

Relaxed and Content (Part Two): Activating the Parasympathetic Wing of Your Nervous System

© Rick Hanson, PhD, 2007
drh@comcast.net

Introduction

In the previous Wise Brain Bulletin (#5, downloadable at <http://www.wisebrain.org/bulletin.html>), we began exploring the portion of your nervous system that helps you feel peaceful and alright. It's formal title is: "the parasympathetic wing of the autonomic nervous system" or PNS, for short.

What's great is that you can trigger the PNS at will, which immediately lowers your sense of stress, brings health benefits like reducing blood pressure and strengthening the immune system, and lifts your mood. This gives you more control over your inner landscape – a nice thing at times when the outer world seems driven by forces that are beyond your influence, from local traffic jams to global warming.

In the previous Part One, we covered:

- The structure of your nervous system
- How stressful events (e.g., multi-tasking, job reviews, arguments, feeling upset, medical worries, letters from the IRS) set off the "fight or flight" sympathetic nervous system (SNS)
- The incredible ripple effects of the SNS throughout your nervous and hormonal systems – all within a few seconds, and all designed to help you survive and have grandchildren

Here, in Part Two, you'll learn about:

- The long-term results (not good) of chronic SNS activation, including the emotional effects of painful or even traumatic experiences
- A simple but comprehensive strategy for dampening the sympathetic nervous system and fueling the "rest and digest" PNS
- The reasons why your fundamental nature is actually rooted in the qualities of the parasympathetic nervous system: peaceful, present, satisfied, and quietly happy.

Descriptions of many effective ways for lighting up your parasympathetic nervous system are interspersed throughout Parts One and Two. For example, the everyday techniques described in Part One included: breathing, intentional relaxation, balancing heart rate variability, and mindfulness of the body. And this article will cover the methods of yawning (really!), meditation, increasing positive emotion, and – believe it or not – fiddling your upper lip.

If you really want a clear picture of what is happening inside you every single time you are hassled, pulled in too many directions, irritated, worried, threatened, injured, or upset, then you might want to read carefully the descriptions of your bodily processes when your SNS flips its switches. On the other hand, that might be more detail than you really want, and if so, you could skim through it and focus on the methods themselves, which are numbered as exercises.

To avoid repetitions of material already covered in Part One, I'm going to assume that you've either read or skimmed that article, or are comfortable just diving into Part Two (which is also fine). And for further information, take a look at the slide shows from our workshops on the "neurology of awakening" (http://www.wisebrain.org/slide_shows.html) and at the Summary of Methods article (<http://www.wisebrain.org/WiseBrainMethods.pdf>).

Long-term Effects of Chronic SNS Activation

In a nutshell, the SNS shunts resources away from long term projects – like building a strong immune system, or digesting food, or making babies – in favor of short term crises, like getting away from an attacking lion a million years ago. Crises that were usually resolved quickly. One way or another.

But long after the lion has pounced on someone else and left you alone, you're still shaking like a leaf! That's because the effects of the SNS diminish *gradually*, while the effects of the PNS diminish *abruptly*. For example, in a frightening situation (= SNS arousal), it takes your heartbeat awhile to go back to normal even after the danger is over. But when you wake up – and are no longer so regulated by the PNS – your heartbeat increases briskly.

One reason for this is that, unlike many other hormones, the dominant SNS hormones – epinephrine (adrenaline), norepinephrine, and catecholamines (which include dopamine) – do not exert any negative feedback to reduce their own synthesis.

Bottom-line, lighting up your SNS is not just a fleeting experience, but something that has a real *stickiness* to it, a lasting impact.

For example, chronic activation of the SNS burdens five major systems of your body: gastrointestinal, immune, cardiovascular, endocrine, and nervous. Let's look at the lingering effects of that wear and tear for each system, with an emphasis on the nervous system, since that's where it feels like we live as conscious beings.

Gastrointestinal

Chronic stress and other sources of SNS activation increase your risk for ulcers, colitis, irritable bowel syndrome, diarrhea, and constipation.

Immune

Routine SNS arousal weakens your body's defenses in numerous ways. This finding is well-documented in numerous studies, and we've all had the personal experience of catching a cold when we're run-down.

Cardiovascular

Hardening of the arteries and heart attacks are all more likely if you experience chronic stress – especially when combined with a steady dose of hostility.

Endocrine

A steady diet of SNS increases risks for Type II diabetes, especially when combined with lots of sugary and refined carbohydrate foods. In the erotic department, it leads to impotence in men and low desire for both sexes.

