles which most often tighten under psychological stress as the 'triangle of tension.'

- When experiencing stress, the shoulders lift, neck muscles contract, the jaw clenches and the brow furrows.
- Under this physiological 'squeeze', it's not surprising that muscle tension is often felt most acutely in the triangle marked by the shoulders, neck and forehead.



THE TRIANGLE OF TENSION

Without being aware, you can spend much of the day in this position if you are dealing with high levels of stress.

Persistent tension can cause muscles to become increasingly shorter and tighter, potentially turning discomfort into a more serious long-term condition.

- People who are in tense jobs requiring little physical activity may be particularly at risk.
- The muscle tension can build up as time goes on and neck and shoulder muscles may get shorter and shorter.

But your stress isn't done with your muscles yet.

Chronic stress may even train muscles to hold tension. [1]

- When stress remains at high levels over a period of time, a condition called neuromuscular hypertension can develop.
- The nervous system becomes accustomed to a certain level of tension in the muscles and begins to habitually and unconsciously hold this position.
- If stress is persistent, this muscle tension can often become sustained at higher and higher levels.

Small supporting muscles often bear the brunt of your stress. [2]

- Studies have shown that many small muscles, designed to operate under limited load, can be particularly affected by stress related muscle tension.
- These muscles are often the first to engage, remaining so until the signal to be alert has passed.
- Persistent levels of stress can leave these smaller muscles active for extended periods.
- This enduring activation may cause a degenerative process, muscle damage and significant discomfort.

Stress and muscle tension are also factors in tension type headaches. [3]

- Tension headaches are extremely common and can be very debilitating at times.
- During a tension headache, the muscles at the temples and upper neck can go into spasm. This results in a sensation of tightness around the top of the scalp or neck causing steady pain.
- This spasm is often at the end of a predictable line of muscle tension running up from your shoulders.

It won't surprise you to learn that, once properly diagnosed, the initial prescription to deal with these headaches often focuses on stress reduction!

Reviewed March 2014 by:

Martin McCawley (B.App.Sc (Phty) - Physiotherapist)
Allen J. Moses (DDS, Asst. Prof. Rush University Medical School)

"This is reductionist thinking at its best. The old complexity made into the new simplexity. Elegant!" - Dr A.J. Moses

STRESS AND WEIGHT GAIN

Comfort foods are less comforting when they end up around your waist.

We've all heard of comfort foods, right? You know, the meals or snacks we crave when stressed. Have you ever noticed that these foods are mostly high in calories (energy)?

Life can be full of cruel temptations.

Well, perhaps not quite. The universe has better things to do than tempt us with chocolate ice cream when we've had a bad day. There's actually a very good reason we reach for high energy foods in these circumstances, and understanding this is the first step to appreciating how important stress can be to weight gain.[1]

Stress signals the body to fuel itself for physical activity (fight or flight).

- We already know that one of the primary functions of the stress response is to make more energy available to us for action.
- Our muscles burn energy like a car burns fuel, and when we put the foot to the pedal, we need more fuel to make the engine roar.
- In anticipation of physical activity, our stress hormones will provide a signal for the body to release more energy into the bloodstream.

Carbohydrates and sugars are the most accessible form of energy, and blood sugar levels can rise significantly when you are stressed.

Our primary fuel sources are carbohydrates and fats but under stress the body adds other components to its energy production line.

Given that glucose (a simple sugar) is the fuel most efficiently converted to energy by our cells, the body ingeniously creates larger amounts of it from a variety of secondary sources.

- The stress hormone cortisol signals our system to convert other substances, including proteins (muscles and tissue) and glycogen (stored in the liver and muscles) into glucose to turbo boost energy supplies.
- This process is called gluconeogenesis, another word you are welcome to forget any time, as long as you remember the following point.
- In a stressed state, the amount of easily accessible fuel in your blood (blood sugar level) can spike significantly.

After more than a day or so of high stress, research shows our blood sugar levels can more than double. [2]

This can be very useful if you're running for your life, but if you're simply sitting in traffic or at your computer, this unused fuel will be left idle in your bloodstream.

There are a host of issues associated with this, not the least of which is the potential for some of this excess energy to be stored as fat around your belly (visceral fat). Apart from being unsightly, this type of fat can be particularly concerning as you will see later in this section.

So stress can stimulate higher than normal energy production, which if unused, has a tendency to be stored as fat. But what does this have to do with us craving naughty foods?

WHEN STRESSED, YOUR BODY GOES TO EXTREME LENGTHS TO PRODUCE EXTRA SUGARS, FUEL FOR 'FIGHT OR FLIGHT'

UNTIL RECENTLY IN HUMAN HISTORY, THE STRESSES WE FACED OFTEN REQUIRED A POWERFUL PHYSICAL RESPONSE. HAVING SUFFICIENT ENERGY TO FUEL THESE RESPONSES WAS CRITICAL TO OUR SURVIVAL.

YOUR BRAIN ASSOCIATES STRESS WITH A NEED FOR MORE ENERGY. SO WHEN YOUR STRESS LEVELS HAVE BEEN HIGH, IT SENDS YOU A LITTLE MESSAGE TO REFUEL BY STOKING YOUR APPETITE FOR HIGH ENERGY FOODS. INGENIOUS, IF YOU HAVE BEEN VERY ACTIVE.

TODAY, HOWEVER, OUR STRESS IS MOSTY INCURRED WHEN WE ARE SEDENTARY. WE DON'T NEED ALL THAT EXTRA ENERGY WHEN WE ARE SITTING AT OUR DESK OR STUCK IN TRAFFIC.

MODERN DAY STRESS CAN DELIVER A DANGEROUS COCKTAIL TO THOSE TRYING TO CONTROL THEIR WEIGHT.

. INCREASED ENERGY PRODUCTION
. NO CORRESPONDING USE FOR THAT ENERGY
. AN APPETITE ENCOURAGING US TO CONSUME HIGH ENERGY FOODS

UNUSED ENERGY IS STORED AS FAT, PARTICULARLY THE DANGEROUS TYPE AROUND THE BELLY.

WHEN IT COMES TO STRESS, THE MESSAGE IS CLEAR

USE IT...OR LOSE IT.

Stress hormones can play havoc with your appetite. [3]

Whether you lose your appetite or reach for a tub of ice cream largely depends on where you are in the stress cycle.

