



IACN International Association of
Clinical Neuropsychotherapy

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Neuroplasticity and Implications for Mental Health

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Table of Content	Page
Introduction	3
Neuroplasticity	3
The significance of neuroplasticity for mental health	4
Developing the capacity to self-regulate	7
Hand-on-Heart practice	8
Genes	9
Generalised Anxiety	9
Obsessive-Compulsive (OC) Tendencies	11
Depression	13
Sleep	14
Manageable vs Unmanageable Challenges	16
The benefits (to you) of cultivating a safe environment	17
Difficult memories	20
In closing	21
References	
Appendix A:	Self-Care to Optimize Neuroplasticity
Appendix B:	Sleep Info and Mindfulness tips
Appendix C:	Image of the Brain

Introduction

This paper is about how to capitalize on the biggest asset in your practice; your *brain*. In particular, how to use the plasticity of your brain to improve your mental health and well-being. It also discusses particular mental health issues within the context of neuroplasticity, how we deal with challenges, the role of our genetic makeup, as well as the importance of cultivating a safe environment.

The Bar is not an easy life. Many barristers seem to alternate between being anxious that they have too much work on and they will never get it all done, or that there is not enough work and their practice is dead. The different kinds of challenges you face in your profession demand strong coping skills, and you would not have come this far if you did not have them.

But even then, things may get away from you sometimes. If you seek help, you might get advice that works for people in normal jobs; take some leave, don't push yourself so hard, exercise more, work less. All well intended, but not really possible if you are in the middle of a long trial. So you might instead stop sharing your difficulties, knuckle down and get on with it, thinking "this is just the way it is being a Barrister, and I need to harden up or give it up."

What I hope you will get out of this paper on neuroplasticity and its implications for mental health, is hope that things can improve, and that improvement can be achieved incidentally within the context of your existing busy lives. You can use your capable brains to change your brains. To do this you need *knowledge*, which I am providing an introduction to here, *awareness*, which I will tell you how to develop, and *discipline*, which you already have in spades.

Neuroplasticity

The focus of this paper is neuroplasticity. I should therefore briefly explain the background and content of that concept.

The human brain has evolved over millions of years. The basic function and structure of the modern human's brain has not changed since the Cognitive Revolution some 70,000 years ago. Its predominant function is to keep us alive for long enough that we can reproduce. It cares about survival, not self-fulfillment and happiness. It will only allow such indulgent emotional states while there is **no threat around**, so in order to thrive and not just survive in the modern world we need to wire the brain to only react to *real* threats, and not to the difficult but not life-threatening challenges. In your case, practice at the Bar. How is that possible?

Until a couple of decades ago, despite plenty of evidence to the contrary, the ruling paradigm in Neuroscience was that the brain develops until you are in your early twenties. Then it remains unchanged until it deteriorates with injury or old age.

One study amongst many that finally caused a paradigm shift was conducted on four Swedish men dying of cancer. In the last days of their lives they learned a new skill; knitting. Post mortem examination revealed that a brand new neural network had developed in their brains. The study proved that new neural networks can form in the brain through to the very last breath (for an overview of pioneering studies on neuroplasticity, see Doidge, 2010).

In a newborn the rate of neurogenesis is a staggering 100,000 new neurons per second. By the age of 25 this number has dropped to 800 per day (Rossouw, 2016). The process of building new neurons from stem cells and producing new neurotransmitters, is enhanced by the following (please see Appendix A for more details):

- good quality sleep;
- regular intake of good nutrients;
- exercise;
- using the brain in new and varied ways; and
- limited intake of CATS (Caffeine, Alcohol, Tobacco, Sugar/Sweeteners)

Some parts of the brain, namely the cortex and parts of the limbic system, develop and change constantly through our experiences. Repetition of a specific pattern of neural firing leads to a neural network forming and strengthening. For example, you may have heard of “Pavlov’s dogs.” Pavlov rang a bell just before feeding his dogs, and after repeating this for a period of time, the dogs would start to drool when he just rang the bell, even when there was no food. This process is called the “Hebbian Principle No.1” after Mr Hebb who wrote about this as early as 1949: **Neurons that fire together, wire together.**

However, the opposite is also true; if we change something, the old neural network will eventually disintegrate. If Mr Pavlov continued to just ring the bell and not give food, the dogs would eventually stop drooling at the sound of the bell. This process is called the “Hebbian Principle No.2:” **Neurons that fire apart, wire apart.**

The brain does not discriminate between “good” patterns and “bad” patterns. Whatever we keep repeating gets stronger, whether that is functional or dysfunctional. What we stop doing gets weaker. It is constantly a game of “use it or lose it”.

The significance of neuroplasticity for mental health

This is significant because it shows that negative emotions and challenging mental states can be changed. They are patterns of neural firing that have formed over time by being repeated, and if we start repeating different patterns instead we will over time change the structure of the brain. If repetition involves *focused attention* the process of change is quicker.

What is required in order utilize plasticity in a helpful way, is *awareness*. Once we have identified something as *helpful* we can strengthen that pattern by focusing our attention and repeating it every day. Once we have identified something as *unhelpful* we can

choose to focus our attention on something else, and the unhelpful pattern eventually disintegrates. This is harder than it sounds.

The brain likes what is *familiar*, even if it is quite dysfunctional or destructive. New patterns will generally feel a bit *uncomfortable* at first, even if they are good for us, because it takes on average two weeks for the new pattern to activate the release of dopamine, which gives us a sense of reward and motivates us to do more of the same. Think for example of how hard it can be to start exercising or eating healthy after a long period of over-indulgence. It takes a while before squats and carrots are associated with a sense of wellbeing. Some substances on the other hand are very easy to get used to because they give an immediate release of lots of dopamine, like cocaine or chocolate, for example. The quicker and bigger the release of dopamine, the higher the risk of addiction.

It only takes about two weeks of daily activation for a new neural network to form. Within 2-3 months of regular use, this network becomes the default network, a habit. If the new habit replaced an old one, within another 2-3 months, the old network will have disintegrated from not being used. You have successfully replaced an old habit with a new one. And even old dogs *can* learn new tricks, it just takes a bit longer. Dr. Dan Siegel describes a case in his book *Mindsight* of a 92 year old man – who just happened to be a lawyer – learning to become affectionate for the first time by activating his Right Pre-Frontal Cortex (RPFC) on a daily basis.