And it's probably not very good for your longevity, either. The body makes cortisol (one of the stress hormones) and DHEA from the same raw materials. DHEA is sometimes called the "anti-aging hormone" due to its beneficial effects. But under stress, production is shifted toward cortisol, so there's less DHEA.

Nervous

The amygdala. Repeated experiences of fear (and perhaps other negative emotions such as disgust or anger) increase what's called the Long-Term Potentiation (LTP) of neurons in the amygdala; in other words, the synaptic connections there are strengthened. Further, repeated stressful experiences lead amygdala neurons to grow more connections with each other. As a result, in a vicious cycle, repeated experiences of fear and stress make the amygdala more sensitive to and more reactive to fear- and stress-related information.

Now, the amygdala plays a central role in the formation of **implicit memories**: the registration of lived experience (especially the emotional and sensate parts) beneath conscious awareness. When the amygdala has become sensitized and energized in a

fearful and negative direction, then it shifts implicit memory that way. Over time, this “dark shading” can lead you to feel a free-floating anxiety, depressed mood, and irritability.

Your implicit memories and negative emotions also create the conceptual lenses through which you see the world. These perspectives seem self-evident – of *course* most relationships are disappointing, of *course* you’ll get in hot water if you say what you really feel, etc. – and are thus typically unquestioned, which is what makes them most problematic; like the proverbial fish, we swim in the waters of our belief systems without realizing we’re soaked in assumptions.

When you peer at the world through subtly shadowed glasses, it looks more daunting and less friendly, which naturally makes you too cautious or too aggressive . . . sometimes with serious consequences. And in a feedback loop, any “tinted” information coming through your lenses increases the negative sensitization of the amygdala, which in turn darkens your worldview, leading to incoming information that’s even more shaded.

The hippocampus. Compared to the amygdala, stress hormones – notably cortisol – have an opposite effect on the hippocampus, a part of the brain that is vital for forming **explicit memories** of events: a clear record of what actually happened. In other words, stress hormones *reduce* long-term potentiation (LTP) in the hippocampus. In the extreme, intense and longstanding stress or trauma can literally shrink the hippocampus.

Further, recent evidence has shown that at least some portions of the brain actually do grow brand-new neurons (contrary to long-held belief), including the olfactory bulb (for smell) . . . and the *hippocampus*. But glucocorticoids due to stress prevent the birth of new neurons in the hippocampus, impairing its ability to produce new memories.

The effects of all this can be quite extreme. For example, in people who have a history of severe depression – which could be regarded as both a result and a cause of stress and painful feelings – the hippocampus can shrink by as much as 10 – 20%. This shrinkage could be one of the reasons for the poor memory associated with depression. Unfortunately, hippocampus atrophy persists after depression resolves; it appears to be a permanent consequence of intensely painful experiences.

The amygdala-hippocampus one-two punch. When the amygdala is over-sensitized and the hippocampus is compromised, it’s a horrible combination: painful experiences can get recorded in implicit memory – with all the distortions and turbo-charging of

an amygdala on over-drive – without an accurate explicit memory of them! Then it may feel like: “Something happened, I’m not sure what, but I’m really upset.”

This could be a reason why victims of trauma sometimes feel dissociated from the actual events surrounding their trauma, yet are very reactive to any trigger that reminds them unconsciously of what once happened.

Depression. Routine activation of the sympathetic nervous system is closely linked to depression, for three kinds of reasons. First, an underlying source of SNS arousal – such as getting fired or needing to care for a demented parent – could also be depressing in its own right; in this case, the two effects, SNS arousal and depression, are associated simply because they share a common cause. Second, the experience of chronic stress has psychological consequences – e.g., no chance to let down, feeling irritable, sense of hopelessness – which can wear down your mood over time.

Third, the physical effects of sympathetic activation undermine the biochemical basis of an even-keeled, let alone cheerful, disposition:

- Glucocorticoids slowly deplete the norepinephrine released throughout your brain by the neurons of the locus ceruleus. Norepinephrine makes you feel alert, attentive, and mentally energetic, so when stores of it run down, you tend to feel a certain dullness, flatness of emotion, weakening of concentration, even apathy – which are hallmark symptoms of depression. (This could a reason why taking glucocorticoid hormones for arthritis can lead to depression as an unwanted side effect.)
- Stress reduces the amount of serotonin – the neurotransmitter that is relaxing, regulates sleep, and buttresses your mood – in your brain. Additionally, it reduces the number of serotonin receptors in the frontal lobes, so they are less responsive to the dwindling stocks of serotonin that do arrive.