- Initially, stress hormones may act to suppress your appetite. This makes sense. Being distracted by a donut while trying to escape an angry dog would hardly be ideal.
- But once the alert has been downgraded, stress hormones direct the body to replace the energy that's just been made available.

Suddenly that donut starts to look mighty good!

The thing is, while these hormones are impressive, they are not smart enough to know whether we've actually used the energy they are directing us to replace. Whether you've just run from a raging Rottweiler or are having a stressful day at your desk, your body sends you the same message:

"*Feed me!*"

Those people actively monitoring their diet are more likely to 'splurge' in times of stress.

- Studies have shown that, if you're consciously trying to limit your food intake, it's even more likely that stress will cause you to eat more and blow your diet. [4]
- This can be even more prevalent in people who have an emotional connection with eating.

The combination of boosted energy production, no real corresponding energy need and an increased appetite is a lethal trio for those dealing with stress and trying to control their weight.

Recent studies have supported the potential link between stress and weight gain.

A broad study observing the effects of psychological stress on weight gain in adults was released by the Harvard School of Public Health in 2009.

- The study observed 1,335 adults in the USA over a nine-year period.
- Over the study period, it was found that psychological stress was closely related to a gain in weight.
- This was particularly noticed in people already dealing with weight issues. [5]

Additionally, research at Yale University has shown that, when it comes to health risks, all fat is not created equal.

- Visceral fat (fat stored deep around the abdomen) is more closely associated with heart disease and diabetes.
- The stress hormone cortisol causes fat to be stored predominantly in this dangerous and unsightly area. [6]

The bottom line is this. If you manage your stress you may also have a better chance of successfully managing your weight.

A note on Insulin

Insulin is the hormone required to make sugars available to cells for energy. Persistently high levels of glucose in the blood, as may occur during chronic stress, can eventually lead to certain cells becoming resistant to insulin.

In certain cases, particularly in combination with obesity, this may result in the development of type 2 diabetes, [7] *a condition under which cells ignore the message to take up and hold onto sugars. In turn, this can cause glucose levels in the blood to remain dangerously high.*

In more serious cases, the persistently elevated levels of blood sugar associated with chronic stress can combine with insulin resistance in the cells to overwork and damage the pancreas, the organ responsible for producing insulin. This may result in insulin dependence. [8]

Further more, for those who are already dealing with diabetes, the glucose spikes caused by stress can significantly complicate the management of the condition. [9]

MOOD AND DEPRESSION

From making you feel off balance to being a factor in cases of depression, stress can be a psychological, as well as a physical burden.

We have known for decades that an imbalance in the hormonal and nervous systems may cause mood disorders.

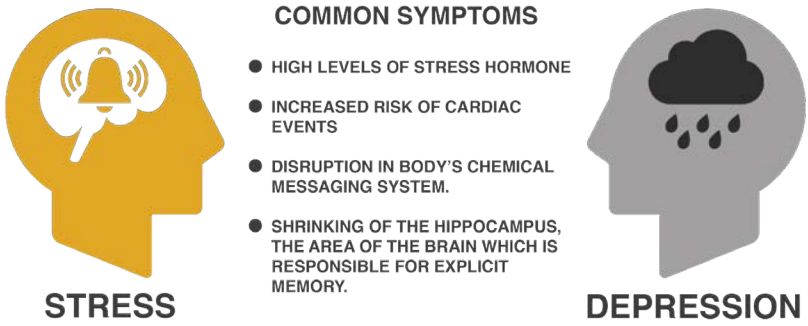
"You're getting on my nerves!". "Stop being hormonal."

Without even realising it, we often make the connection between altered mood and disruptions in our body's internal messaging systems. This isn't a figment of our imagination. Psychologists have been drawing a link between mood and body chemistry for over 100 years. The significance of what Freud theorised back in the early 1900s has more recently been affirmed by studies in the field of neuroendocrinology (The study of the how the nervous and hormonal systems interact).

This shouldn't be surprising. The same pathways that carry the alerts of the stress response also transport the messengers that govern our moods. Put in its most simple terms, people with a lot of stress hormones circulating around their bodies seem more likely to succumb to a range of mood disorders including more serious forms of depression.

In fact, according to Dr. Robert Sapolsky, one of the most respected professors in this field, *"It is impossible to understand either the biology or psychology of major depression without recognising the critical role played in the disease by stress."* [1]

While there's some debate as to how the trigger is pulled, it may be harder to deny the smoking gun when it comes to stress and depression. A number of key symptoms are shared by both.



That stress and depression seem to co-present is not hard to believe. There is now, however, a building body of evidence that one may contribute to the other. Studies have shown that:

- Inducing stress in lab rats causes them to exhibit depressive behaviour. [2]
- Serious stress in childhood is a predictor of depression later in life. [3]
- Genes linked to depression seem to be triggered under stress conditions. [4]
- Persistently high levels of the stress hormone cortisol may cause depression. [5]
- Persistent stress can, in combination with a perceived lack of control, be seen to induce a state of learned helplessness, often associated with serious depression. [6]

So, stress and mood disorders, including depression, seem to be closely linked. But how?

The exact mechanisms are still being debated but the finger seems squarely pointed at those powerful stress hormones that we've encountered so often in this module. Persistently high levels of cortisol in particular, seem capable of disrupting the messengers of mood regulation. [7,8]

Hormones that regulate both mood and the stress response travel down the same internal highways.

Stress Hormones	Mood Hormones/Neurotransmitters
• Cortisol	• Serotonin
• Adrenaline	• Dopamine
• Noradrenaline	• Noradrenaline

When stress hormone levels increase, mood regulation seems to suffer. Reduce stress hormones and it seems to improve.