For changing the brain *short and often* is more efficient than long and infrequent. If you are learning something new, like playing a new instrument, daily practice is significantly better than a one hour practice on the weekend. For adults **12 minutes per day** is enough, for children only 6 minutes of focused attention on the new skill is required in order to efficiently build a new neural network. This does not even have to be in consecutive minutes, you can break it up as much as you like. If you are learning to drive a car shorter segments are not convenient, but if you are practicing emotional awareness or down-regulation of stress, you could with benefits do this for one-minute twelve times throughout the day, or in 24 segments of 30 seconds!

If your resistance has now hit the roof by this talk of practicing new skills, it is good to remember that your mental health can improve not only by practicing new skills, but equally by *not* continuing to do what you are already doing that is unhelpful. Back to Hebbian Principle number 2; what fires apart, wires apart.

Whatever you focus your attention on frequently becomes a strong neural network that is easily activated, with the thoughts, images, emotions and bodily sensations that go with it. Think for example of the neural network called “*I can't do this.*” This thought may lead to thoughts of being humiliated in Court, images of angry faces and a strong sense of dread in your stomach. This network may be activated increasingly often with increasingly devastating effect. You end up wasting precious time and energy, and it does not feel good either.

We cannot control what comes up in our mind. But it is good for you to know that it is only your attention that will keep it there! If you do not give attention to an unhelpful

thought that comes up, it will go away by itself. On the other hand, the thoughts that you do give attention stay and grow in intensity, and they will also come up more frequently. Your attention is like the fertilizer, sun and water in the garden of your mind. Make sure you don't give attention to the weeds!

Good mental health is an *integrated* brain; a system that self-regulates to maintain homeostasis (equilibrium) with the Pre-Frontal Cortex (PFC) engaged. We improve our mental health by increasing awareness of what is going on in our body and our mind, of how things affect us, and whether reactions are helpful or unhelpful.

By observing what is going on internally and responding in a helpful way, we build and strengthen:

- connection between different parts of the brain; and
- neural patterns that with frequent use become default functional coping mechanisms.

To illustrate the importance of good connection between different parts of the brain I am now going to show you a highly sophisticated model of the brain...Here it is... your hand (Siegel, 2010).

Close your hand over your thumb into a fist. Your wrist is the brainstem, also called the Survival brain, sending signals down to the body. The thumb is the Limbic system, also called the Emotional or Impulsive brain, where the alarm goes off if there is a threat. Your fingers are the cortex wrapping around the lower parts of the brain. At the front is the Smart brain, the Left Pre-Frontal Cortex (LPFC) and RPF.

Communication in the brain is determined by proximity and strength of connection. You can see how the middle finger representing the Middle Prefrontal Cortex (MPFC) touches the Limbic system, the Brainstem and Left and Right hemisphere. When all is calm in the Limbic system there is good cortical blood-flow to all parts of the brain and the MPFC is relaying information to the Smart brain and regulating activity in different parts of the brain. However, if the alarm bells are suddenly ringing like crazy in the Limbic system, all the blood-flow is sucked into the Survival brain and the MPFC is temporarily disengaged and flips up! We "flip the lid"! We have no executive control, we are completely in "Fight or Flight" mode. Whilst it may feel quite satisfying at the time to flip the bird, it can be a bit embarrassing to think back on once we have calmed down. It is not nice to feel that we have lost control, and maybe we realize that we said or did things that we regret once we have calmed down and can think again.

When you carry out practices that increase self-awareness and self-regulation, the MPFC is activated. Activated frequently, the MPFC grows in size and connectivity to right and left hemisphere, Limbic system and Brainstem. The stronger your MPFC is, the easier it is to prevent it from flipping. The functions of the MPFC include: body regulation, attunement, insight, empathy, morality and intuition (Siegel, 2010). All good to have, especially around other people.

Developing the capacity to self-regulate

Like any skill, the capacity for self-awareness and self-regulation develops through disciplined practice. When you practice observing what goes on in your mind and in your body without reacting to it or doing something with it, you develop the capacity to respond in a deliberate manner rather than react in an impulsive manner. This kind of practice underpins the notion of Mindfulness, which has been so much talked about. It is called *practice*, not perfect. In the same way that you are *practicing* as a Barrister and I am practicing as a Psychologist, we all practice to develop in that capacity. We don't have to be perfect at it, in all our pursuits it is continued *practice* in a conscious, reflected manner that makes us better at what we do.

In these practices the objective is not to blank your mind but to keep re-directing your focus back to where you want it each time you get distracted. If your mind is very agitated, consider it good a resistance training opportunity for the mind! Each time your monkey-mind hops onto something else, you notice what caught your attention and return the focus to your breath, your bodily sensations or whatever your chosen object of attention is. When you focus on the breath, the breath will slow down naturally. When the breath slows down, the mind slows down and it is easier to maintain focus.

Mindfulness practices are very simple but very hard to do at first. You can start off by using a guided Mindfulness or Meditation – there are a few suggested in the reference list - but eventually you will be able to do it on your own for longer and longer. In the beginning it is easier to practice while your mind is already relatively calm, for example just before going to sleep or when you first wake up. You are also then not taking up precious work time with mental hygiene, for those who are reluctant to do so at this point. The opportunity cost is low. You may also find it easier to keep your focus if you include the body. You may for example try focusing on your movements and breath whilst swimming, walking, practicing yoga or stretching. You can also include it in normal daily activities, for example each time you go to the bathroom or have a drink of water.

It may not happen the first few times that you practice, but you will after relatively few attempts experience a sense of calm and clarity. Having a personal positive experience of these kinds of practices will be more motivating than anything that I can tell you. If something is pleasant we want to do more of it.

These kind of practices can have significant immediate effects in terms of down-regulating the stress response, as well as strengthening the MPFC in the long term. The Hand-on-Heart practice described below can calm down a panic attack in less than a minute. You have neurons around your heart and in your belly, just like in your brain. Depending on how you are wired, one of the hands placed on the heart will change the heart variability rate, ie calm you down (Siegel, 2013). Also a bit of oxytocin (the cuddle hormone) is released this way, which relaxes the body and improves the mood. About two thirds of us are wired for the right hand on top, but it will generally be the one you place there spontaneously.

Hand-on-Heart Practice (Graham, 2013)

1. Close your eyes.
2. Put one hand on your heart and one on your lower belly.
3. Breathe out slowly and fully. Pause, and then the inhalation happens by itself. Repeat this three times, just focusing on making the exhalation as long as possible that still feels comfortable.
4. Bring a half-smile to your face.
5. Feel the warmth from your hands, your heartbeat, and the rise and fall of your breath.
6. Notice how you feel in your body. Keep breathing out slowly.

