

Dr Julia F. Christensen

'Absolutely delightful!'

Joseph Devlin,
Professor of Cognitive
Neuroscience, UCL

'Wow, I love this book!'

Dr Jeff Rediger,
Medical Doctor,
Harvard Medical School

THE PATHWAY FLOW to

The New Science of
Harnessing Creativity to Heal
and Unwind the Body & Mind



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FLOW**
to

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The Pathway to Flow

*The New Science of Harnessing Creativity
to Heal and Unwind the Body & Mind*

DR JULIA F. CHRISTENSEN

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To my parents

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Disclaimer

A little warning before we begin: The brain and its interrelations with the rest of the body, with our behaviour and the environment, are very complex. They are systems within systems that connect, engage, disengage and jam with one another. There are thousands of scientific papers about all the specifics – and there is still very much that we don't know. If I were to write about all of it here, this book would simply be too long, and not very interesting. Therefore, for the purposes of this guide, I will do my best to stay away from too much scientific jargon. I'll prioritise the information in a nutshell, over lengthy specifics. This means of course that, understandably, my science colleagues may wish for more formal detail and terminology here and there, but I hope that they can bear with me, while you and I explore our pathway to flow in a way that is practical, memorable, and useful for readers of all stripes.

This book is not a substitute for medical or therapeutic attention, and it is important to remember that this field of research is still very much in its infancy. If you are suffering from psychological distress, mental health, or medical issues, consider speaking to your appointed doctor or mental health practitioners and follow their advice.

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Introduction: The New Science of Why we Can't Stop Thinking

The fact that you are holding this book in your hands is the wildest example of how life sometimes redirects us in ways we'd never imagined. I'm a former professional dance student from Denmark, turned neuroscientist via France, Spain and the UK. Years ago, a serious back injury made a professional dance career impossible and I had to completely rethink my life. However, instead of picking at that scar, I'd like to share how I dealt with the aftermath of it. After hanging up my pointe shoes, I soon discovered that there was a limit to how still I could keep my mind, and I deeply missed the feeling of connection and expression that I had tapped into through dance – regularly, and without having to think about it. So I decided to embark on a scientific career to discover what we know about how our brain works, to better understand this feeling. Drawing and writing became my creative outlets and my tools to fight restlessness. In these pages I will share how I learned to unlock my own, new pathway to flow and how you can discover yours too.

Would you like to develop a calm, poised focus, a state where you feel entirely absorbed and productive, without any effort at all, whenever you need it? If so, this book is for you. It will give you an overview of the science that will help you tap into the flow state too. Do you remember hours spent drawing as a child, lost in blissful oblivion? That's flow. Or the way it feels to be absorbed in a good novel, in a dance, in martial arts or yoga practice, in playing your favourite instrument or cooking while listening to a good album? Whatever it is, this is your you-time. You may not even see time pass once you're in that zone. You may even forget about that one urgent thing on your to-do list you really want to sort out before the weekend. Such is the power of the flow state – all-consuming, soothing, and totally free!

The late Hungarian scientist Mihaly Csíkszentmihályi who pioneered this concept,¹ refers to ‘flow’ as a much-cherished state of recovery and relaxation for our body, both physical and mental, that activates the brain in a very special way. People may experience it when reading,² submerging themselves into the zone of a story,^{3,4} when listening to or making music,^{5,6} dancing,⁷ or when doing photography, making art, creating a film or listening to an audiobook. There have been accounts for centuries, if not millennia, from artists about the benefits of this trance-like state, and now evidence is starting to emerge from the sciences that regularly experiencing flow may even be related to good health outcomes for all of us – not least because it reliably unwinds our mind.

Yet, there are many reasons why such a focus is difficult to harness. Among them are the fact that we live in a rapidly evolving modern world but our brain’s operating system is about 300,000 years old, with no USB port for updates to modern world v.2.0. All we can do is learn as much as we can about how it works and how to use it – and that’s where this book comes in.

Our brains evolved in a harsh, prehistoric world and developed to be sensitively attuned to identifying potential threats and potential pleasures – this radar has kept us alive, but in today’s world we’re exposed to a lot of stimuli *all the time*. Our environment is scattered with signals that promise pleasure and we live in large, interconnected societies where interpersonal conflicts and risks (real and perceived) happen by the minute, both in person and via our ever-present screens. Whether our brain is telling us to move swiftly towards food, sex or a notification icon or to immediately engage in fight, flight or freeze, neurobiological processes will trigger a state of *high alert* in the body. This in turn activates the memory systems in our brain in order to serve up information about past experiences. These systems evolved to protect us by having information about previous dangers and reward sources readily available, but in practice it is now more likely to serve up negative memories, anxieties, concerns and distractions. If, when presented with this parade of negative thoughts, we don’t know what to do to help our body re-establish a balance, the mind can

spin into a loop of rumination. The good news is this same mechanism also holds the key to setting your mind free and generating *positive* thoughts. We can lead our bodies into a relaxation state that will activate memories of calm, joy and positivity inside our brain.