Serotonin also encourages the locus ceruleus (LC) to release norepinephrine. When serotonin levels drop due to stress, that leads to even less norepinephrine from the locus ceruleus, which has already reduced its norepinephrine flows due to increased glucocorticoid stress hormones (which we discussed in the bullet just above).

In short, less serotonin means more tension, worse sleep, more vulnerability to a blue mood, and less alert interest in the world.

- Moderate and brief stresses – in other words, manageable doses – lead to a release of the neurotransmitter, **dopamine**, in the pleasure circuitry of the brain. That’s one source of the “high” in some stressful activities like race car driving, difficult skiing, rock climbing, etc.

But – prolonged exposure to glucocorticoids flattens dopamine production. Then, as the classic criterion for depression says, there is a loss of enjoyment in activities once found pleasurable.

Summary

We evolved to handle short bursts of intense stress, and live to tell the tale. But the modern lifestyle of fairly steady levels of moderate stress is completely unnatural, and it has many bad consequences for your physical and mental health. That's perhaps the most fundamental reason for increasing the activation of your parasympathetic nervous system.

Yawning: Exercise #5

So now, as another method for activating the PNS – and one that could be happening on its own as you try to assimilate all the material we just plowed through – try yawning!

Yawning activates the PNS on inhalation and the SNS on exhalation. Taken as a whole, it sure feels like a net PNS intervention.

Strategic Perspectives

Even though you've just had a fairly nightmarish tour through the potential collateral damage of the sympathetic nervous system, we still need that system, and it's got to work well, whether it's to get through a minor crisis at work or rise to meet the challenge of a late-night call from a teenager who needs a ride home from a party-gone-bad.

Nonetheless, we really do live in a time of SNS gone amok, and we would really benefit from reducing its over-reactions. How to do that?

For sure, it makes sense to deal with your environment. That could mean looking for a job with a less insane commute, parenting a spirited child in ways that help him learn more self-control, or simply fixing the leaky faucet that's driving you crazy at night.

You could also take medications. For example, tranquilizers like the benzodiazepines work by relaxing muscles and by inhibiting the locus ceruleus excitation of the amygdala, reducing its reactivity. Another class of drugs called beta blockers fit into some of the neuronal receptors for epinephrine and block its effects – like a bandaid covering a lock so the key can't get in. (Interestingly, beta blockers reduce the

formation of memories of upsetting events, and are being explored in the treatment of trauma.)

That said, there are a lot of limits on working with the external world, and lots of benefits in working with the inner world (see the article, Why Inner Skills, at <http://www.wisebrain.org/articles.html>). And there are well-known problems with prescription medications; for example, the benzodiazepines are sedating and addictive.

Therefore, I believe that both research and personal experience tell us that it is the *inner skills* – not environmental fixes or medical treatments – which make the greatest difference to our resilience, well-being, and long-term health.

In terms of bringing a better balance to your autonomic nervous system, you can be skillful inside your own body/mind in three kinds of ways:

- In the moment, dampen the immediate SNS response. For example, focus on moderating factors like social support, the sense of what you can do, and hope for the future. Or distract yourself, or remind yourself not to sweat the small stuff.
- Over the long-term, soothe SNS reactivity. For example, really emphasize positive emotions in your life and practice taking in the good to help those good experiences register deeply in implicit memory, both of which should reduce amygdala reactivity over time.
- Activate the parasympathetic nervous system. As we've discussed, PNS arousal has inherent benefits, plus it puts a blanket on the SNS. Inner skills for triggering the PNS have been the focus of Parts One and Two of this article.

Further Methods for Parasympathetic Activation

Introduction

By the way, you may have already noticed that many techniques of PNS activation work together. For example, relaxing is itself usually a pleasant experience, thus triggering mildly positive emotions.

To review, we have already covered:

- Breathing
- Relaxation
- Lowering heart rate
- Mindfulness of the Body
- Yawning

Now we'll explore three more methods.

Meditation: Exercise #6

Meditation activates the PNS for many reasons, including pulling attention away from stressful subjects and activities, sitting quietly, relaxing, and bringing awareness into the body.

An interesting, possible additional reason has to do with a common method of meditation: paying attention to the sensations of the breath around the nostrils and upper lip. In your brain, the olfactory bulb – which receives sensory signals from the nostrils – sends neuronal projections directly to the amygdala, probably due to the evolutionary importance of detecting disgusting, frightening – and sometimes, pleasant – aromas. When you bring your attention to the breath around the nostrils, you activate the sensory networks in that area, including the olfactory system.