If you have a bit more time, you could add this:

7. Think of a peaceful, safe place. Either a real or an imagined one.
8. Think of being with a person who loves you, this can be a real person from the present or the past, or a spiritual figure. Somebody who embodies compassion.
9. Feel this person's love and compassion flood through your body, and feel gratitude for being loved in this way.
10. Again, notice the warmth from your hands and how you feel in your body. Notice your breathing, deep and slow.
11. Start to wiggle your toes a bit and notice the room around you, and when you feel ready, you can open your eyes.

This whole practice can be done in just 1 minute, but even just **one** conscious long exhalation activates the Parasympatic Nervous System and gets you out of "Fight or Flight" mode temporarily. It is like rebooting the computer. Each time you do this, *this* network gets stronger and easier to do, with greater effect. Eventually it can replace the old response to for example the negative thought "I can't do this."

Here are some good reasons why the Hand-on-Heart is good to practice:

It is a lot more *pleasant* than, for example, playing the broken record of imagining being humiliated in Court and having to sell your house because your career is over. Playing that broken record achieves absolutely nothing else than to reduce the blood flow to your LPFC, making it extremely hard to do your work.

Doing the Hand on Heart practice releases the GABA neurotransmitter – the breaking system in the brain - thus reducing the agitation. You end up feeling more calm and clear and can focus on one thing, for example your work. An extra bonus is that you have temporarily switched from the Sympatic Nervous System (also called "Fight or Flight") to the Parasympatic Nervous System (PNS; the "Rest and Digest" mode). Practicing this shift throughout the day means that you can easier switch to the PNS when you are eating so that you can digest your food properly, and at night so that you can get good quality sleep. You are no longer completely stuck in "Fight or Flight" mode, but can fluctuate between the two states.

Lastly, there is one more huge advantage to practices like the Hand on Heart practice: you switch to a **positive mind state**.

The brain operates in very different ways depending on whether you are in a positive or negative mind state (Fredrickson, 2012). Whilst our survival as a species is attributed to the negative mind state, our climb to world dominance is mainly due to the positive mind state.

Operating with a negative mind state we:

- avoid risk; and
- rely on old well-proven ways and methods

Operating with a positive mind state we are:

- creative and innovative;
- hopeful that things will work out; and
- open to trying something new

Based on what I know about your work, the latter mind state is likely to be more useful when you have to think on your feet.

Genes

Some of you might say, this is all very well and good, but I am doomed anyway because of my genes. That is probably NOT true. There are only about 10,500 single strain, genetic disorders, most of them extremely rare, and an endless number of multi-strain disorders that are linked to the environment and your experiences (Rossouw, 2016).

Eric Kandel got the Nobel Prize in 2000 for his discovery that the environment and experiences plays a role in whether genes express or not. Whilst he studied the Californian sea slug (Kandel, 1998), the same applies to humans. For example, you may have drawn the short straw and inherited the short rather than the long allele making you genetically predisposed to low serotonin and depression. But then you draw the long straw and grow up in a safe, enriched environment, so that genetic predisposition does not express! Moreover, you will now pass on the long allele to your offspring (Rossouw, 2016)!

In the context of Neuroplasticity I will now discuss some common mental health problems that decrease productivity and wellbeing. As with many physical health problems, like bad backs, mental health problems can cause suffering and impairment even if they are not clinically significant. We have an extraordinary ability to get used to and put up with discomfort. In addition, the brain likes what is familiar, so there is often a resistance to change unhelpful patterns.

Generalised Anxiety

Prolonged stress can lead to Generalised Anxiety; anxiety that is fairly constantly present and cannot be pinned on anything specific but may be worse in certain situations. During long periods of high stress the brain is constantly flooded by cortisol, which is toxic to the brain. Cortisol excites the Amygdala, the Security Guard that sits in

the Limbic system. This leads to hyper-vigilance and the alarm bells go off at things the Amygdala would normally ignore, resulting in further release of the stress hormones adrenaline, noradrenaline and cortisol.

The Hippocampus, which is the Administration Office in the Limbic system, is inhibited by cortisol. The Administrator cannot effectively put experiences in time and context and form explicit memories when flooded by cortisol. We end up feeling a bit upset most of the time without really knowing why, and past experiences feel like a blur. The Administrator's relay of information to the Chief Executive Officer sitting in the Left Prefrontal Cortex is also compromised so the executive part of the brain is not fully in charge. When anxiety peaks our mind goes blank and we cannot think of what to say or do, as there is no activity in the executive part of the brain (Rossouw, 2016; Schore, 2012).

There are many sources of anxiety in your profession but they all tend to result in worries about not being good enough, making a mistake, being publically criticized and humiliated and your career being over.

Big challenges with uncertain outcomes always cause some level of anxiety. Your work consists of exactly that, and although you work your hardest, you constantly risk being criticized and held accountable for things that are often outside of your control. So it is good to know that a certain level of anxiety is *normal* when you are doing something difficult in an unsafe environment.

The higher the anxiety level is, the more the thinking and perception circuits of the brain are adjusted so that what you perceive and think fits in with that anxiety. Homeostasis is maintained, and the brain cares more about that than your long term happiness. The thoughts and perceptions by the anxious brain tend to generate more anxiety, as they create a negative rather than objective view of yourself and your situation.

This negative bias is what underlies the so-called "Imposter Syndrome," which is quite common in professions where you constantly feel at the edge of your potential. "I have been lucky to get away with it until now, but I am sure they will find out how useless I really am this time." You *cannot* be objective about yourself when you are anxious about your performance. Your self-appraisal will always be more negative than other people's appraisal of you, no matter how good your actual achievements are.

Anxiety tends to get worse over time if left to develop. The more you worry about the future and ruminate about the past, the more you strengthen the neural networks that fuel your anxiety. Learning to recognize how anxiety tends to manifest itself for you is important in order to catch it early and manage it. Your early symptoms may be bodily tension and restlessness, or irritability, frustration and anger, or social withdrawal, or excessive worry and rumination, or changes to appetite and sleep patterns, or problems with concentration and memory.

Awareness of our general anxiety level can help us to predict over-reactions and prompt us to down-regulate before responding to situations. We can say to ourselves "I am

pretty stressed or anxious right now, so things will seem worse than they really are. My automatic reactions to things will be off the mark and need to be held on a short leash.”