In building a toolbox of knowledge about this special edition brain of ours, we can use simple strategies in our everyday lives to feel relaxed, solve problems and steer clear of behaviours that make us feel like we aren't achieving our potential. And with that, we will be building our pathway to flow . . .



Today I'm a scientist researching the arts, creativity and the brain, currently at the Max Planck Institute for Empirical Aesthetics in Frankfurt am Main, Germany. And scientists do experiments. So, let's start with a quick one:

Imagine a pink elephant. Imagine it vividly, dancing . . .

Do you see it? Okay.

Now, for sixty seconds, try *not* to think of this pink elephant. Give it a go.

Did you succeed? Did you fail?

I should tell you now – if you didn't manage it, you're not the only one. In fact, it's nigh on impossible. You can't stop thinking.

Why not? Because, our mind is never empty. In fact, our mind wants to be full all the time. We can't get rid of thoughts by just deciding to stop thinking them. This is not a symptom of a lack of willpower, it's a fundamental feature of how the brain works. As long as a brain is alive, it keeps itself busy with impressions from our environment, sensations from our body and thoughts that are already in our head. This is an unstoppable process, and an absolutely necessary one on an evolutionary level. Neuroscientists have previously shown that there are systems in our brain that work fast and automatically, and which ensure that we can't stop our brain with our conscious will. The reason seems to be that it would be quite unhealthy for us if we did. Imagine if the brain suddenly stopped processing, or decided to empty itself without warning. It would be a disaster. So don't worry if you have never been able to

empty your mind of thought – ‘like a bathtub when you pull the plug’, as they say in meditation class. This just means that your brain is functioning in the way that it was wired.

But what to do when our thoughts turn into grinding torture instruments that stress us out and threaten to steal our sleep and peace of mind, and even mindfulness and meditation can’t help? What to do when we can’t seem to focus on any one thing? According to Oliver Burkeman’s eponymous bestselling book, all being well, we get about *Four Thousand Weeks* on earth. How do we want to spend ours? Ruminating?

As a dancer-turned-neuroscientist, my curious mind has been trained to look for new solutions to old problems and to translate them into something that can be applied to make our brains, and our lives, happier and more productive. Like *Kintsugi* (金継ぎ, ‘golden joinery’), the Japanese art of creating something new and beautiful out of broken pottery, I’m convinced that we can transcend the roles our personal tragedies have forced upon us and repair our lives instead, creatively joining our broken edges with lacquer laced with gold – creative energy. Whoever you are, whether what sends your thoughts spinning is life-changing trauma or ‘just’ everyday worries, I believe we can all lace our thoughts and actions with beauty and precious, creative energy, and heal. Many professional artists cope with deeply traumatic childhoods, neurodiversity, mental health and identity issues, and so on, through the act of creating. Just like our ancestors before us, who naturally sought the arts to cope with a world so much harsher than that in which most of us live today.

My own fruitless attempts at harnessing spinning unproductive thoughts set me on a quest to explore scientific findings from all over the world with a simple objective: I wanted to know why a state of flow is so hard to reach, why mindfulness meditation just doesn’t seem to work for everyone and, most importantly, I wanted to find an alternative solution that works for those of us with persistently full minds. During this search, I found that modern neuroscience holds the key to why so many of us struggle and why it isn’t just about trying harder. I also discovered a scientific explanation for how we can find and use a reliable shortcut to get to that

elusive state of peaceful focus whenever we want. When we embrace a recreational artistic practice – whether it be dancing, painting, sewing, cooking, sketching, playing the guitar or making jewellery, it activates systems in the brain that produce a sense of all-encompassing calm. Regular practice can create incredible changes in how you work, think and feel, increasing your concentration, productivity and patience. But you need to know *how*. As a starting point for *your* Pathway to Flow, I reveal what Pathway Prompts are in Chapter 8, to get you started off on your path.

