

BO'S MINI e-BOOK
the **NEUROSCIENCE** of **DEPRESSION**



CREATED BY BO FORBES + EMBODIED AWARENESS

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THE MIND or MENTAL BODY.

Before we dive into the mind (and alongside it, the brain), let's ground our exploration in context.

Popular culture, medicine, education, and even contemplative traditions share a complex, often paradoxical view of the mind-body relationship. In principle, we support its existence but in practice, it's a different story.

Almost from birth, we steep in conditioning about the nature of the relationship between the mind, brain, and body. It's a hierarchy, we learn, with the brain at the top and the body at the bottom. Not surprisingly, we describe the brain in metaphors that evoke the efficient running of a company or the motherboard of a computer.

We make much of the fact that the brain shapes who we are, that damage to the smallest quantum of neural matter can change us in fundamental ways. So deep is our investment in the primacy of the brain that we shuttle to the background the knowledge that in gestation, neither the brain nor the nervous system is medically viable until approximately twenty-four weeks. (This begs the question: If not the brain, then what, exactly, directs our development for the first six months of life? Could the body play a role?)

And then there's the mind: We privilege mental knowledge and marginalize the body's intelligence. We see the mind as the medium—the eyes—through which body experience happens. "Mind over matter," we hear. "Change your thoughts and you'll change your world." "The Mind is Everything; what you think, you become."

We tend to conceive of the mind as primary, intelligent, and evolved and the body as secondary, instinctual, primitive. The mind is the medium through which we experience the body **and** the driving force behind what happens in the body. Given this dialectic, it is no surprise that we've come to view the mind and thoughts as *self* and the body as *other*. To acknowledge any connection between the mind, brain, and body might seem like progress. And yet, we have only to be avid students of culture to note that in response to apparent progress, the relegation of the body to secondary status re-engineers itself, taking subtler forms.

Want to know more about the wisdom of the body?

Check out this [blog article](#) on the specifics

Not surprisingly, the accepted cause-and-effect paradigm of disease sees anxiety, depression, chronic pain, and other emotionally mediated illnesses as genetic, biochemical, or neural anomalies. This paradigm attempts to trace every illness to a malfunctioning group of cells, part of the body, or region of the brain. When we don't feel well emotionally or physically, we follow the medical model: we see a doctor, who searches for a problem (or cluster of symptoms) and finds a way to manipulate it. This can be a problem: **If we have anxiety or depression or chronic pain, for example, it's a mental illness, and thus our mind and mental state is the problem.**

Yet emerging research in the neuroscience of emotional health is beginning to demonstrate unequivocally that the commonly accepted "causes" of anxiety, depression, chronic pain, and other emotionally-mediated illnesses are not as simple as we might think. For example, inflammation is not just a **correlate** of depression but is now **causally** linked to depression.

Science is now beginning to understand what many cultures have known for millennia: The mind, brain, and body are part of an intricate, intelligent, non-hierarchical system that plays a role in the genesis of physical and emotional health.

The body is smarter and more intelligent than we think, and plays a key role in healing and balance.

What's more, emerging research links the body and its inner senses (including interoception, proprioception, body agency, body ownership, and our social body) to depression, anxiety, chronic pain, addictions, body image issues, and more. We can now say with confidence that these illnesses are also **diseases of disembodiment**. How's that for turning things upside down?



THE DEFAULT MODE NETWORK.

Back to the mind and brain. You'll remember that the mind is the part of us that thinks and reasons, while the brain is its neural underpinnings. This means that the mind and brain are separate; and yet, it also means that they have a reciprocal relationship: When we think in certain ways repeatedly over time, for example, this mental pattern influences the way networks of neurons in the brain fire together (or don't) over time. Anxious or negative thoughts, for example, can shape neural networks. And when our brain expresses these patterns, this in turn influences our thoughts. (And of course, all the other elements of the mind, brain, and body network are affected by the mind and brain and also impact them in a state of continual reciprocity.)