When significant anxiety is identified, the first step is *always* to down-regulate, for example with the Hand-on-Heart practice or just breathing out slowly. Once we start calming down, which in itself is a LPFC function, we can gradually activate more complex processes in the LPFC, such as analysis and problem solving. We also regain full access to our functional coping strategies, which we can keep improving on all our lives. But the first step is *always* to calm down in order to bring cortical blood flow to the Smart brain, otherwise we will “flip the lid” and react to high levels of anxiety with our automated survival responses, no matter how sophisticated our coping mechanisms normally are.

Some anxiety is situation specific, usually due to a negative past experience priming us to feel anxiety before and during a similar experience (see “Difficult Memories” below). Situation specific anxiety often involves anticipatory anxiety, including negatively biased and catastrophic thinking. Identifying which specific situations cause anxiety for you can help you to predict and ignore negative thoughts and remind you to down-regulate before and during the event. As a general rule it helps to be *process* oriented rather than *goal* oriented. In Court for example, thoughts of “I must win, I must be excellent, I must get everything right” which are goal oriented, lead to anxious thoughts about “what if I don’t.” Instead you could try to stay process oriented in Court: e.g. breathe out, take notes, speak slowly, maintain eye contact. Focus your attention on the present.

In summary, rewire your brain to be less anxious by:

- Normalise anxiety; it is inherent in your work.
- Down-regulate frequently, many times every day - enhances the MPFC and the Hippocampus, increasing integration and lowering your base cortisol level amongst other things!
- Stay aware of signs of anxiety/stress and how it makes you over-reactive and negatively biased.
- Reduce your intake of caffeine – you have enough nervous energy already (norepinephrine).
- When worry and rumination comes up, refocus on something else.
- Identify and rewire difficult memories.
- Stay Process Oriented, stay present.

Obsessive-Compulsive (OC) Tendencies

“OCD” (Obsessive-Compulsive Disorder) is a term that we often throw around to describe somebody with peculiar habits, including ourselves. Whether it is obsessive thoughts that we cannot get rid of or actions that we are compelled to carry out whether we want to or not, we can all be a bit “OCD” in times of stress. However, for some people certain thought- and behavior patterns can establish as a habit and eventually become hardwired neural networks, referred to as character traits. If OC tendencies become entrenched and troublesome, it is good to get some professional help.

Obsessions and compulsions, like all mental health problems, are due to a lack of integration in the brain, which results in lack of self-regulation. Studies of patients with severe Obsessive-Compulsive Disorder (OCD) show increased neural firing within specific structures of the brain (e.g. the Insula, Orbito Frontal Cortex and Anterior Cingulate Cortex) and low connectivity between these structures and other parts of the brain that help to modulate and resist impulses, in particular the Cerebellum (Moody *et al*, 2017).

OCD is linked to serotonin and dopamine deficiency. Adrenaline chews up serotonin, dopamine and glucose, thus intense or prolonged periods of stress can lead to low levels of serotonin and dopamine along with the afternoon sugar cravings (Goleman, 2003). Serotonin directs all motivation and activity. When we are low on serotonin we are less able to regulate our thoughts and behavior in a conscious manner. Default or automatic patterns take over whenever we are not driven by adrenaline to complete certain tasks.

When we are low on dopamine, which is the reward system of the brain, we have to repeat or continue with an activity for longer before we feel satisfied that this is now complete (Russouw, 2016). For example, it is not enough to tidy my desk, I also have to make sure all the books in my bookshelf are exactly lined up. Or I have to check several times that I have turned off the computer before going home. A far more subtle manifestation of OC is when you find it increasingly hard to be satisfied that you have completed a *work* task. As you spend more and more time checking your work, there is less opportunity to derive dopamine from other sources. As you work increasingly more in order to get the same dopamine release, you keep depleting your stores of serotonin and dopamine. Breaking your work down into discrete tasks and setting time limits can help reduce the risk of getting stuck in OC loops.

OC tendencies are related to anxiety. As dopamine levels go down, the level of norepinephrine (which creates the “nervous energy”) goes up. You get a feeling of not being done, not being safe, and what you perceive and think will fit in with that anxious feeling. You might pin your anxious feeling on a fear of germs and wash your hands until the skin is raw, or more commonly in your case; you may continue checking your work – it gives you something to do with your anxiety and you can eventually feel a sense of improved wellbeing as dopamine gets released. OC tendencies become addictive because dopamine gets released as a result of feeling productive or protecting against the perceived threat by activating obsessive thought patterns or ritualistic behavior patterns. The problem, of course, is that the anxiety is not dealt with directly so the relief is only temporary and the obsessions and compulsions must be repeated. As with any addiction, we need to keep escalating our OC patterns in order to get the same level of dopamine release. This is how OC tendencies can turn into OCD.

How to reduce OC tendencies

- Build new compensatory networks; goal oriented, non-compulsive behavior and thought patterns.
- OC networks disintegrate when not in use, ie if we resist the impulse and do something else instead, that is driven by a conscious decision not an impulse, then within 2-3 months the OC networks start to disintegrate.

- Strengthen the integration in the brain (Mindfulness, activating all different parts of the brain through a variety of activities, psychotherapy).
- Increase dopamine levels (exercise, doing new things) and derive dopamine release (satisfaction/pleasure) from a wide range of sources.
- Be specifically alert to signs of anxiety (bodily symptoms, thoughts, emotions) and down-regulate.
- Set a time limit on work tasks to reduce the risk of getting stuck in OC loops.

Depression

Chronic high level of stress depletes the stores of serotonin and dopamine, which may lead to symptoms of Depression including low moods, low self-worth, low energy and lack of enjoyment. The work you do is entirely LPFC driven. This is good in some ways, as LPFC activation is connected with positive emotion and a sense of control and order. But we also need regular RPFPC activation to feel that life has colour and that we are connected with the world around us. Otherwise, in the long term, we may end up feeling isolated, rigid, and seeing life in black and white. Social and emotional connection then becomes difficult because those networks are rarely used, and we may withdraw further to avoid the discomfort.

When Depression is severe it is difficult to actually make a change and do the things we know are helpful. That is usually due to the lack of serotonin and dopamine. It is good to know that so we don't beat ourselves up about our inability to change or stick with something. Anti-depressants can be helpful in the short term, just as a "leg-up." However, without creating some real changes in how we think and live, any improvement from the medication tends to be temporary. "The Jury is still out" on the effects of long-term use of anti-depressants. There is some discussion that it may lead to shorter periods of wellness between episodes of Depression (Littrell, 1994) as well as a more chronic course of Major Depression (Fava, 2003). Self-medicating with alcohol or marijuana increases the severity of depressive symptoms and reduces neuroplasticity, making positive change more difficult.