There is a huge amount of research about the thoughts that populate our minds and steal our concentration, sleep and peace of mind. Unfortunately, the information about these intrusive thoughts, why we have them, and what we can do about them is slumbering in academic journals, hidden behind walls of scientific jargon. With this book, I would like to translate that knowledge and introduce an alternative to rumination and the frustration of trying and failing to master looping thoughts. Aided by cutting-edge neuroscience and a close look at artistic impulses humans have embraced since time immemorial, we will learn to guide our wandering minds into healthy, peaceful, sustainable thought patterns, to make us calmer, more productive – and even more likable. A regular creative practice conditions the mind to find that flow state more easily, enabling us to find our way back there, even when we don't have a paintbrush in hand. You just need to see, hear, smell, taste or feel an element of your practice – and off flows your mind, emerging refreshed and energised on the other side. This is an easy-to-read, science-backed guide, with actionable advice. It worked for me, and I'm hoping parts of it will work for you too.

One important point to understand is that our body is a system of many interconnected organs, tissues and neural pathways. More often than not, we're unaware of how our thoughts develop, but there are neurocognitive mechanisms by which our thoughts are linked to processes in the body. We see this when our brain detects rewards, danger, or when it simply needs us to move.

Building a reliable pathway to flow doesn't mean that we have to exist in perfect yogic harmony and avoid all ups and downs. Our

brain and body's systems very much like to be used. They want to be thrilled and excited, as much as calmed and soothed. That keeps them in training, just as our muscles stay strong through regular exercise. The best behaviour or activity that I've found to offer the safe space where all this can happen is a creative practice. Modern neuroscience shows that artistic practice is the ideal guide, whether that is as a creator or a spectator. In fact, archaeologists have found evidence that humans may have been using what we today refer to as 'the arts' as a beneficial practice since the dawn of civilisation. Why? Because of the powerful opportunities for imagery, meaning-making, self-expression and communication that they afford. If we choose the right art form for *us*, it transforms a ruminating mind and makes flow possible. We can be lost in thought – with helpful, healthy direction.

You may be thinking that you're not an artist and this can't possibly be for you. But, as long as you have a human brain, an artistic practice can be *your* guide to a peaceful mind. Regular flow with a creative practice can be linked to increases in our creativity, productivity, even our likability. And the more we do it, the easier it becomes to tap into that state of flow. The key strength of this approach lies in identifying a creative pursuit we enjoy and that we can engage in without getting caught up in perfectionism and the drive to create something grand, or memorable, or worthy of praise. It should, first and foremost, be a personal creative practice which, almost as a side-effect, fosters healthy activations in the brain (and, as a consequence, in the wider body) during the process of creating. This means that the *outcome* of our practice is unimportant. If we end up with an object, painting, dance or text that does not meet current aesthetic expectations, it should not worry us. It's the neurobiological changes in our brain and body that happen during the process of immersing ourselves in our art that matters. So, join me on this journey to finding your flow.



Pathway to Flow is made up of two sections, to reflect the theory and the more practical aspects of the practice. In Part One, we'll

explore the neuroscience of habits and rumination – this section will help you to understand the key processes that keep your brain alert at all times and why they can sometimes work against the things that you want more consciously, such as being productive, or relaxing. In Part Two, we will explore science-based, art-led solutions to rumination, from practical hacks to use in your work to case studies of individuals and communities who have embraced artistic practices as a way to overcome a wide range of personal or systemic challenges, from anxiety and depression to more severe traumas. We will meet filmmaker Susana, who uses photography on her Instagram as a pathway to flow; Jamie Oliver, who finds flow with cooking while also using it as a respite from the crippling feeling of being neurodiverse in a world that is not; Nazanin Zaghari-Ratcliffe, who knitted a ‘freedom dress’ for her daughter Gabriella while arbitrarily incarcerated in Iran and thus stepping into a cocoon of colours, textures and movements on repeat that filled her time and spun her thoughts in healthy directions, until freedom really came. And we’ll meet many more, including some small examples of my own pathway to flow with drawing and dancing Argentine tango.

Soon, you will be one of us, finding your flow with your art! I hope this book can remind us of what our ancestors knew all those years ago: self-expression is not just fanciful – it’s core to our humanity and can be the key to healing.

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PART I

THE RESTLESS MIND

The neuroscience of habits and overthinking

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I. *Mind-full-ness*

If you're human and alive, you have a brain. And this is a very special brain, unique in the animal kingdom. It has very basic neural systems in place that allow you to survive in the wild, while, at the same time, it also has neural systems that can write poetry, fairy tales, dance ballet on pointe, play improv on a saxophone, and create a delicious dish of pasta as an expression of love. Bizarrely, or, wonderfully, these systems overlap. And we can use this to our advantage to reach flow.