Over the last two million years (just an instant in evolutionary terms), the brain has developed a new structure called the prefrontal cortex, or neocortex. The prefrontal cortex (PFC) deals with the following abilities:

- Planning
- Anticipating the consequences of our actions
- Social behavior
- Morality
- Our relationship with chronological time

The default mode categorizes ideas, events, and people in order to simplify and be efficient.

These are positive qualities, and ones we need to survive in modern times and in a complex social structure. Yet as you may have noticed, these abilities are not always mindful or embodied, and not always grounded in the present moment. So the very qualities that help us get ahead in life, that assist us in functioning the way we're expected to actually have a hidden cost.

In fact, you could say that the brain and mind have a “hidden cost center” known as the Default Mode Network. Located right along the midline of the prefrontal cortex, the default mode is most active when the brain is at rest—in other words, when *it's* **not** focused on a particular task.

The default mode network (in its modern incarnation) was discovered in approximately 2001 by a group of neuroscientists, notably Marcus Raichle. They were measuring the neural correlates of certain tasks (watching which areas of the brain light up in response to functions such as arithmetic or language). They happened to notice that when someone rested between tasks, the brain “defaulted” to a certain state. In this supposedly quiet state, the brain recorded more activity, and used up more resources (think blood and oxygen) than it did in the task-focused (also known as the task positive) state. They called this the “resting state.”

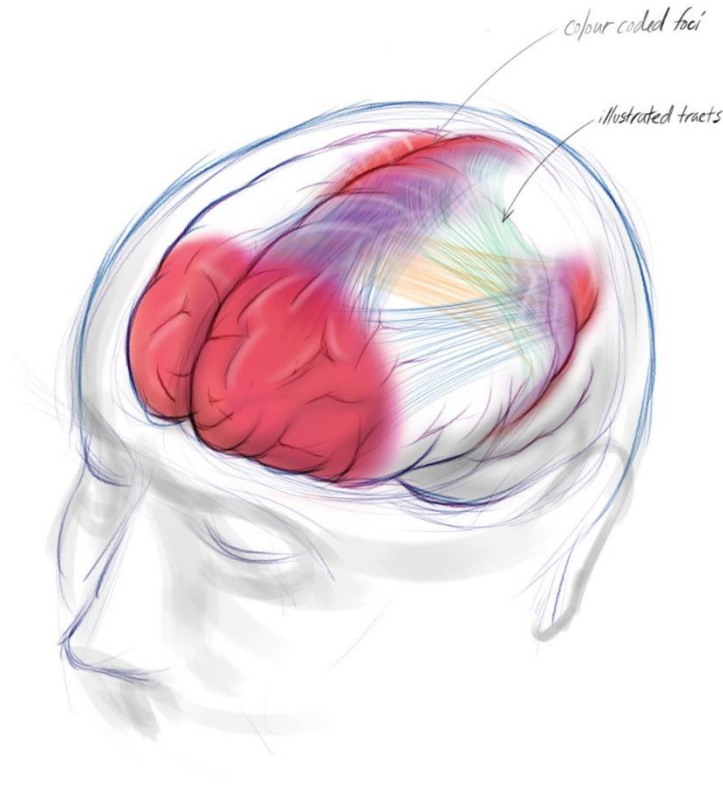


Illustration of the brain's Default Mode Network by Glen Oomen

When engaged, the default mode network:

- Ruminates on the past
- Compares the present to expectations vis. what “should” be happening
- Worries about and rehearses future events
- Engages in negative self-evaluation (think of your inner critic)
- Has a relentless self-focus
- Judges ideas, experiences, and other people that it defines as “other”
- Constructs narratives about our experience (and in anxiety, that tends to focus on the dire nature of body experiences such as increased heart rate or rapid breathing—in other words, instead of just being immersed in the physical sensations of anxiety, it interprets these sensations as dangerous)*
- Interprets our experiences, adding a layer of meaning-making
- In anxiety, the default mode interprets the world, and others, as dangerous
- Righteous indignation (thinking about how other people are wrong, being outraged by their clear wrongness(!), and dwelling on what they “should” do) comes into play here
- Implicit bias is often part of the default mode, too
- Oddly enough, loneliness is connected to this state as well (more on that another time)

The default mode isn't just a "resting state." It's incredibly costly in terms of blood, oxygen, and nutrients.