What will help reducing the symptoms of stress related depression

1. Good self-care, as described in "How to optimize Neuroplasticity" (see Appendix A for details).
2. Frequent turning off of the stress response, e.g. Hand-on-Heart practice, Mindfulness, Relaxation.
3. Activating the RPFPC, for example by first doing a quick Body Scan and Autobiographical Recall of the day. Then you are ready for other RPFPC activities. Social connection, activities requiring spatial awareness, play, creative activities and listening to music are all RPFPC functions. Your Left brain might be tired at the end of the day, but the Right brain is fresh as a daisy!
4. Talk to your GP if symptoms persist. Medication for a short period of time may help you to get going with new neural patterns.

Sleep

You have all heard repeatedly that good sleep is important. However, I want to place this in the context of neuroplasticity in an effort to persuade you that good sleep really *is* important.

Adults need 7-9 hours of good quality sleep in an *average* night. This is because the REM sleep phases are longer in the last couple of the 90-minute sleep cycles. REM stands for the Rapid Eye Movements that indicate we are in this stage of the sleep cycle. During REM sleep the Hippocampus is active and the PFC is quiet. The hypothesis is that the Hippocampus offloads material from the day to long-term memory in the cortex, so that we can wake up with an empty in-tray. The Hippocampus also produces new neurons from stem cells and fills up the neurons with new neurotransmitters (Russouw, 2016).

So REM sleep is important for memory formation, neurogenesis and the production of neurotransmitters. If REM sleep is inadequate it affects our ability to acquire new skills, the integration of knowledge and life experiences, and we get low on neurotransmitters like serotonin and dopamine.

Insomnia and broken sleep are the most common sleep problems. Both can quickly establish a negative spiral; the anxiety about not falling asleep or waking up during the night and then being tired the next day prevents falling asleep and causes waking up in the night.

It is good to know that we can manage quite well on a few nights with *less* than the average of 7-9 hours. The brain builds up a sleep deficit and will naturally recover some of the loss if given the opportunity within a reasonable time. So if you know that you can have at least 1-2 catch-up nights per week during a long trial, you may be able to effectively down-regulate the anxiety about being tired that would otherwise cause insomnia.

Sleep is one of the most habitual behaviours we have. This is good and bad. Bad sleep habits develop quickly and established sleep disorders erode our ability to change the habit. However, relatively quickly a new bedtime routine can build a positive association to improved sleep and confidence in being a good sleeper. There is more detailed information about this in Appendix A and B. Essentially, we need to start down-regulating at least half an hour before sleep time so that by the time we fall asleep we have completely let go of the day and are “off-line” until the alarm goes.

Speaking of the morning wake-up alarm, if you wake up feeling like you are dead, the alarm has probably woken you up when you were in the deep sleep phase. You can try setting the alarm at a different time or go to sleep a bit earlier in order to wake up during light sleep. This is the main advantage to having a regular sleep-time and waking-up time; you can figure out when you feel it is easiest to wake up.

It is very common amongst people with a high stress work life to fall asleep quickly and then wake up after 3-5 hours. After this they may get broken sleep, at best. They may

think they are one of those special people who can live on very little sleep, but that is probably false. They wake up after 3-5 hours because the body has got what it needs from the first 2-3 sleep cycles when deep sleep dominates. You can keep running then and that is what your brain tells you to do. A bit like an escapee on the run hearing pursuing dogs bark in the distance, you collapse in exhaustion and get back up and keep running when you have had the minimum rest required to do so. So even if you have no trouble falling asleep, it is essential to down-regulate completely before going to sleep in order for the brain to understand that the dogs will not start chasing again until the alarm goes off.

When you down-regulate using mindfulness or another form of relaxation, you release the GABA neurotransmitter. GABA is the braking system of the brain. It is like a soothing goo that inhibits the firing of neurons. Another effective way to release GABA is to use alcohol, marijuana or benzodiazepines. A bottle of red or a sleeping pill, and we drop off to sleep very nicely. Doing this once a month is not going to cause any harm other than possibly a heavy head the next morning, however, as sleep routine is highly habitual we will very quickly need it most nights, if not every night. Instead of engaging the brain's natural ability to release GABA, we rely on alcohol or drugs.

Alcohol, marijuana and Benzodiazepine will send us straight into deep sleep - and keep us there. The body will get the chance to regenerate, but not the brain. There is no REM sleep happening to speak of. So over time, the neuroplasticity is seriously compromised and the brain becomes rigid. Ultimately this may lead to atrophy or cell death, and conditions like dementia. This is especially evident for elderly in nursing homes who have little stimulation, poor nutrition and little exercise. If their neuroplasticity is further compromised by being given benzodiazepine to calm down or sleep better, they often quickly develop symptoms of dementia which may be reversed if they come off the medication (Russouw, 2016).

Alcohol has many negative short and long term side-effects on our organs and neural structures, but I just want to mention one thing in relation to anxiety. Whilst alcohol initially relaxes the brain, it has the opposite half-life effect. As soon as the alcohol starts to break down through the liver, it agitates all the neurons and causes them to fire. We feel on edge, irritable, restless, tense and anxious. It is harder to concentrate and remember things. This effect can persist for days after a big night of drinking. Then we may feel we need a few drinks to calm down, and whoops! The negative spiral is happening. A regular intake of 5 standard drinks per night is associated with cell death in the Hippocampus (Russouw, 2016), which is amongst other things where new neurons are produced and memories are formed. A "safe" limit from a neuroscience perspective is considered 2 standard drinks. However, if we rely on a couple of drinks for winding down at night, an addiction can very quickly develop, which usually leads to increased intake over time.

I also want to mention something about caffeine. It is not only in our beloved coffee. Caffeine content can be even higher in black tea and there is also caffeine in chocolate and of course some soft drinks that are too evil to mention. Caffeine is a strong stimulant that increases the level of norepinephrine in the brain. Norepinephrine creates the nervous energy that makes us alert, but in excess it causes hyper-vigilance and anxiety.

It takes about 4.5 hours for the effect of caffeine to wear off. Some few people feel more sleepy after a coffee at night, but the norepinephrine may still cause agitated sleep. The general advice for good sleep is to keep the daily intake of caffeine below 4 shots and not have any late in the day. If you tend to feel a bit nervous even before your first coffee, you have plenty norepinephrine as it is and it may be good to stay away from caffeine all together.

Manageable vs Unmanageable Challenges

Challenges drive all development in the brain, both positive and negative. Challenges that are perceived as manageable lead to increased blood flow and serotonin in the PFC and neural *proliferation*; new neural pathways are formed and existing pathways strengthened. There is a sense of safety and wellness.