Yet, we mostly know very little about this special edition brain of ours – how it works, how to engage or appease it. In order to learn how we can access flow states reliably and manage our brains in a way that improves our wellbeing, we first need to understand more about how it all works.

Your Body-Orchestra

Imagine your body as an orchestra. Touch your chest and picture an orchestra pit just there. Do you see it? Your organs, tissues and muscles are instruments now. There are string players, gently striking their bows, easing your blood around your body. Violins, cellos and guitars play your tune. And there are brass instruments like trumpets, and some cymbals. They take care of the strong oomph of undertones when hormones jump into your blood as it passes through spleen and liver. There are also instruments that your body-orchestra only has one or two of: one heart, one spleen, two lungs. You can think of them as the instruments that there are only a few of in an orchestra and that set important accents; a drum, a harp, two bandoneons. And, there are always some maracas in the corner, sprinkling notes in between the main notes. Cha cha

cha . . . these are the messenger substances, like endorphins and bonding hormones, that travel through our body when things get exciting or when we calm down.

The reason I want you to think of the organs, tissues and biochemical transmitters of our inner body as the instruments of an orchestra is:

1. because both organs and instruments are precious, sometimes irreplaceable, and deserve our utmost care, and
2. because I would like you to understand that you can control more of what is going on in your body than you think.

The long and short of it is, you can have a say in what kind of music your body-orchestra plays – a bit like the way you can choose to go to a live concert where they play Brahms, or to one where you can enjoy Metallica. Depending on your taste, one may bore you to pieces, while the other might entice and calm you down at the same time – maybe even give you flow. As you grew up, you'll have learned how different music makes you feel, and that you can choose which record you load into your stereo, or which playlist you pick on Spotify. The music that rises to your ears, depending on your choice, kicks off a whole wealth of biochemical processes between your ears and your brain before you even become aware of it.

This starts with the physiological processes that allow you to hear the music. Via little hairs in your ears that vibrate with the rhythm of the tune, the music is 'translated' to tiny electrical impulses in the auditory cortices of your brain. These then propagate all the way to the broader neural circuitries that give rise to your feelings, in the limbic system. These processes happen automatically and instantly as you listen to the music and they will change how you feel. The neural activity will also resonate with the memory systems at your temples. The memories that are stored there give the music that special tinge of feeling, that special deep feeling of 'me'. And as you become fully aware of the music, it may

make you want to cry, dance . . . or both. We've all experienced the way listening to different kinds of music, in different kinds of formats and moments, makes us feel, well, differently.

So, for the purpose of this book, take this view of your body: It's an orchestra made up of precious instruments and you can have a say in what music it is playing within you, rising to your awareness through biochemical processes ('biochemical process' just means that there is a chemical reaction inside your body with biological ingredients from your inner medium). By making different choices about what you *do* with your body in the world, you can, to a certain extent, stir these processes and affect how you feel.

But how does this orchestra work? The instruments of our body-orchestra play by their own inertia, and they play all the time. Our organs are similar, and luckily so, provided that all is in order, and that all the connections between the conductor (the brain) and the orchestra are working, we don't have to think about having to 'play' each of them. Our heart beats, our lungs fill themselves with air every four seconds thanks to automatic systems in our brain, and we are spared from consciously having to keep time.

If every musician was playing their instrument just the way they wanted, at some point, it would be quite chaotic. Nature, therefore, made sure that there are neurobiological mechanisms in place that ensure our body-orchestra plays the right symphony *together*. These basic mechanisms are taken care of by our brain stem, a neural system sitting deep down in our brain, just over the spinal cord. It is one of the oldest structures of our brain – we even share it with most animals, and everything about it is automatic and instinctive. If you make a fist and hold it up so your thumb faces you, you can imagine that your arm is the spinal cord leading down into your body, and inside your fist you're holding the brain stem and its tender folds. This brain stem of ours is located just above the nape of our neck and approximately 2.5 centimetres towards our nose. Layers of brain systems have been added to that basic structure as we evolved and ultimately, this resulted in the

brain as it is today, but everything starts from this instinctive, automatically functioning brain stem.

Crucially, these layers are connected. It's not like they are just lying one on top of the other. If you added your other hand to the fist now, imagine that neural *pathways* are connecting the layers – from one hand to the other – and are telling one hand what the other is doing. Neural pathways are a bit like motorways with multiple lanes that information can travel by efficiently. They connect different parts of the brain so they can communicate easily. So, while the brain stem is working automatically, it is also talking to other brain systems constantly. It is exchanging information with brain structures that are older, phylogenetically speaking (meaning that these structures also existed in beings that lived before *Homo sapiens* evolved), like our memory systems and all the sensory systems we use for seeing, hearing, smelling, touching and tasting, as well as with some slightly more modern parts of our brain that we share with other mammals. These include the insular and limbic system where social information, our emotions and homeostatic information (sensory updates about things like our body temperature that help our brains keep our body environment consistent) are processed.