What's more, when it's active (as it is for all of us), the default mode launches an inflammatory response analogous to that of the immune system. Furthermore, this mental and neural inflammatory response can prompt a cascade of neurobiological events in the body that includes inflammation in the immune system, autonomic nervous system, connective tissue matrix, and enteric nervous system. The converse is also true: Inflammation in any of these systems can trigger an acceleration of default mode network activity. (Have you ever noticed that when you experience an allergic inflammatory reaction to food, that can influence your thinking and the way you interpret your world and relate to others?)

One response includes mental and neural (mind- and brain-related) inflammation, while another is physical. Both are inflammatory; when they occur over time, both create chronic inflammation.

In many ways, then, these different sources of inflammation in the mind, brain, and body network are all ways of practicing inflammation—and may all be ways of "practicing" anxiety.

Lowering default mode network activity is one of the primary ways we can lower inflammation in the mind, immune system, enteric nervous system, and autonomic nervous system.

**And as you might guess, teaching ourselves to simply have a body experience without narrating, evaluating, or judging it is one of the key elements of balancing anxiety and practicing resilience.*

The first times you try it, or do so in new situations, it'll feel new and awkward and ineffectual. Keep going; it takes time to wire in new habits.



THE PARABLE OF THE SECOND ARROW.

There is a popular parable told by the Buddha about the two arrows. It goes something like this: The Buddha asked a student, “If you get hit by an arrow, is it painful?” “Yes,” answered the student. “And if you get hit by a second arrow,” the Buddha continued, “is it even more painful?” Again, the answer was yes.



On the previous page, we see that the default mode takes a direct experience we have in our body (and in the moment) and spins a narrative about it. (It's the second arrow.) Here's how the parable applies to the neuroscience of depression.

The Buddha explained that the first arrow is the one **life** shoots at us. It's the raw pain we feel in response to “shit that happens.” The first arrow is pure direct experience. We can't control the first arrow; it's part of life.

The second arrow is the one **we** shoot at ourselves. It's the elaboration on, proliferation of, and rumination about our pain. The narrative, the meaning-making, the mental machinations and interpretations and inflammation. The second arrow turns our pain into suffering. We **can** control the second arrow; in fact, doing so is the “goal” of many contemplative traditions.

How do we do this? The parable points to the answer: We lean in to the first arrow—the pain, sorrow, loss, longing. We stay present with the sensations that accompany it.



“Learning how to think really means
learning how to exercise
some control over how and what you think.
It means being conscious and aware enough to choose
what you pay attention to and to
choose how you construct meaning from experience.

Because if you cannot exercise
this kind of choice in adult life, you will be totally hosed.”

David Foster Wallace, from [THIS IS WATER](#)

A WANDERING MIND IS AN UNHAPPY MIND

You may be wondering, “Yeah, but what if the default mode state doesn't actually **cause** suffering and inflammation but is the **result** of suffering and inflammation?”

Two researchers, Matthew Killingsworth and Daniel Gilbert, set out to answer this very question. They used a highly effective and sometimes controversial technique called **experience sampling** to determine how often our minds wander (the brain's default state is often equated to mind wandering.)

They surveyed 2,250 adults with a mean age of 34. Using an iPhone app, they interrupted participants several times daily and inquired into their thoughts, feelings, and actions at the time they were “pinged.” They asked three questions: 1) “How are you feeling right now?”; 2) “What are you doing right now?”; and 3) “Are you thinking about something other than what you're currently doing?”

The results of their study found that nearly 47% of the time, people were thinking about something *other* than what they were actually doing. In other words, they were not mindful and not in the present moment.