A challenge that is perceived as **unmanageable** is identified by the Amygdala as a *threat*. This leads to an over-activation of the stress response and we “freak out.” Blood flow to the LPFC is restricted and we activate and strengthen existing survival patterns, neural *protection*. The thinking- and perception circuits in the brain are affected by the high activation in the Amygdala and our ability to be rational and objective is compromised. Perceptions and thinking take on a *negative bias* to fit in with the anxiety (Goleman, 2003).

Whether challenges are determined by the brain as manageable or not depends on our sense of safety. We cannot always control what challenges come our way, but we can to a large extent regulate how safe we feel. The more unsafe or critical the external environment is, the more we have to rely on our capacity to calm down and create an internal safe environment (more about cultivating a safe environment below).

The key to dealing with all sorts of challenges is to monitor and regulate your stress response. You cannot control automatic reactions in the brain, but you can learn to recognize and down-regulate, i.e. turn off the stress response by activating the PNS. It also helps to remember that you cannot be rational about the situation until you have done this. So calm down and *then* think about it. Just by engaging in the process of calming down, for example by doing the Hand-on-Heart exercise, you have forced some blood-flow back into the LPFC. Gradually you can then engage in higher order executive functioning. Rational analysis while you keep your anxiety in check, maybe taking several breaks during this process to calm yourself down, leads to an acceptance of what *is*. You can then consider your options and problem solve. An unmanageable challenge becomes at least mentally manageable, giving us the best chances of success.

If you have been practicing observing your thoughts, emotions and how you feel in your body, you have built a strong connection between the MPFC and the limbic system. This enables you to monitor and regulate high anxiety instead of “flipping the lid” (cortex).

You may also remember that stress is accumulative. It may be a small challenge on top of other challenges that ends up triggering you. This is due to cortisol building up in the brain, causing hyper-vigilance and over-reactions. The more and longer you have been

stressed, the more likely you are to perceive another challenge as unmanageable, even when you would normally not do so.

On that note, it is helpful to remember that other people have brains, too, even when there is little evidence of that. If you suggest or request something, and the other person is clearly anxious, angry or just stressed and exhausted, you are not going to get the most positive response. You also will find it very hard to reason with that person. Instead you run a high risk of losing *your* calm and mirror their emotional state. That is due to the mirror neurons in your brain (Goleman, 2003; Doidge, 2010).

A good strategy in this situation is to pick a better time for the conversation. If that is not an option, try to create a safe environment. Sit down when talking, especially if you are taller, and give the other person space. Try to relax your body and speak slowly with a low voice. The more you calm yourself down, the other person's mirror neurons will pick this up and you can hopefully have a smart-brain to smart-brain conversation. If none of this is working, remember to not take it personally. There is quite likely something going on for the other person that has nothing to do with you. Clear out as fast as you can to prevent further harm to the relationship.

People do not experience emotion in the same way. There are different affective styles that determine strength, duration and expression of emotion (Goleman, 2003). Our responses are unified in the brain, not fragmented. If you have a big, fast emotional response it will be matched by a big, fast physiological response directed by the autonomic nervous system.

To what extent our affective style is due to nature or nurture is not certain, but it *can* be altered. People who calm down quicker after experiencing strong negative emotion are also better at regulating emotion, they have a lower baseline cortisol level and higher immune system functioning (Goleman, 2003). Hence learning how to down-regulate strong negative emotion has many benefits. Brain studies also show that positive emotions are grounded in reason and activated in the LFPC. In order to develop our positive emotions and emotional intelligence, we can analyse emotional events afterwards. We can learn what our triggers are, how they affect our perception and thinking and try to develop new more helpful responses to these situations.

The benefits (to you) of cultivating a safe environment

Our brain seems to have a default negative bias. Growing up we remember better unpleasant or threatening experiences so that we can avoid them in future. If there are plenty of negative experiences, our *avoidance* patterns grow big and strong. Our sense of emotional or physical safety is frequently compromised and we rely on what has helped us survive so far rather than trying new things. If we grow up in a predominantly safe and stimulating environment, our *approach* patterns grow strong. We have neural proliferation and growth, we can learn new things all the time because we feel supported and safe doing so (Hart, 2011; Shcore, 2012; Russouw, 2014).

Whether we grow up in a safe enriched environment or a compromised, critical environment shapes our brains in a fundamental way. We develop these strong approach patterns or avoidance patterns as children. However, the process in which the environment affects us remains unchanged all through life and our brains can be rewired to become more avoidant or more approaching if the influences are strong and prolonged enough.

As adults we are active players in our external environment. Our actions lead to responses in that environment. We can make it less safe by being critical and reactive, and we can make it safer by being supportive and open. In elite team sport there is now a big focus on creating safe environments in order for the individual players and therefore the team as a whole to achieve better (Russouw, 2014). For example, they learn to “Hug and Shrug.” If a player makes a mistake in a game, the player gets a forgiving pat on the back and a reminder to focus on moving on. “Let it go, let yourself be good again”.

As Barristers you are always in competition with each other one way or the other. In addition everything you do is literally judged by others all the time. A lot of the time you are over-reactive due to being stressed and tired. It may feel like you are constantly on the battlefield and that everyone is fighting for themselves. Whilst may be strategic to intimidate your opponent in Court until that person is a blubbering mess, being constantly on the battlefield is extremely *unhelpful* from a neuroplasticity perspective. Even if you are the best swordsman in the country, there is always the chance you get caught off guard or that somebody more agile is going to get you eventually. You can never show weakness, you can never close an eye.

How wonderful would it be to feel safe amongst your colleagues at least outside of the courtroom! How wonderful would it be if you knew you would receive a consistently friendly response when you try to connect with somebody, however briefly? What goes around, comes around. I know this is sounding a lot like I am telling you to play nicely. But I am actually encouraging you to act in pure self-interest! When you know the importance of a safe environment to your performance and mental health, you could actively cultivate this for your own personal benefit! Changing your own behavior may or may not have an immediate effect on the dynamics of for example your Chambers, but over time it definitely will. There may already be a culture in your Chambers of supporting the most junior members a bit, but sometimes those who deserve it the least may be the ones who need it the most. The angriest person could also be the most anxious person (Goleman, 2003).

As young children we have no control of our external environment and we have limited ability to regulate our internal environment. As adults we can at least to some extent do both. Sometimes we are our own fiercest critic and we *could* work on rather being our own best support, with great benefits to our mental health and performance. As with everything in the brain, the inner voice that gets the attention grows stronger.