Of course, there are also connections with the most modern parts of our brain, the prefrontal cortices that sit close behind our forehead, that are responsible for our ability to reason, think, imagine, plan for the future and to perform complex decision-making tasks. These systems are fairly unique in the animal kingdom, but never forget: all of it builds on very basic survival mechanisms in the brain stem.¹ Even the most modern parts of the brain, the prefrontal systems that make us so distinctively human, receive information from this very basic and automatic system via relay stations throughout the brain.²⁻⁴

We are rarely aware of what these basic survival mechanisms are whispering into our prefrontal brain systems and, from there, into our awareness.⁵⁻⁸ But they are affecting our behaviour^{9,10} – including our ability to experience flow – so let's understand a little more about these whispers.

Golden Threads: How Mind and Body Connect

The brain stem's primary job is to take care of the basic constants of our body, like our heartbeat, our breathing and our hormone levels. We can imagine the brain stem as a jukebox with pre-recorded discs. It takes care of biological processes that are genetically pre-programmed to happen, like our breathing, our heart rate, or our hormonal changes for the day-and-night rhythm. We don't have any conscious control over these songs, and the various pre-recorded songs each make us feel a certain way. They are life-saving discs, stored in the genes that 'make' our brain after our conception, for each of our basic needs: sleep, food, water, air, shelter, reproduction, and so on. When we repeatedly disturb these automatic functions with our chosen behaviour, a spinning mind is the result. The discipline called psychoneuroendocrinology studies these interactions between our behaviour and our inner medium.^{11,12} 'Psycho' means psychological, so everything to do with what we think, feel, or refer to as our 'mind'. 'Neuro' is, well, our brain's actions. 'Endocrine' is another word for hormones. Hence, psychoneuroendocrinology is the science that is concerned with understanding the interactions between what our brain does, our hormones, our behaviour and how we feel.

For example, we feel sleepy when, rather than a pop song, our jukebox plays a lullaby. That song – the sleep hormone melatonin, when it rises in our blood – makes our whole body slow down.^{13,14}

While we cannot change the songs that are recorded on these discs, we can sometimes have a say in which one we play. If we notice that our heart is pounding, and we feel scared, angry or stressed, we should know that the song that is playing inside us is often the result of something that we are doing or exposing ourselves to. This 'doing' can be active, or it can be just thinking stressful, threatening thoughts, sitting still for too long, or interacting with an annoying colleague. In all these scenarios we are enacting, or enabling, a behaviour. Now, as soon as we notice our pounding heart and looping thoughts, we have the power to choose to act out a different

behaviour, or to choose a different environment to be in, or alter our present one. Thanks to the modern prefrontal cortices of our brain, we can make conscious decisions about what we want, and what we don't want, to *do*. And through the body-brain connection, this new behaviour will help us load a different disc into the jukebox – and appease the heart rate, making us feel less scared, angry or stressed.

It is possible for a decision to influence the way we feel physically because our body and brain are intimately linked.^{4,15} If you touch your hairline at the back of your neck now, and let your fingers slide down your neck, you can imagine the spinal cord being protected by the vertebrae, those hard bones that you feel in your neck. Inside the spinal cord, long nerve cells, called ganglia, flow down into our body. Like long golden threads of yarn, they are connecting the neural systems of our brain with organs, muscles and tissues throughout our body so they can play their tune when needed.^{6,10,16} These golden threads continue all the way out into the outmost tips of our fingers and the skin on the tips of our toes so we can touch and feel – and stand on our tippy-toes if we're a ballet dancer. Via these connections between brain and body, information flows. Back and forth. This happens through what scientists call *neural transmission*.^{17–19} This is a complex biochemical process that we won't go into but the important message to remember is that information can flow *from* our brain, to our body. And the information also flows *from* our body, *to* our brain.

To summarise; there are channels of communication between our brain and our body. With our behaviour and the movements of our body, to a certain extent, we can modify some of what's going on in our brain. For good, and for bad.

There are specific discs with pre-recorded symphonies for different basic needs, like for when we're going to sleep and for when we're hungry. Let's take a closer look at two examples.