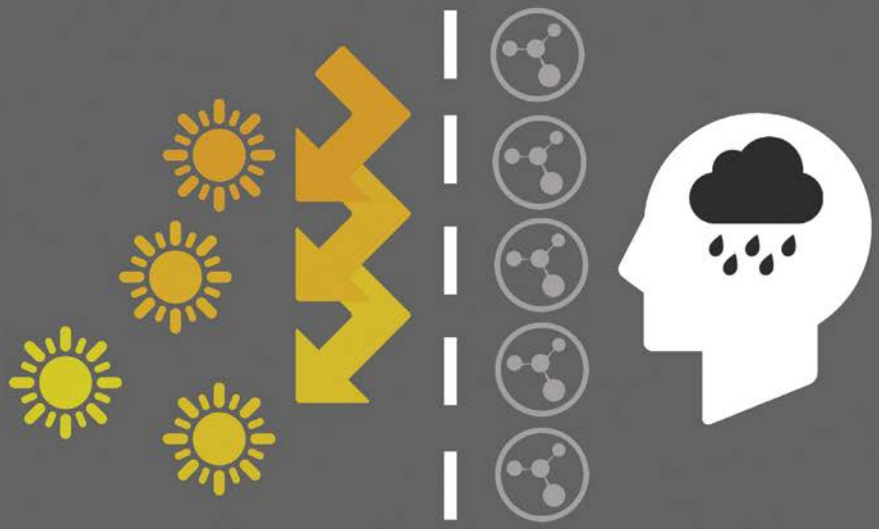
Simply put, when stress is teaming down the highway, mood regulators seem to be nudged off the road. So, why does this happen? One credible theory observes that stress hormones may inhibit the production of transporters that carry the 'feel-good' hormone serotonin. [9] In short, If you can't transmit your 'feelgood' hormone, you may not feel that good.

Traditionally depression and mood disorders are viewed from a either a biological or psychological perspective.

These two different schools of thought have often operated in isolation from one another. However, as the evidence builds, doctors of both mind and medicine are increasingly seeing stress as a unifying theme in their varied approaches to mood disorders.[10] *(See diagram at the bottom of page 53.)*

Reviewed March 2014 by:
Dr. Sandra Thebaud - Psychologist

"As a practicing psychologist with a strong background in stress and stress management, I believe this article accurately reflects the effect stress can have on mood disorders, including depression. It lends credibility to the importance of learning to manage stress by using tools like the Address Stress relaxation exercises."

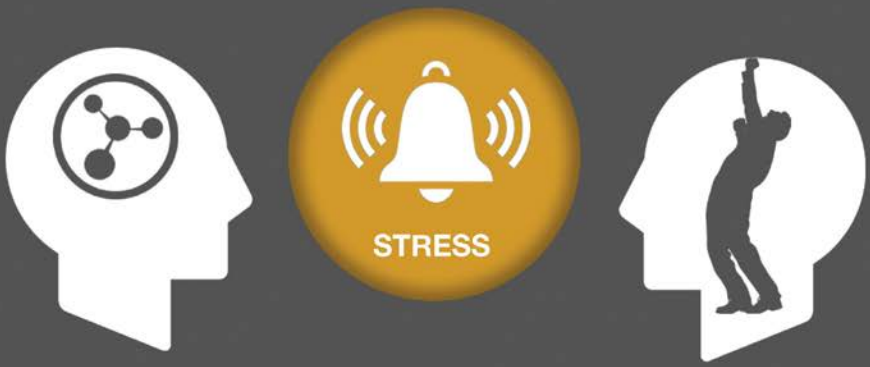


SEROTONIN

IS YOUR BODY'S FEEL GOOD HORMONE

CORTISOL

IS A STRESS HORMONE WHICH INHIBITS THE TRANSPORT OF SEROTONIN. LOW LEVELS OF SEROTONIN AVAILABILITY ARE ASSOCIATED WITH DEPRESSIVE CONDITIONS



BIOLOGICAL VIEW

MOOD DISORDERS ARE CAUSED BY HORMONES, NEUROTRANSMITTERS AND GENES

PSYCHOLOGICAL VIEW

MOOD DISORDERS ARE CAUSED BY LOSS OF CONTROL AND NO OUTLETS FOR FRUSTRATION

BRAIN FUNCTION, ANXIETY AND MEMORY

Like an efficient manager, a calm brain is on top of its processes and filing. A stressed brain, on the other hand, has other things to worry about.

The brain is the key organ directing the stress response in the body. Well, actually the brain is the key organ directing almost everything in the body!

In a recently published article, Dr. Bruce McEwen (Professor of Neuroscience at Rockefeller University) highlighted the parts of the brain known to be particularly vulnerable to chronic stress. [1]

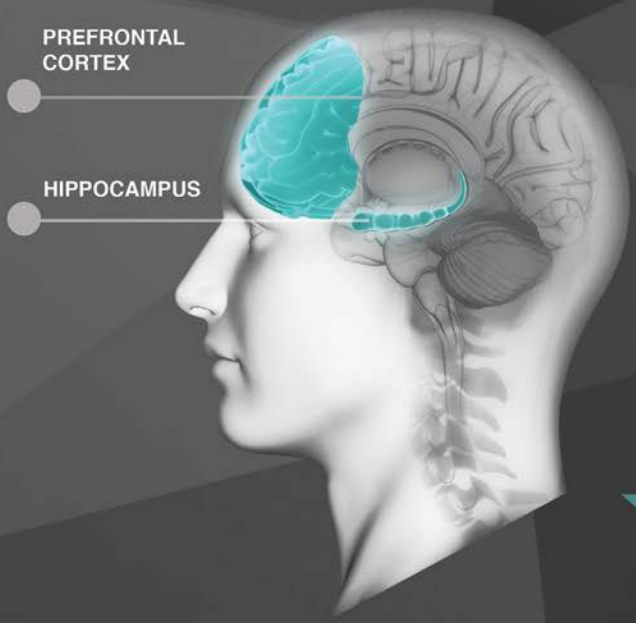
1. **Hippocampus**: Responsible for memory formation
2. **Amygdala**: Area of the brain related to fear, anxiety and mood
3. **Prefrontal Cortex**: The location responsible for decision making, memory, control of impulsive behaviour, as well as the regulation of the stress response

Your brain is incredibly versatile.

Like a good highway system, it builds wider roads and better connections in the areas with greater traffic. Spend too much time under stress and the parts of your brain that drive fear and anxiety can become larger and more sharply engaged.

Conversely, the areas of the brain under 'detour' during periods of persistent stress, logical decision making for example, lose connections and are downsized.