The best that can be said for the inner critic is that it could make us try harder to achieve a good outcome. Depending on the type of challenge, we could benefit in our efforts from a release of adrenaline to sharpen our senses or make us run faster. However, when the

critical voice threatens dire consequences if we don't succeed whilst highlighting our real or imagined weaknesses, the balance can easily tip from being effectively spurred on, into a sense of panic. Our response to the critical voice is increased anxiety, restricting cortical blood-flow to the LPFC and inducing a negative state of mind focused on self-protection, risk avoidance and social disconnect (Russouw, 2014). Hence we may still perform, but we are not thriving. Whilst the critical voice gets attention, it is impossible to feel safe or good enough, regardless of our actual achievements. We stick to what we know best and avoid trying new things.

In any activity that requires high executive function, whether it is socializing, playing sport or delivering a pleading, we respond astronomically much better to the supportive inner voice. The supportive voice provides encouragement and reassurance, a sense of meaning and social connection. It basically makes us feel safe and stimulates cortical blood-flow to the LPFC. We can thrive and excel, learning equally from our defeats and triumphs, whilst maintaining a stable sense of self-worth. We feel safe to give things a go.

It is also important to cultivate a safe environment at home. If you feel that you have been on the battlefield all day, it is good to start down-regulating and creating an inner sense of safety as soon as you are on your way home. Then you will be more open and connect better with people at home, leading to a more positive response from them.

In this regard it is helpful to activate your RPPFC, for example by doing a quick Body Scan or a review of your auto-biographical data of the day (as a brief report in your head of everything you did, what you had for breakfast, etc). Activating your RPPFC makes it easier to connect with other people.

It is also good to be selective about TV programs and other entertainment you introduce to your environment. After work while you are supposed to be winding down towards good sleep is *not* the time to watch World News or programs about the dark side of human nature. If you are a criminal barrister it is especially good to steer well away from this. Not only can you get triggered by what you watch and read, it may also confirm to your brain that the world is a dangerous and depressing place where people are bad and nobody is safe. It may lead to feelings of hopelessness, helplessness, anger and fear. This has a significant effect on your night sleep in the short term and on your mental health in the long term. It is much better to watch or read something really funny, good hearted or beautiful. There is a lot of that in the world, too.

Difficult Memories

We have all got difficult memories and we all know how they can keep causing us misery and affect our self-esteem for years after the actual event. Again, a feature of the brain designed to keep us safe and reduce pain by avoiding similar situations in future, it can lead to considerable suffering and dysfunctional avoidance patterns.

Memories are formed in the Hippocampus and stored in the cortex. Both parts of the brain are plastic. This is good and bad. Memories are formed like a jig-saw puzzle, with images, emotions, thoughts, and bodily sensations as the bits to the puzzle. When a memory is activated the pieces come apart. This is when new information, the self-serving or self-depreciating changing of events, rewires the memory. However, if there is no new information connected with the memory, which is usually the case with ruminations, it will re-form in exactly the same way (Hanson, 2012).

When a memory is activated it will always take on the emotional content present in the Limbic system at the time of activation. As it is generally our negative emotions and thoughts that activate distressing memories, our negative memories run the risk of taking on a darker and darker shade of grey, depending on how bad we are feeling when the memory is activated. However, knowing this, we can use the neuroplasticity of memory systems to our advantage! We cannot change the events of the past but we can modify their emotional charge. This is what happens when we tell somebody we feel safe with about a distressing experience. Purely by the other person helping us to feel safe and accepted, our Limbic system calms down and the distressing memory will be reformed in our brain with a calmer and more positive emotional charge.

You can also rewire your difficult memories on your own (Graham, 2013)

- First you do the full Hand-on-Heart practice (see above).
- When you have got your Safe Place and Compassionate Friend nice and clear in your mind, you go into the dark room of the difficult memory, activating all aspects of that memory; images, thoughts, emotions and bodily sensations.
- When the difficult memory is all clear in your mind you go back to the Safe Place.
- Then you keep switching forth and back between the difficult memory and the Safe Place 3-4 times, before merging the two. If that is too hard, keep going forth and back.
- Then you allow the difficult memory to fade into the distance, while the Safe Place and your Compassionate Friend get clearer and clearer in your mind and your body is completely relaxed.

Please *do* try this at home, it is free, simple, safe and effective. If you have some memories that cause so much distress that you even in a safe environment, with effective calming down techniques, cannot think about them without getting very agitated and distressed, then you may require some professional help with those memories.

Alternatively, you can write your difficult memories down when you are feeling calm and safe, down-regulating each time the negative emotions get too intense. Handwriting

is more effective for this purpose than punching the keyboard, as the motor activity of handwriting forces more blood-flow to the LFPC.

It is more important for survival to avoid pain than to seek pleasure, although these are both basic human needs. In order to counter the negative bias in the brain we need to focus more attention on positive experiences in order to remember them better. This is important to know because it affects how you judge your last holiday, your relationship with your partner and your practice. Unless you actively spend time focusing and reflecting on your positive experiences, you end up with a negatively skewed perspective. You may judge your last holiday, your marriage and your practice more harshly than they deserve – remembering the negative experiences and not the positive ones. You are born with a negatively biased brain so positive experiences need extra focus in order for you to remember them and maintain a balanced view.

An important positive side-effect of rewiring difficult memories is that it teaches us self-compassion. The last thing we need when we are experiencing or re-experiencing in our mind something distressing, is to keep kicking ourselves when we are already down. It achieves a lot, but I promise you, none of it is helpful. Instead, studies show that self-compassion both feels good and helps to cultivate a safe internal environment that allows us to bounce back from adversity and flourish again (Graham, 2013).

In closing

The structure and function of our brain makes it possible to deliberately select and focus on helpful mental states and challenge unhelpful ones. This process is transformative. The training of the mind cultivates happiness and changes the very structure and function of the brain.

It is very similar to how the body is able to do exercise that in turn transforms the body to become strong and effective. Just like we cannot all become Olympians, we cannot all become the Dalai Lama. However, we will all benefit from training the mind to some extent and that then provides a new platform from which to develop further.



Come sit down beside me
I said to myself,
And although it didn't make sense,
I held my own hand
As a small sign of trust
And together I sat on the fence.

-Leunig.