The Sleep Symphony

The sleep symphony is automatically loaded into the jukebox of our brain stem when night falls. Receptors in our eyes and skin

note the fading light and send messenger substances towards the brain-stem systems, telling them to get ready for sleeping.¹⁴ Composed and pre-recorded during evolution and then stored in our genes, this song automatically lulls us to sleep following a fixed pattern, orchestrated by the brain stem. As the comforting notes of the pineal gland sprinkle the hormone melatonin into our bloodstream, our eyes start itching, we start to feel drowsy, and we slowly glide into dreamland as our heart rate falls and our blood pressure decreases. All of this happens automatically – if we let it, with our behaviour. For example, if we let our body relax while reading or knitting or listening to music before going to sleep, the sleep symphony in our body plays undisturbed. If, however, we expose our body to blue light sources, do high-energy sport, or consume things that frighten or anger us like thriller movies, social media or news about war, our body's sleep symphony can't play properly. Blue light, fear and anger tell our jukebox to load discs that release a different set of hormones and neurotransmitters into our bloodstream.^{20–22} And these have absolutely nothing to do with sleep. Rather, they prompt wakefulness, or activate the fight or flight response. Then, we can't sleep.

In the worst case, we repeat this behaviour (for example, *always* watch TV before bed, or *consistently* doom scroll before sleep), and this causes the disc with the sleep symphony to get scratches that need mending. Doctors would call this *disturbed sleep patterns*.

The prefrontal cortex of the human brain is a unique piece of machinery in the animal kingdom. It allows humans to retain control over our behaviour through the choices we make. For example, we can choose to watch TV, or to do something else that is more conducive to sleeping.

If only it were that easy, right? We'll get to the part about why those choices in the *right* direction are sometimes so hard to make . . .

Hungry Eyes

Now, consider this second example. The disc with the hunger symphony is automatically loaded into the jukebox in our brain

stem as soon as receptors in our gut, our pancreas, and in the fat of our body detect low levels of nutrients or energy. Compared to the sleep symphony, the organs that play a role when we're hungry release a whole different set of messenger substances into our blood to inform our brain-stem systems about the low levels of energy. The appetite hormone ghrelin – grumpy and menacing – comes rushing through our blood, making us hungry. And it doesn't stop rushing around until we've eaten. This hunger symphony may sound a little discordant at times, but it's incredibly effective at making us keep the energy supplies of our body stocked up.

Again, we can derail this prehistoric tune with our chosen behaviour. For example, if we eat food with sweetener, messages are sent to our gut informing it that a lot of sugar is coming. The taste buds in our mouth send these signals to the gut via our brain stem, down the ganglia in our spinal cord. These signals, in the case of artificial sweetener, cause our gut to produce far too much digestive fluid. If this remains unused, which it does, as sweetener doesn't contain any real energy like natural sugar would, signals are sent to the brain that nutrients and energy are still needed to balance the amount of digestive fluid. As a result, we never stop feeling hungry and overeating is the logical consequence.

The basic knowledge to grasp here is this: it's a two-way process. While our automatic brain and body systems make our organs function from the inside, what we *do* in the outside world with our behaviour, and what we expose ourselves to can impact our internal systems and organs just as much. We have immense power to trigger good or bad things in our body and brain. Once we understand which discs we have in our brain-stem jukebox, and how we can tailor our behaviour to support our body-orchestra instead of sending it into imbalance with our behaviour, we'll be on a path to success.

Strike a (Thinker's) Pose

When it comes to our emotions, the science seems to point one way: how we feel depends on the choices we make because our

brain and behaviour have a symbiotic relationship. With our choices, we can impact our moods. Raise your hand and make a thinker's pose. At the tip of your fingers, behind your forehead, is your prefrontal cortex. These folds of grey and white matter allow us to do something unique in the animal kingdom: think, imagine, symbolise, be creative, reason, make decisions, take *informed* action, and have agency in what happens to us. But, unlike those brain-stem jukebox discs that play just one song, the music that our behaviour can make our brain play is more susceptible to change, and to mistakes, but also to doing good. We can compose the song that plays in our head – our thoughts – with our behaviour.

As we know, our behaviour is part of what guides the processes in our brain, our heart, lungs, spleen, liver and all our other organs, which in turn direct the messenger substances and hormones that populate our blood. And all this happens on top of the base-rhythms and melodies that are taken care of by the jukebox in our brain stem. Sometimes, our behaviour is powerful enough to influence even those basic processes, for better or for worse. Our heartbeat accelerates, or decelerates, the thyroid glands play hormone songs that make us feel certain ways, depending on the tune that we have started with our *behaviour*. Sometimes it's good, sometimes it's not. Let's look at a couple more examples.