Killingsworth and Gilbert observed something most of us would not expect: the nature of our activities (what we're doing) has only a modest impact on whether our mind wanders. (In other words, our minds are not more likely to wander when cleaning the bathroom than working on our latest blog).

They found that people's minds often wandered to pleasant activities, something we'd imagine to be helpful (the “power of positive thinking” and all that). And yet, the positivity of their mind-wandering had no influence on participants' mood. Or happiness. The researchers concluded that mind-wandering (the default mode's activity) was the cause and not the consequence of unhappiness.

The findings indicted that people were less happy when their minds were wandering than when they were focused, and that this was true for all activities regardless of their nature.

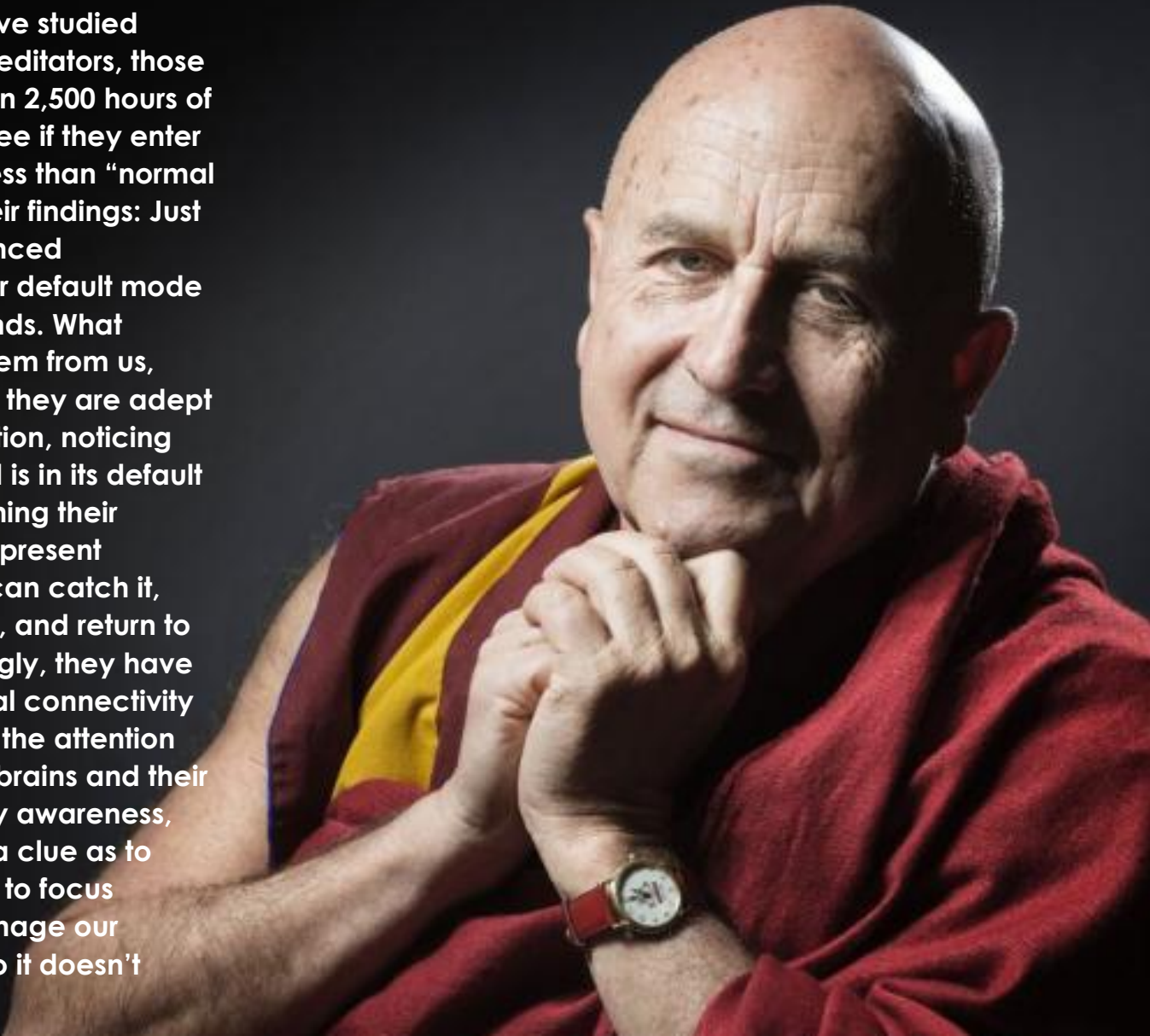
The researchers stated that a wandering mind is an unhappy mind, and concluded, “The ability to think about what is not happening is a cognitive achievement that comes at an emotional cost.”