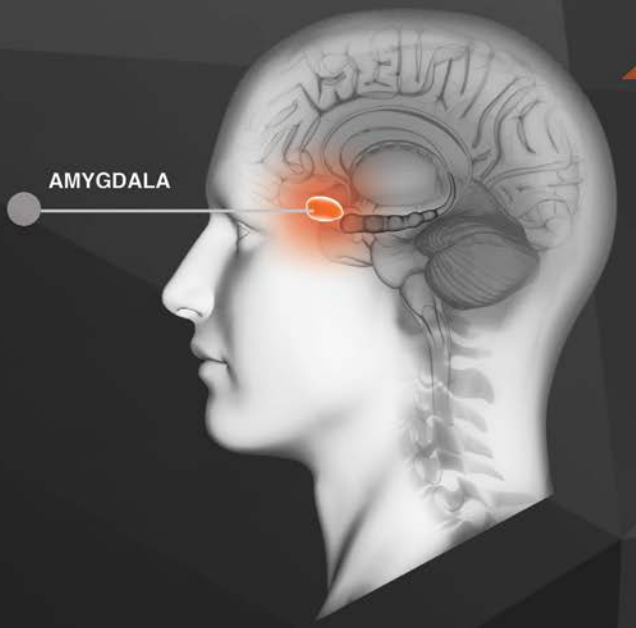
Put simply, persistent stress may cause some parts of your brain to increase in size and others to shrink.



PARTS OF THE BRAIN MAY BE COMPROMISED OR EVEN SHRINK UNDER PERSISTENT STRESS.

THIS AFFECTS:

- LOGICAL DECISION MAKING
- REGULATION OF IMPULSIVE BEHAVIOUR



PARTS OF THE BRAIN MAY BE SENSITISED, OR EVEN ENLARGED UNDER PERSISTENT STRESS.

THIS AFFECTS:

- FEAR
- MOOD
- ANXIETY

These systems do not work independently.

Intense levels of stress can cause the part of your brain responsible for fear, mood and anxiety to hijack the part responsible for logic and behaviour regulation. [2]

In such cases, we can lose the ability to logically work through the challenges we face. Instead, we succumb to a primal stress response that favours knee-jerk reaction over thoughtful reply.

Logic is not the only brain function to suffer in this state. When the part of the brain that processes fear and anxiety is overly sensitised, and sometimes enlarged, a more general tendency towards anxiousness may follow.

There is evidence that the more stress we've had to deal with in the recent past, the more susceptible we can be to anxious tendencies today.

In a stressed state, retrieving and laying down memories can also be affected [3]

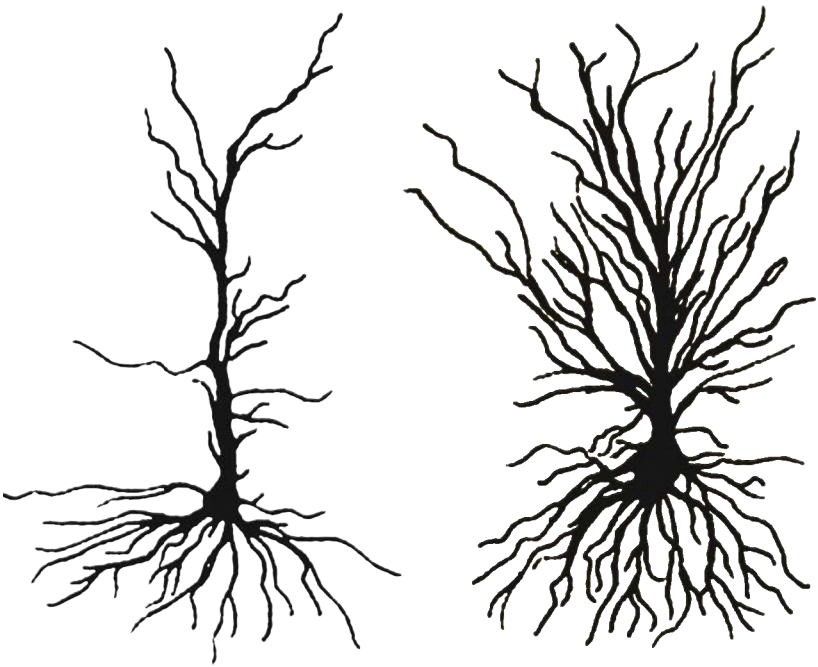
We all know the feeling of going blank under pressure ... stopped in our tracks, unable to recall the simplest things.

- Under high stress, everything from the name of a person you know quite well to your own telephone number can be frustratingly inaccessible.
- Likewise, in cases of extreme stress, people often report not being able to recall the event clearly or even at all.
- The good news is, in cases of transient stress, these effects are short-term and full memory function should return once the stress hormone circulation subsides.
- In fact, under short-term (acute) stress, cognitive function can even improve, helped by an initial increase in glucose levels (energy) supplied to the brain.

Unfortunately, the same cannot be said for those dealing with persistent or chronic stress.

In cases of chronic stress, short-term memory may actually be compromised more significantly, together with the ability of the brain's memory circuits to communicate with each other. [4]

- After long periods of persistent stress, the hippocampus , a small but critical area of the brain responsible for memory function, can become damaged.
- The build-up of stress hormones can also cause your neural connections (brain circuits) to reduce in number, making it harder to access your memories.



ATROPHIED NEURONE **HEALTHY NEURONE**

Prolonged exposure to stress hormones, particularly high levels of cortisol, can set off a cycle in the brain that can be very concerning.

This potentially vicious circle is illustrated on the opposite page.

The good news is, recent research shows that reducing the levels of circulating stress hormones can reverse these effects over time with greater success than previously thought. [5]

This is yet another reason to dedicate a little time each day to managing your stress.

INCREASED LEVELS OF STRESS HORMONE.

INCREASED CAPACITY FOR FEAR AND ANXIETY. POOR ACCESS TO LOGICAL PROCESSES.

BREAKDOWN IN THE CONTROL OF THE STRESS RESPONSE.

POTENTIAL DAMAGE TO THE HIPPOPCAMPUS AFFECTING MEMORY AND CORTISOL REGULATION.

SKIN HEALTH

The skin is your body's largest organ, a shield from the outside world and a window to your inner health.

You don't need to be a dermatologist to understand that when you're stressed or rundown your skin is often the first to show it. But, sometimes it helps to hear it directly from the experts.