Still Life

Sitting is a behaviour. Even if it is very still. For those of us with full mobility, it's something we instruct our body to do. Most of us sit loads. At work, in front of the TV, while gaming, browsing social media, and so on. One study shows that on average, middle-aged people sit for around 597 minutes per day (give or take 122 min/day) – that's almost ten hours. This behaviour can make our organs play a symphony that wreaks havoc in our body, and therefore in our mind too. For example, when we sit our blood pressure is higher than when we stand,²³ and this can develop into a health hazard. Research shows that having 2.5 hours of standing or light exercise interwoven into an 8-hour work day would decrease

general blood pressure significantly.^{24,25} Even being active just twice a week lowers risk of coronary heart disease by 41 per cent.²⁶ Yet, most of us sit. This could be because we don't realise that the looping pink elephant thoughts that populate our minds are sometimes caused, at least in part, by the neurobiological consequences such as this sitting choice.

Sitting for too long can catapult our body into a full-blown stress response. This means our body releases a cocktail of 'action' hormones and neurotransmitters into the blood (cortisol, adrenaline, dopamine, etc).

As soon as I found this evidence, I understood why my mind was going astray in ways that I hadn't experienced while being a dancer. As a dancer, I didn't sit very much. Now, as a scientist, I do. Of course, these messenger substances aren't bad in themselves, in fact they're exactly what we need if we are running away from a lion. However, if they remain in the body too long *and we don't use them*, they cook the body in its own broth, making our veins porous and breaking down our body's immune defences against viruses, instead of protecting it. Professional dancing obviously also has a lot to do with stress hormones. However, dancers have one advantage – they get up and dance it out. Physical exercise gets rid of the stress hormones (be physical – that's what these hormones were for in the first place). Sitting, however, does not make use of the cocktail of the stress response. And, according to the evidence, if it persists over longer periods of time, this stress symphony wears out the organs of our body-orchestra, which are playing their instruments at top levels of exertion, preparing the body for imminent action – which never comes. We just keep sitting.

I got so startled by this evidence that I now keep a timer that reminds me to get up from my desk and move around each hour.

Here's what the science shows us: leaving our spine in one position for long periods of time stresses the position of the hips that are bent forward in an unnatural way, it impacts our shoulders and neck. Receptors all over our body are in charge of detecting when there is danger of injury in the body and they funnel this information to our brain, when something is not right. When our brain

receives information about the problem, it sends signals to different parts of the body to solve the problem via the ganglia in the spinal cord: for example, it stirs the strings of our adrenal gland (which sits behind our waistline) to release the stress hormone cortisol into our bloodstream. Cortisol is a hormone of action. It rushes through the blood in our immobile body singing *move move move!* At this point, we may start feeling restless. If we keep sitting and sitting, our brain thinks that it's failing to protect us and our thoughts move into dangerous waters instead. So how then do we convince our body-orchestra to play in the right way? First, we must understand why the stress symphony works the way it does.

The Stress Symphony

The stress symphony was composed during our evolution to protect us from prehistoric lions and other dangers in our ancestors' scary world. It is a life-saving disc in the brain-stem jukebox. It sends messenger substances shrilling through every vein at high speed and sends our blood rushing around out into the periphery of the body, into our arms and legs. This is so that oxygen is available in the large muscles, in case we need to run away from a lion or fight an adversary. The breathing rate of our lungs increases, the adrenal gland pumps out cortisol, and our heart pounds. In this state, our attention is a tunnel, focused only on the threat. Our memory and ability to think is impaired, and we may even struggle to formulate words into a coherent sentence. Our body is in a biological state of alarm.

All of this is to protect us, but the state is exhausting for our body, and when the stress has passed, we need recovery.

The 'advantage' when it's a real lion that's making our organs play the stress symphony is that we get up and run away or fight. Running, also a behaviour, has specific effects on our body. Due to the energy expenditure, the use of oxygen and the exhaustion that it produces in the wider body, we get rid of that stress-related hormone cocktail. This is how it was planned by nature. That's what these hormones are for: action. Afterwards the hormones dissipate

because now they've done their duty, making us *act*. At the end of the tune of the stress symphony in our brain stem, the release of endorphins is also pre-programmed, which gives us a comforting feeling of relief. This is the ointment as our body shifts into a recovery state, managed by the final verses of the stress symphony. This endorphin response is also the reason for the 'runner's high',²⁷ a state of elation that some people experience when they run, pushing their body to the limits. (Not all runners and athletes experience runner's high; studies show only about two thirds of them do,²⁸ and even that comes with drawbacks, but more on that later.)