As a result, you are flooding the amygdala with information that has a neutral quality to it (that quality is called “feeling” – distinct from emotion – in Buddhism), or a positive quality if you meditate with incense. That would tend to crowd out unpleasant information within the amygdala. It could also sensitize the amygdala increasingly over time to neutral information, leading its processing to be increasingly dedicated to neutral information compared to negative information.

This is not the place to give instructions about meditation, which you've probably been exposed to already. And you can get good information from the books of Christina Feldman, Jack Kornfield, Jon Kabat-Zinn and many others.

Here, I would simply like to encourage you to meditate regularly. Even for just one minute a day. But every day.

And consider joining a regular sitting group in your area. There are an amazing number of meditation groups sprouting up around the country.

Positive Emotion: Exercise #7

Positive feelings activate the PNS directly by lowering cardiovascular reactivity. They also do so indirectly by priming a person to experience life in more optimistic and pleasant ways, and the effects of that include reducing the sensitization of the amygdala to negative events. Anything that gives you a positive feeling – especially of a more relaxed sort, like contentment, gratitude, lovingkindness, or tranquility – will usually arouse your PNS.

Yes, sometimes it is hard to have positive emotions. And that difficulty alone can cause some negative emotion! But just do what you can. There are two great wings to psychological growth and spiritual practice: being with and working your inner and outer worlds. While *being* with is primary, there is still a great role for working with, including the cultivation of positive feelings. (For more on this point, please see the Two Wings article in Bulletin #2, at <http://www.wisebrain.org/bulletin.html>.)

If you like, experiment with cultivating positive emotion for a few moments, and whatever you experience is really fine.

Perhaps focus on what you feel grateful for. Or feelings of lovingkindness, perhaps for yourself or some people you are close to.

And to really reap the rewards of experiencing positive emotions, help yourself by taking them in (see the articles on taking in at <http://www.wisebrain.org/articles.html>).

Fiddling the Lips: Exercise #8

Last, here's a cool but kind of goofy method: fiddling with the upper lip, including producing that "blub blub blub" noise kids love to make. The evidence for it is anecdotal - mainly from people who work with horses or with troubled children who bite - but interesting.

This method could work by:

- Stimulating the PNS nerve fibers that innervate the lips, and thus send activating reverberations throughout the whole PNS.
- Triggering positive emotions associated with nursing, feeding in general, thumb-sucking, etc. Note that children and even adults can comfort themselves through touching their lips.
- Stimulating salivation, which is controlled largely by the PNS.
- Simply distracting yourself from stressful stimuli through its sheer absurdity.

Concluding Perspectives

Over the Long Haul

Many of us balance a driven and routinely stressful way of life with vacations or the occasional day off. This is a kind of "binge and purge" approach to stress

management, but it is not at all effective. You cannot undo the accumulating effects of chronic stress with intermittent respites, even in Tahiti.

There is no way around it: each of us needs to have minimal chronic stress combined with a steady state of relaxed, alert, contented coping that emphasizes PNS activation with just enough SNS arousal to get the job done – whatever it is. In a single sentence, that’s your best-odds prescription for a long, productive, and happy life.

Foreground and Background

Consider puffy white clouds against a blue sky: the element that’s least present – the clouds – pops to the foreground and dominates the picture. And if you’ve ever tossed three coins to produce the six lines of the hexagram used in the I Ching, the ancient Chinese system of divination, you’ve encountered a similar phenomenon, this time from a great wisdom tradition: if heads represent yang (the light and active principle) and tails represent yin (the dark and receptive principle), then one head and two tails would be a yang line, since it is the yang element – in the minority – which stands out.

Or consider TV shows or movies which spotlight conflict and lack of communication . . . but against a backdrop of routine daily cooperation in human societies. Cooperation is so ubiquitous that it becomes the “sky” against which the clouds of conflict stand out – and capture and dominate our attention.

Recall the point made in Part One: if your SNS were shut down, you would continue to live and function (though maybe be sluggish in an emergency). But if your PNS were deactivated, you would quickly die. Your parasympathetic nervous system is absolutely fundamental to life.

The PNS is wallpaper, sky, taken for granted, undramatic, in the background. Human culture, and definitely the modern media of television and movies, are largely about the SNS. Action, conflict, sex, million dollar moments, death, crisis, fairy-tale endings, etc. are different and dramatic. It’s therefore easy to start thinking that chronic stress and living awash in the SNS are what’s really natural, the bedrock of existence.

But in reality, cooperation, relaxation, and equilibrium are the hub of the great wheel of life.