Stress can affect skin by making it sensitive and reactive. [1]

An article published by the American Academy of Dermatology highlights stress as a contributor to a number of uncomfortable skin conditions including:

- Psoriasis
- Rosacea
- Acne
- Hives
- Fever blisters
- Seborrheic dermatitis

This isn't really surprising. Most of us have seen it first hand.

- 'Breaking out' when we're stressed or run down
- Coming out in hives of anxiety
- Eczema flaring when we're under the pump

The fact that the skin is affected by our psychological state is not a new idea. There is now an entire field (called psycho-dermatology) devoted to understanding the links between what goes on inside our head and on the surface of our skin. [2]

So, how does our stress 'bubble to the surface' for all to see?

The diagram over the page lists six ways stress may affect the skin.

STRESS AND SKIN HEALTH

INCREASED OIL PRODUCTION

HIGHER LEVELS OF CORTISOL HAVE BEEN SHOWN TO INCREASE OIL PRODUCTION, LEADING TO OILY SKIN, ACNE AND OTHER SKIN RELATED PROBLEMS. [4]

ALTERNATELY FLUSHING AND GOING PALE

CONSTRICTING AND DILATING BLOOD VESSELS DIRECT BLOOD TO OR FROM THE SKIN'S SURFACE IN RESPONSE TO STRESS.

COLLAGEN LOSS

CORTISOL CAN SIGNIFICANTLY PROMOTE COLLAGEN LOSS FROM THE SKIN. COLLAGEN IS A PROTEIN THAT GIVES SKIN FIRMNESS AND ELASTICITY. COLLAGEN LOSS UNDER STRESS OCCURS UP TO TEN TIMES FASTER IN THE SKIN THAN ELSEWHERE IN THE BODY. [7]

REDUCED HEALING PROPERTIES

STRESS NEGATIVELY AFFECTS THE BARRIER FUNCTION OF THE SKIN. THIS CAN CONTRIBUTE TO DEHYDRATION AND THE INHIBITION OF THE SKIN'S ABILITY TO HEAL ITSELF AFTER INJURY. [4]

INFLAMMATION, REDNESS AND ITCHING

NEUROPEPTIDES RELEASED BY NERVE ENDINGS ARE THE SKIN'S FIRST LINE OF DEFENCE AGAINST INFECTION. PROLONGED STRESS MAY LEAD TO INAPPROPRIATE RELEASE OF THESE POWERFUL MOLECULES.

SKIN CANCER

A STUDY BY SCIENTISTS AT JOHNS HOPKINS UNIVERSITY SHOWED STRESS CAN SPEED THE ONSET OF SKIN CANCER BY 200% IN MICE EXPOSED TO A STRESSOR (IN THIS CASE, THE SCENT OF A FOX). [6]

Research suggests that stress activates immune cells in your skin, resulting in inflammation that can contribute to many dermatological conditions. [3]

- The skin is your first line of defence against infection.
- Studies have shown that when your body is under the 'red alert' of a stress response, an excess of white blood cells close to the surface (your protectors from foreign invasion) may be the cause of many common skin conditions.
- Additionally, an overreaction by the skin's protective T cells may also result in flaking and scaling.

To quote dermatologist and clinical instructor at the University of Miami's Miller School of Medicine, Dr. Flor Mayoral:

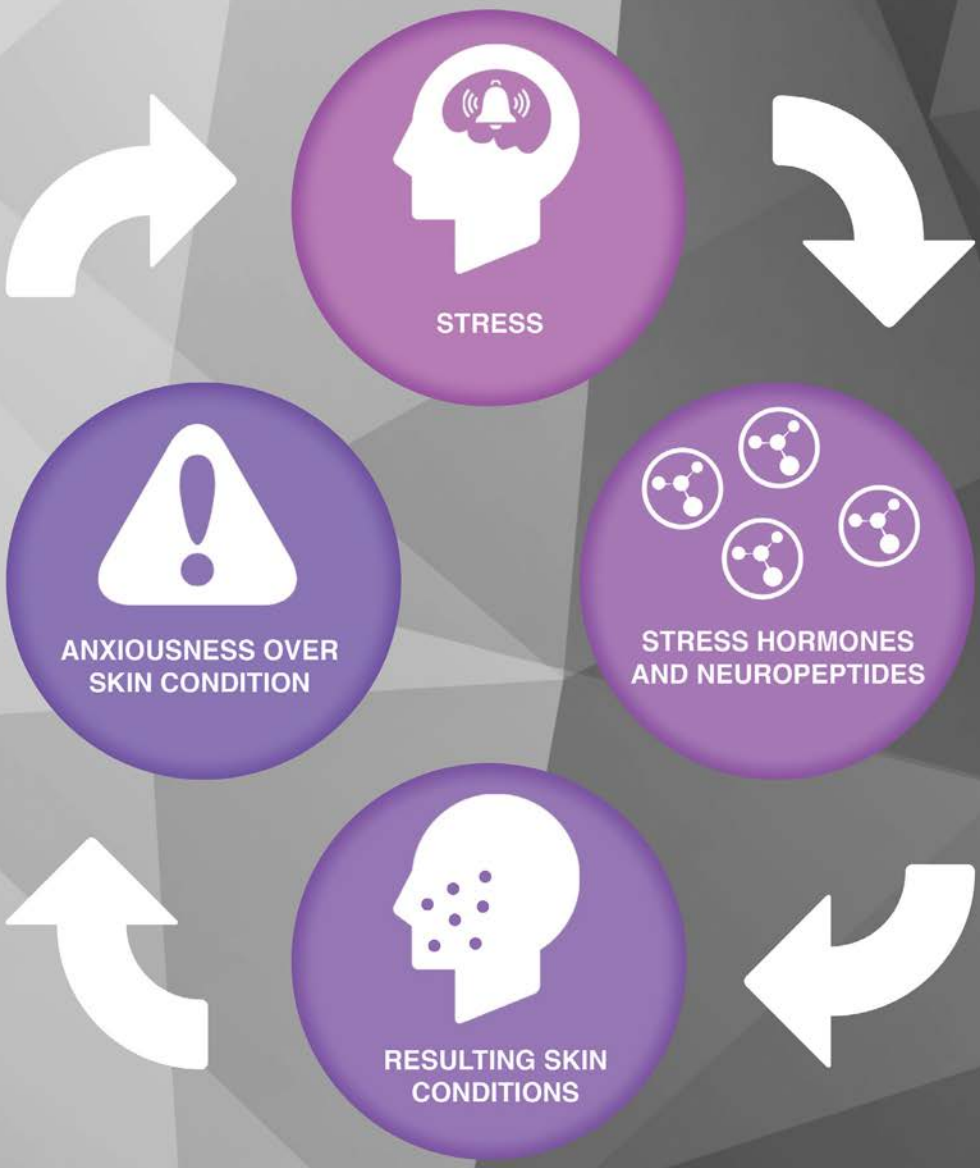
"In treating hundreds of patients over the years with skin conditions such as eczema, rosacea, acne and psoriasis, I have seen firsthand how stress can aggravate the skin and trigger unexpected flare-ups that, in effect, create more stress for patients" [4]