(Killingsworth, M. and Gilbert, D., 2010)

Rx FOR THE MIND, BRAIN, AND BODY.

It's important to understand that we all have a default mode network. In fact, it's not a "bad" thing to have one. (Actually, it forms the foundation for creativity, imagination, and productive mind-wandering).

Researchers have studied experienced meditators, those with greater than 2,500 hours of meditation, to see if they enter default mode less than "normal people" do. Their findings: Just like us, experienced meditators enter default mode every 5-7 seconds. What differentiates them from us, however, is that they are adept at paying attention, noticing when their mind is in its default state, and returning their attention to the present moment. They can catch it, switch attention, and return to focus. Interestingly, they have increased neural connectivity (links) between the attention centers of their brains and their centers for body awareness, which gives us a clue as to where and how to focus attention to manage our default mode so it doesn't manage us.



One of the most important insights that research on the default mode network offers (there are now several thousand studies and counting) is the insight that **we can't "manage" the default mode (read: the mind) using the mind itself.** And as the study on the previous page tells us, we can't manage it using positive thinking. (This is why it's hard to treat intransigent default mode patterns by talking to a friend, reasoning with ourselves, or even though cognitive and insight-focused psychotherapy.)

So what do we do to manage the tenacity of the default mode network—or put another way, how can we avoid shooting the second arrow, particularly with respect to anxiety?

Emerging research shows that people with depression often have difficulty with reappraisal, one of the primary techniques of cognitive-behavioral therapy. (CBT, as it's called, is one of the gold standards for treating depression.) Even though it's not effective to use the mind to treat this part of the mind, there are a couple of quick-and-dirty cognitive interventions.

We can try some “light” mental labeling. This means that during meditation or sitting at your desk or in a moment of depression, the mind can be recruited to briefly step in and label the type of thought you're having. For example, you can say “obsessing over details” or “negative self-judgment” or “revisiting the past” and return your focus to what you're doing. But keep it brief (and, if you can, light).

The Buddhist tradition also has a lovely practice of inquiry. When we're immersed in a challenging thought pattern, we can ask ourselves the following:
Is this kind? Is this true? Is this helpful?

If the answer to any of these nodes of inquiry is “no,” you can lightly label the thought and return attention to the present moment.

But by far the most effective ways of managing default mode thinking, the kind that exacerbates or even primes depression, are:

1. mindfulness
2. embodiment (the check-ins we often do before and after practice help quiet the default mode, as do other embodied practices like fascia work)
3. immersing ourselves in states of creative flow (think art, music, dance, gardening, and so much more).

TIP FOR MANAGING NEGATIVE THOUGHTS:

The embodied check-in is hugely important in depression. It helps monitor our nervous system and our levels of depression. Knowing the activation in the mind-brain-body network allows us to intervene with tiny therapeutic tools that can be used multiple times throughout the course of a day. This helps us lower our current state of sad affect. It helps us be more present not with thoughts and emotions, but with how they feel in our bodies. Moving into our bodies, known as interoception, can interrupt a cycle of rumination.

DEFAULT MODE NETWORK QUIETING PRACTICE.