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Self-Care to Optimize Neuroplasticity

Important Nutrients for the Brain

Low GI (glycemic index) food (wholegrain, vegetables)

B3, B6, B12, Folic Acid, Zinc, Magnesium

Omega-3 fats (e.g. cold water fish, flaxseed oil, fish oil, eggs, walnuts)

Protein rich in Amino Acids (meat, eggs, fish, beans)

Chromium (sweet potato, corn, wholegrain)

Good Sleep Routine

- 7-9 hours of good quality sleep (5-6 sleep cycles of 90 min.)
- Bedroom **dark, cool, quiet - remove anything work related and all Technology (phone, iPad, computer)**
- No screen 1 hour before sleep time
- Don't go to bed hungry, eat something High GI (e.g. toast w/jam)
- If phone is used as an alarm, place it as far as possible from the bed and on Silent (no vibration) or in Night Mode
- If you start ruminating or worrying, write them in a "worry diary" you keep next to your bed. 15 min. max.
- Lavender, Sandalwood, Ylang-Ylang or Rosemary essential oil on the pillow or in the bath (optional)
- Drink warm milk or chamomile tea (optional)
- Read something boring/soothing until very sleepy
- Down-regulate to feel safe and "off-line" (e.g. progressive muscle relaxation, guided meditation, or mindfulness of the breath)
- Magnesium (high-absorbent) can help reduce muscle tension
- St John's Wart (non-prescription) has been clinically proven to help with mild/moderate anxiety and depression and insomnia/broken sleep (check with your GP as it may interact with other medication)

Exercise

Optimally 30min+ per day of cardiac activity that makes you puff. Increases BDNF (which stimulates the neuron's growth of dendrites through which it connects with other neurons) and breaks down cortisol, the toxic bi-product of stress.

Avoid/Limit intake of CATS

- Caffeine (limit to one in the morning) - coffee, black tea, caffeinated soft drinks, chocolate.
- Alcohol (especially in the evening, compromises sleep)
- Tobacco
- Sugar/Sweeteners

Engage in NEW and VARIED brain activities

Developing new activities and skills, doing things in new ways, new learning, and *connecting* with other healthy brains!

Sleep

For an excellent explanation of the sleep cycles and how to address some common sleep disorders, visit:

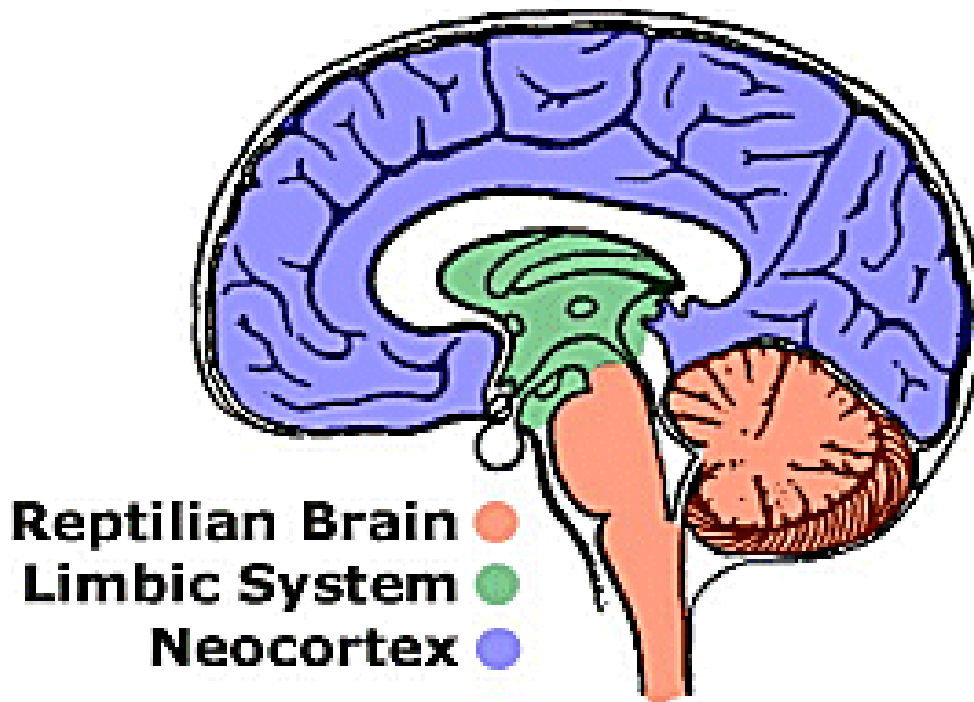
<http://www.sahealth.sa.gov.au/wps/wcm/connect/public+content/sa+health+internet/clinical+resources/clinical+topics/substance+misuse+and+dependence/sleep+problems+-+insomnia+management+kit>

Useful Guided Mindfulness Apps

1. *Headspace*: You can subscribe for 10 days for free and after this you don't need it anymore; you know what to do. However, if you choose to subscribe you will have access to an extensive library of purpose specific guided mindfulness sessions. What I like about the 10 first days of *Headspace* is that you get good instructions and good explanations for what you are trying to achieve in Mindfulness. It is a different session each day, there are little cartoons and the voice is pleasant. The sessions do not have to be completed in 10 consecutive days, but you may find it easier to establish the habit that way.
2. *Calm* and *Buddhify*: Both have a good selection of guided mindfulness sessions for different purposes and situations.
3. *Yogaglo*: You can subscribe for 10 days for free as a good introduction to yoga as a Mindfulness practice. There are hundreds of classes to choose from, but there is a good filter system so that you can get the level and duration and target you are after. The quality of the sessions is generally good and eventually you will find teachers that you really like. There are sessions here as well that are purely mindfulness practices, but if you go for yoga your body benefits as well! You improve your breathing, flexibility and strength, as well as your mind-body connection. There are particular yoga sessions of 5-15 minutes that wake up the body in the morning, that enhance good sleep, that are good if you sit a lot, or if you have pain in different parts of the body. All you need is a mat.

YouTube

YouTube is full of Mindfulness and Yoga sessions that are FREE! You may need to try a few before you find some that you like, but then you can just stick to those. I like SaraBethyoga.



The Brainstem, also called the “The Reptilian Brain” or “Survival Brain,” is fully developed and fully functional at birth. It is not plastic and it is the last part of the brain to die. We share this part with all animals.

The Limbic System, also called the “Impulsive” or “Emotional Brain” is partially developed and partially functional at birth. Some parts, like the Amygdala and Hippocampus, are somewhat plastic. We share this part of the brain with other mammals, and it allows us to form attachment.

The Neocortex is the latest addition to our evolution as a species and our life. It is only fully formed in our early twenties. It is relatively plastic; changing with experiences. The left pre-frontal cortex (your forehead) is considered the “Smart Brain,” your CEO.