Neuroendocrinological research shows that the stress symphony can start reverberating through our body for many reasons. It may be because we really spot a lion or an adversary in the wild, or because we've sat for too long before a continuously rising inbox, an aggressive colleague, or upcoming assignments.

For most of us, continuing to sit in a situation where cortisol is high in our blood and our body is ready to run, lungs filled with air, legs pumped with oxygenated blood, won't help us, even if we are doing mindfulness meditation. Importantly, these stress hormones, like cortisol, are neurotoxic (unhealthy for our neurons) if in our body for too long. The body basically attacks itself after a while, and this makes our thoughts spin even further out of control.

Mind Control

Never forget that we have a brutal survival artist between our ears, as much as a consummate poet. The delicate meanderings of the prefrontal cortices are preoccupied with symbolic thought, creativity, abstraction and ideas, but they depend on survival mechanisms that function according to some very binary, basic premises like reward or punishment, like or dislike, yes or no, friend or foe, threat or safety, fight or flight.

What enters our senses is very quickly evaluated according to these opposites by basic sensory systems of the brain and brain stem.²⁹ There is no avoiding that. Depending on the outcome of

this first, fast and unconscious processing, the information is then sent on for further processing.^{30,31}

These fast and basic systems are all about ‘me, me, me’: safety and survival – act first, think later. That’s how they kept us safe throughout evolution, in a difficult and dangerous terrain. In our modern world of abundance, however, you may see the advantage of learning to think first, but due to how these basic systems work, the only way we can achieve this is by changing our behaviour. These basic systems are simply too fast to catch up with our thoughts.

The Resting Brain

This brings us to why the activation patterns in our body are linked to what is going on in the mind. We’ve already discussed the close connection between the body and the brain. So how exactly does the mind fit in? In psychology, taken really broadly, the *mind* refers to our conscious experience. It’s what we think and feel: our perceptions, memories, beliefs. It’s something ephemeral, not unlike the hard-to-grasp-concept of the ‘soul’. There are vast research fields across philosophy, anthropology, psychology, neuroscience and even computer science that are grappling with the concept of consciousness. For the purposes of finding a practical solution, let’s simplify. In short, the music of our body-orchestra, at least in part, creates our thoughts. And our thoughts may dance gracefully to that music, or they may not. That depends on whether the music is a gentle, harmonious hum or a stress symphony. Do you remember the pink elephants, those thoughts we cannot let go of? A stress symphony is likely to make unpleasant pink elephant thoughts start practising pirouettes and other loops to that tune, stealing our concentration. This is when we are most desperate to switch off and just stop thinking for a moment.

It was when I was ruminating about my own inability to switch off my unwanted thoughts that I came across a paper about the ‘resting brain’. In 2001, Marcus Raichle and his colleagues from the Washington University School of Medicine, St Louis, used

functional magnetic resonance imagery to scan participants' brains.^{32,33} And they did something slightly unusual for neuroscientists. Usually, neuroscientists analyse the brain's activity while participants are doing a specific task. Raichle and colleagues, instead, analysed the brain activity of their participants while they were *not* doing a task, studying them while they were *resting* between tasks.

The results were astonishing.

When participants were apparently doing nothing at all, their brains weren't doing nothing. On the contrary. The results from the brain scans showed that *resting* is very much a behaviour too, and our brain remains very active. The researchers found that, during rest, a specific network of brain regions was notably active.

Raichle and colleagues nicknamed this network the brain's *default mode network* because further research showed that this network was always active, even when participants were asked to rest, and the network seemed 'on' by default.

Imagine the default mode network like a golden network of nerve cells inside your brain. A network that consists of interconnected parts of the brain, pulsing with activity while we are resting, and letting our mind wander. Raichle and his colleagues, and many researchers since then, have shown that this network touches on brain regions that are active when we think about ourselves and on different brain regions that are active when we think about others. Glittering bursts of activity also span the regions that the brain needs to create imagery, our sense of self, and to help us remember the past and plan for the future. Remember the last time you sat and listened to your favourite song? Your thoughts were connecting you with the present moment, as well as travelling back and forth in time, imagining situations, people, and yourself, all at once? This was your default mode network at play. And now hold your breath – researchers have found out that when we contemplate artworks that we really like – the default mode network is *on*.^{34–36}



Our brain is never off, even when we're resting. So, trying to 'just stop thinking' is doomed from the outset. There is this beautiful