Embodied Check-In:

- Am I in my body? To what degree?
- What is the speed of my mind?
- What is the depth and rate of my breath?
- What is my nervous system status?
- What do I notice in my abdomen?
- Can I perceive sensations that occur in my body? (Warmth, fullness)
- Do I feel rooted and grounded in my feet (or whatever part of me is touching the Earth in this moment)?
- What is my level of physical energy?
- Is there a narrative happening—a story that's stuck in my mind?
- What is my emotional tone?
- Do I sense an immune response, i.e. illness or defense mode?
- Do my muscles/connective tissue feel hydrated and supple or dehydrated and tight (or somewhere in between)?
- What else do I notice in my practice lab? How is my body speaking to me?

Do the Practice:

You can choose any of the practices on Page 12, or you can try the “Shrugger” Connective Tissue Release Pose here.

SHRUGGER: CONNECTIVE TISSUE RELEASE POSE

Props:

Blanket or yoga mat to lie on

Two yoga therapy balls or tennis balls (see below)

One yoga block or a stack of books

Tip: When it comes to working with muscles and connective tissue (they're embedded in one another, so when you work with one, you work with the other for the most part), LESS IS MORE. It's tempting to think that we need to torture our muscles and tissue into submission in the “no pain, no gain” approach. If we do this, however, we can inflame and even damage our connective tissue cells. At the same time, we can inflame and activate our autonomic nervous system, which linked with and wired onto our connective tissue pathways. We recommend using [Yoga Tuneup Balls](#) (Hey! That's a link you can CLICK ON!) with a sock over them to cushion the impact. In a pinch, of course, you can use tennis balls with thicker socks.

STEP ONE: PRIME YOUR CONNECTIVE TISSUE. Your connective tissue is sentient and intelligent. Take a moment to “prime” the area you're about to engage with before adding sensation. You can try this sitting or standing, or even on your back with your knees bent. Begin breathing slowly and deeply, in and out through your nose. Draw your right hand across your

body and set it about halfway between you're the side of your neck and your left shoulder. Shrug your left shoulder for a moment and notice which part of your "shrugger" muscle (trapezius) feels tightest. Hold your finger pads there gently. Direct your awareness to the contact point between your fingers and your body. Let awareness begin to pool there. After you feel attuned to this area, you can also direct your breath to enter this space too. Note that you can do the whole practice in this way to great effect without using the therapy balls or amplifying sensation. (Certain parts of your connective tissue, particularly interstitial connective tissue cells, have many more times the amount of receptors for interoception, or embodied awareness—more about that coming up—than they do for proprioception, or awareness of where we are in space.



Figure 1. Ball placement while sitting

STEP TWO: ADD THE THERAPY BALLS. If you'd like to add sensation, place the sock-padded ball underneath the tightest part of your shrugger muscle on the left side. Take a moment to let your body receive the pressure. Check in to see how it's being received. If you find yourself clenching your body against the stimulation, or your eyes are "bugging out" (opening wide), or you feel nauseous in any way, these are signs that your nervous system is saying "Too much!" If that's the case, add more padding to the ball.

To reduce the level of sensation, stretch your legs out on the ground. To increase it, bend your knees. To increase sensation further, you can lift your hips in the air (think Bridge Pose) to create that. If you prefer the practice with your hips lifted, place a block underneath your sacrum in Supported Bridge Pose so your legs can relax. [See Figure 2 below.]

Remember: Your nervous system is "listening" to the amount of sensation you're creating—and so is your connective tissue. Modern dominant culture pressures us to be productive, to DO, to accomplish. And dominant yoga culture takes that on, too. Sometimes we've been taught the fallacy that strong sensation creates change, and that less sensation won't do the trick. If that comes up for you here, it's a great opportunity to make it conscious, to acknowledge it fully, and to begin a slow revolution by allowing sensation (and therefore, change) to be more nuanced.



Figure 2. Ball under the trapezius.