The American Academy of Dermatology seems to agree. In the words of one of their publications,

"When dermatologists treat both the skin and stress, the skin often clears more quickly and completely as the influences of stress are diminished." [1]

Reviewed February 2014 by:
Norman Price, MD (Dermatologist)

"Chronic stress poses a clear and present danger to the normal functioning of the skin and can result in many stress induced dermatological conditions. Patients who successfully reduce the burden of stress they carry may find themselves to be more resilient to diseases of the skin." - Norman Price, MD


STRESS
STRESS HORMONES AND NEUROPEPTIDES
RESULTING SKIN CONDITIONS
ANXIOUSNESS OVER SKIN CONDITION

AGEING

Can stress make you old before your time?

"This job, your nagging, my in-laws, these bills, this commute... will make me old before my time."

We've all heard this refrain.

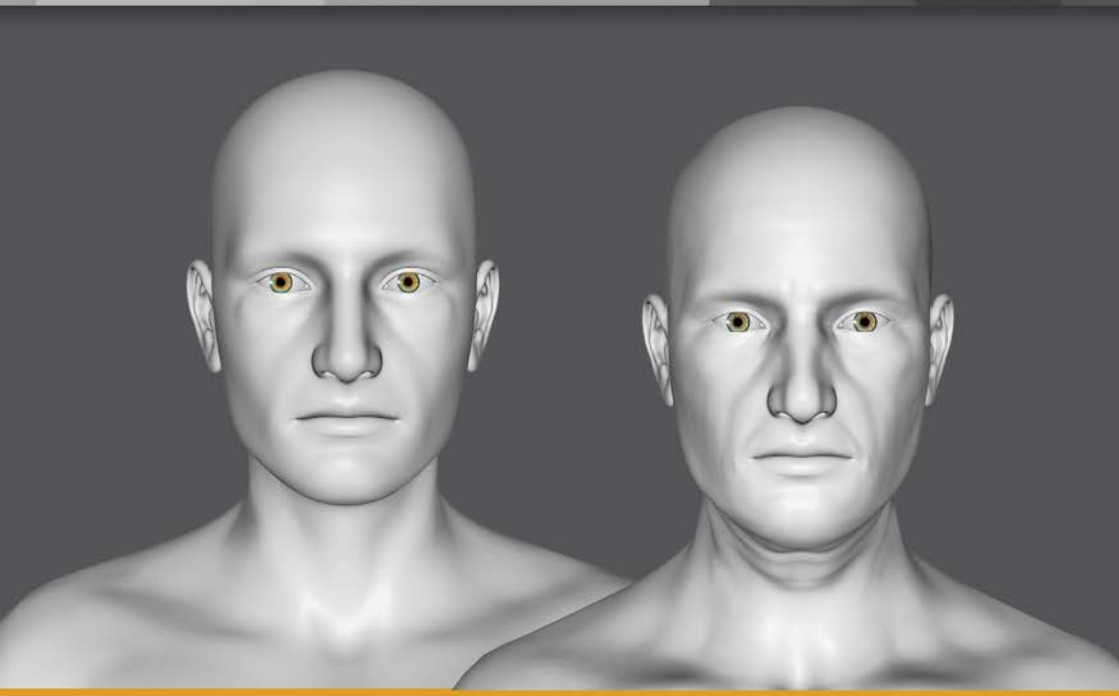
Intuitively, it's not hard to understand that stress takes its toll on the body over the years. But can stress actually make us age more quickly?

This is exactly the question explored in a study at the University of California in 2004. [1]

- The team focussed on a group of women aged between 20 and 50 who had been experiencing high levels of stress for years on account of caring for a chronically ill child.
- It was found that the longer a person had been caring for a sick child the more affected the structures governing the ageing process in their cells became.

Stress may actually accelerate the natural ageing process on a cellular level.

- Your chromosomes (the structures that carry your genetic blueprint) have little caps at their ends called telomeres.
- Every time a cell divides, these telomeres get a little shorter. In the natural ageing process, they eventually get so short that the cell can no longer divide.
- As more cells reach the end of their telomeres and die, the effects of ageing become apparent.
- Muscles weaken, skin wrinkles, eyesight fades, organs fail and brain function diminishes.



CHRONIC STRESS MAY ACCELERATE THE SHORTENING OF TELOMERES, THE END CAPS ON YOUR CHROMOSOMES WHICH PLAY AN IMPORTANT ROLE IN CELL DIVISION AND TISSUE RENEWAL IN THE BODY.

THIS CAN ACCELERATE THE PHYSICAL AGEING PROCESS.

The research found that chronic stress appears to accelerate this process. The longer a person had been caring for a sick child, the shorter their telomeres became. In some instances, the shortening was a decade further advanced.

Persistent stress earlier in life may affect our ability to deal with stress as we age.

- As we get older, our ability to regulate the stress response may diminish. The result is that we can end up with higher levels of stress hormones in our blood for longer periods of time even in the absence of an elevated stress experience. [2]
- The symptoms of these elevated hormone levels can be more of a physical burden, as we get older.
- Research suggests that this deregulation may be a result of damage to the hippocampus, the part of the brain responsible for both memory and regulation of the stress response.
- If this part of the brain has already been affected by stress earlier in life, this effect may be even more pronounced.

Stress may also contribute significantly to many external, cosmetic signs of ageing

- **Grey Hair & Hair Loss** - Stress has been shown to disrupt the function of melanocytes, the cells in the body responsible for adding the colour to our hair. Stress may also cause hair to enter a resting (telogen) state, or even cause it to fall out prematurely.
- **Wrinkles** - Persistent stress can cause the protein collagen to be rapidly broken down resulting in a reduction in skin 'tightness' particularly in the facial area.

See the articles on *pages 60 and 68 f*or more detail.

So, 'address your stress' to help you age more gracefully? Sounds like a good deal all around!

Reviewed (February 2014) by:
Dr. Peter Dobie, MBBS
(Specialist in Integrative and Anti-Ageing Medicine
Member, American Academy of Anti-Ageing Medicine)

"It has become increasingly evident to me in my medical practice that stress can accelerate the ageing process. I frequently recommend stress management techniques to my patients." -Dr P. Dobie

HAIR LOSS AND GOING GREY

Stress can make your hair stand on end. It may also make it go grey, or fall out.

Stress may be a primary reason for unexplained hair loss. [1]

Experts suggest that after traumatic events such as extreme emotional stress, disease or surgery the body, takes a 'time out' from growing hair to concentrate on recovery and healing.

Daniel K. Hall-Flavin M.D, a psychiatrist at the Mayo Clinic goes into a little more detail on the subject, highlighting three ways high levels of stress may result in less hair on your head. [2]

1. White blood cells, signalled by a stress response, may attack the hair follicle, stopping hair growth and making hair fall out.
2. Emotional or physical stress may drive growing hairs into a resting or 'telogen' state, potentially causing them to fall out.
3. Extreme forms of anxiety or tension can even result in a condition called trichotillomania, literally an irresistible urge to pull your hair out.

Losing one's hair can cause significant distress and this can often compound the problem.

Anecdotally, stress has long been suspected of turning us grey before our time. Increasingly, science is supporting our suspicions.

- Our hair is coloured by a pigment called melanin, which is produced in cells called melanocytes.

- There is now evidence that stress hormones can disrupt the signals instructing these cells to deliver the melanin needed to give our hair its colour. [3]
- More recent research suggests that stress hormones can actually cause the cells responsible for producing melanin to migrate from hair follicles leaving them unable to produce this colouring agent as effectively. [4]

It would seem there is a growing body of evidence to support what U.S. presidents from Bill Clinton to Barack Obama have known for years.

More stress can result in more grey hair.

However, there is a silver lining to this thinning grey cloud.

- Stress related hair loss is not necessarily permanent.
- Reducing stress may result in hair growing back. [2]
- Likewise, a reduction in stress hormone levels may allow melanocytes to stay put in our hair follicles. This is where they are needed to help make us the blondes, brunettes and red heads we really are. Well, for a bit longer anyway.

So, if you're experiencing persistent stress, don't 'go grey' or 'lose your hair' over it. Taking some time out to calm your stress response may just be a better approach.

Reviewed February 2013 by:
Norman Price, MD (Dermatologist)

"Chronic stress poses a clear and present danger to the normal functioning of the hair and can result in many stress induced hair conditions. Patients who successfully reduce the burden of stress they carry may find themselves to be more resilient to diseases of the hair. Likewise, the development of hair diseases can induce stresses themselves which in turn often aggravate the underlying hair disease." – Norman Price, MD

HEART DISEASE

Persistent stress may be a cause for concern. But do we actually take it to heart?

According to the World Heart Federation, we may. *"Life's stresses have long been thought to increase a person's risk of cardiovascular disease."* [1]

Studies show that chronic stress is a good predictor of coronary heart disease. [2]

Researchers have observed an elevated risk of heart disease in people experiencing stress through depression, loneliness or an absence of quality social support. [3]

In other work, experts have highlighted a strong link between anxiety and heart disease.

- A research team in Bonn, Germany recently observed that blood showed a much greater tendency to clot in patients showing high levels of anxiety.
- This may be due to a stress response designed to limit blood loss should we be wounded in 'fight or flight'.
- This increased clotting tendency could, say researchers, be the missing link that explains why anxiety patients have three to four times the risk of succumbing to heart disease. [4]

Another extensive account seems to confirm this link.

- The Whitehall Study in the UK found that those government employees with the least control over their work (and subsequent higher anxiety) had higher rates of heart disease. [5]

Other internal factors related to stress can also mount a formidable attack on your heart (see diagram).


STRESS
PRESSURE
HYPERTENSION
HIGH
CHOLESTEROL
OBESITY

Earlier in this section, we discussed how stress may increase your:

- Blood pressure (*page 14*)
- Cholesterol and triglyceride levels (*page 24*)
- Weight (*page 42*)

When elevated, these are all broadly accepted indicators for heart disease.

Hypertension (high blood pressure), for example, is a condition that can be particularly damaging to the cardiovascular system.

Dr. Robert Sapolsky, a professor at Stanford University and expert in stress physiology has eloquently addressed the potential effects of high blood pressure on the cardiovascular system. [6]

According to the professor:

- Persistently high blood pressure may cause the walls of the blood vessels that regulate blood flow to thicken.
- This high pressure can cause small tears in these vessels resulting in inflammation.
- It is in these areas of damage that arterial plaque may form.
- This kind of damage to blood vessels may be an even better predictor of cardiovascular issues than cholesterol levels.
- In addition to this, blood returning to the heart under high pressure can result in an enlargement of one of the heart's ventricles, a condition called left ventricular hypertrophy. No need to remember the name, but it's worth knowing that this condition may be one of the most accurate predictors of heart attack risk.

In short, there are a number of ways stress can put pressure on your heart. Take some downtime each day to 'address your stress' and your 'ticker' may thank you.

Reviewed March 2014 by:
Dr Ross Walker (Preventative Cardiologist and Media Presenter)

"There is no doubting the link between all forms of cardiovascular disease, high blood pressure and stress. Stress management techniques are a vital part of the long term management of cardiovascular disease and hypertension and should be incorporated into every preventative cardiovascular program." Dr. R. Walker

TEETH GRINDING AND GUM DISEASE

Stress can be a nasty grind for your teeth, gums and jaws.