Note the two white arrows. One points toward the ball placement, and the other to where the hips are potentially lifted in Supported Bridge Pose. (*Strong recommendation: When snapping photos of connective tissue work, ensure that therapy balls are not the same color as the yoga mat.*)

STEP THREE: THE ARM DANCE. Begin to lift your left arm (the side where the ball is) into the air and point it toward the ceiling. Do a “slow dance” with the arm. As you do, you’ll find that sensation begins to travel into the small, often tight or dry spaces that don’t get much attention. You can also bend that arm, hold your bicep in your free hand, and lightly pull the arm across your body. [See Figure 3.]



Figure 3. Arm Dance.

STEP FOUR: FEEL THE DIFFERENCE BEFORE SWITCHING SIDES. To know how long to remain here, check in with your nervous system. There’s usually a point where things feel complete to your body (not your mind) and where doing more doesn’t seem like it’ll get results and even, like it might create inflammation. When the pose feels complete to your body, take the ball out from underneath your left shoulder. Allow your tissue to settle. (You might feel a “fluffing effect” where the tissue begins to feel more hydrated and full. In this interlude between the two sides, your tissue through its intelligence begins to reshape itself in an organic way. This is

an incredible opportunity to allow our body to create, or recreate, its own intuitive and organic shape free from the pressures we—and the modern world—place on it.

Before switching to the other side, it's also helpful to try a movement or stretch of your choice so your nervous system can register the difference between sides. You can even come up to sitting. Rest on the block so your bum is elevated. Sense and breathe into the difference between sides. You can also lift your right arm (the one you haven't tended to yet) into the air to sense the ease of its movement, and then do the same with the left arm to see if they feel different. Or you can turn your head from side to side. The particular pose or movement you choose to let your nervous system "digest" the difference isn't important. In fact, you might choose different things on different days. But this interlude is an important part of your mind, brain, and body assimilating the learning here.

When you've played with feeling the difference, repeat these instructions on the other side.

Feel the Difference:

- Am I in my body? To what degree?
- What is the speed of my mind?
- What is the depth and rate of my breath?
- What is my nervous system status?
- What do I notice in my abdomen?
- Can I perceive sensations that occur in my body? (Warmth, fullness)
- Do I feel rooted and grounded in my feet (or whatever part of me is touching the Earth in this moment)?
- What is my level of physical energy?
- Is there a narrative happening—a story that's stuck in my mind?
- What's my emotional tone?
- Do I sense an immune response, i.e. illness or defense mode?
- Do my muscles/connective tissue feel hydrated and supple or dehydrated and tight (or somewhere in between)?
- What else do I notice in my practice lab? How is my body speaking to me?

NOTE: What did you notice? What was happening in your practice laboratory after the first check-in? What's left—or what abides—now? If you have a long-term relationship with anxiety, how does the Shrugger Connective Tissue Release Pose impact that? Is this a "keeper" for your practice—or put another way, was the personality of this practice beneficial for **your** nervous system? Consider recording your observations in your embodiment journal.

FREESTYLE PRACTICES.

CHOOSE ANY PRACTICE YOU LIKE.

DO A CHECK-IN FIRST.

DO THE PRACTICE.

FEEL THE DIFFERENCE.

RECORD THE DIFFERENCE IN YOUR JOURNAL.

NOT SURE WHAT YOU'D LIKE TO CHOOSE? CLICK ON ANY OF THE BOXES BELOW TO ACCESS THESE PRACTICES ONLINE. (JUST CLICK, AND THEY'LL OPEN UP IN A COMPUTER BROWSER.)

FACE-DOWN BURRITO POSE

PIRIFORMIS (BULLSEYE BUTT) RELEASE

FOOTBALL: CONNECTIVE TISSUE RELEASE POSE

HAMSTRING SAVASANA + EMBODIED SELF-COMPASSION

SUPPORTED RECLINING TWIST

THREE-STEP PROPRIOCEPTIVE PRACTICE

EMBODIED BELLY MEDITATION

BALANCING ANXIETY + BUILDING RESILIENCE