While most people grind or clench their teeth to some extent, it's habitual in a significant percentage of the population, according to the Bruxism Association U.K. [1]

In these cases, jaw muscle contractions may cause grinding and clenching motions in the jaw, potentially resulting in:

- Tooth wear and breakage
- Pain and limited movement of the jaw
- Headache
- Earache

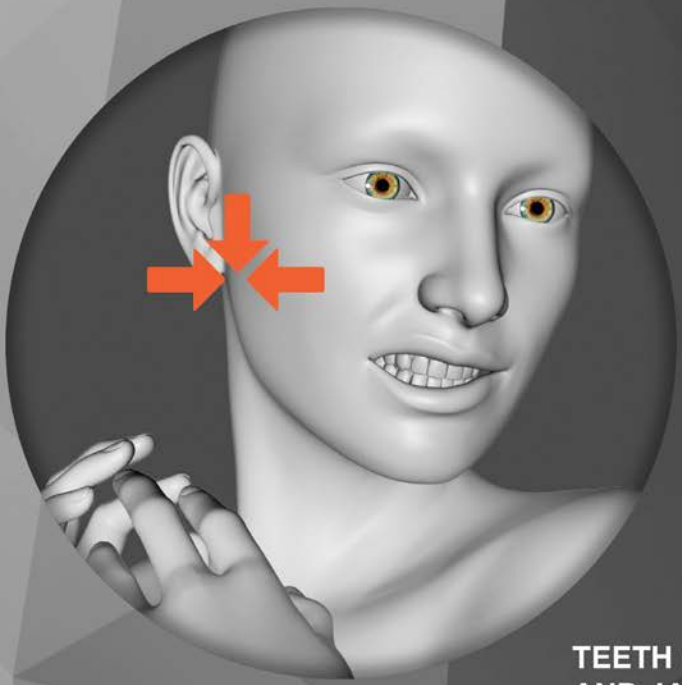
Dentists refer to problematic teeth grinding and jaw clenching resulting from such jaw muscle contraction as bruxism.

As we know, muscle contraction and stress are closely related.

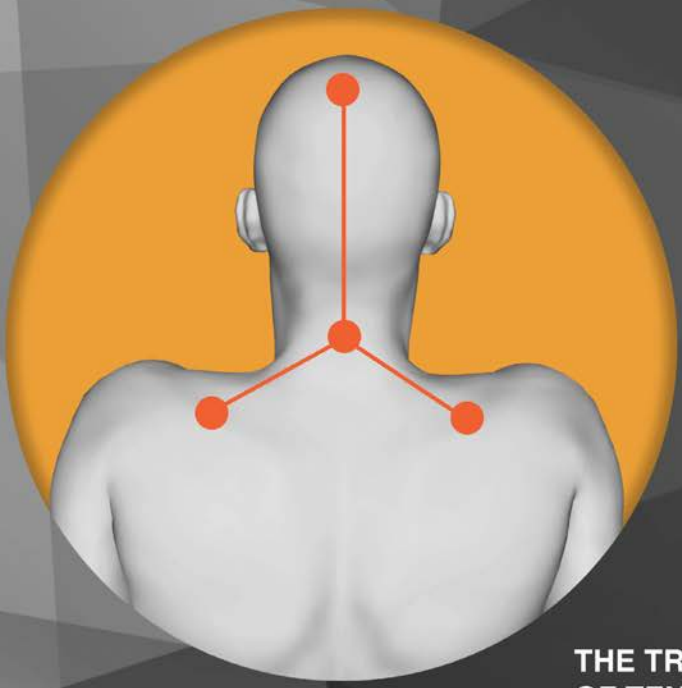
- Increased muscle tension is one of the first symptoms you will see during a stress response.
- The stress hormone noradrenaline alerts the muscles to be primed for emergency and a shortened tense state is the sign they are engaged.

Specialists refer to the muscles most susceptible to tightening under psychological stress as the 'triangle of tension.'

- When experiencing stress, the shoulders lift, neck muscles contract, the jaw clenches and the brow furrows.
- Under this physiological 'squeeze,' it's not surprising that muscle tension is often felt most acutely in the triangle marked by the shoulders, neck and forehead.



TEETH GRINDING
AND JAW TENSION



THE TRIANGLE
OF TENSION

Up to 70% of bruxism cases may be related to either stress or anxiety. [2]

While sleep disorders and lifestyle factors are also associated with habitual jaw grinding and teeth clenching, stress, anxiety and other psychological components have been strongly linked to bruxism in a number of clinical studies.

Researchers at the Hiroshima University Hospital Clinic of Prosthetic Dentistry studied two groups of volunteers - one with sleep bruxism and one without. [3]

- Those with bruxism showed a far greater stress reaction to an experimental stress task than those without.
- According to the researchers, these results show an association between bruxism and psychological stress sensitivity.

Another study undertaken at the Helsinki University Central Hospital assessed the link between bruxism and stress among 1,339 adults. [4]

- In all categories, frequent 'bruxers' reported higher levels of stress in their daily lives.
- Those reporting ongoing bruxism made more frequent use, not only of dental services, but of general occupational healthcare too.

This would seem to support the conclusion that bruxism is a good indicator of elevated levels of stress. But there's more still to the dental health picture.

Stress may contribute to gum disease.

- It's safe to say that oral hygiene may not be the first thing on your mind when you're stressed. The resulting bacterial build up is further facilitated by a weakened immune system.

- In addition to this, reduced and chemically altered saliva production (dry mouth syndrome), often associated with the stress response, can cause an increase in dental plaque build up and gingivitis.

This combination of behavioural and physiological factors can be a powerful negative force in your mouth. Studies support the link between stress and dental health. In 2012, the Academy of General Dentistry reviewed one such study, undertaken jointly by three major U.S. universities, and concluded that emotional anxiety was a significant contributing factor to periodontal disease. [5]

Stress may also cause a weakening in the bone structures of the body and inhibit calcium absorption.

Elevated levels of cortisol associated with the stress response can cause bones and teeth to be compromised in two ways:

- Firstly, by inhibiting calcium absorption in the small intestine (calcium is important to tooth development & bone strength)
- Secondly, by reducing production of the cells responsible for making bone (osteoblasts). See *page 32* for more detail.

Given the apparent effects of stress on gums, jaws and teeth, the U.K's National Health Service has joined a growing number of dental professionals in recommending stress management as a way of saving teeth and gums from the daily grind. [6]

Reviewed March 2014 by:
Allen J. Moses (DDS Asst. Prof. Rush University Med.School)

"Bruxism is a source of increased stress. Reducing stress is an intelligent treatment for bruxism. Seems simple. These guys got it. How come it took so long for everyone else to get it right?"
- A.J. Moses

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