

The Wise Brain Bulletin

News and Tools for Happiness, Love, Productivity, and Wisdom

Relaxed and Contented (Part One): Activating the Parasympathetic Wing of your Nervous System

Rick Hanson, PhD

Introduction

It's amazing but true: there is actually a neurological system in your body that you can trigger at will to help yourself feel less stressed, more peaceful, and more happy.

It's full-bore title is: "the parasympathetic wing of the autonomic nervous system," or PNS, for short.

In this article, you'll get a crash course in your own nervous system and how the PNS fits into it, mixed with lots of ways you can use to activate your own PNS.

The Autonomic Nervous System

If you like, take a moment to observe your breathing as it is, right now. Next, relax and let your breathing slow down. Then, for another moment, deliberately breathe faster.

Doing this shows the workings of what is called the "autonomic nervous system" (ANS). This system regulates many automatic bodily processes, and it usually operates outside of your awareness. But actually, you can exercise conscious influence over the ANS – and that remarkable fact puts you in the driver's seat for the core machinery of emotional well-being in your body.

Overview of the Nervous System in General

To operate that machinery, it helps to have some background information about your own nervous system:

- Individual neurons act to inhibit or excite, to put on the brakes or hit the gas, red light or green light.
- Those functions of individual cells get writ large in assemblies of thousands, even millions, of neurons.
- The nervous system (NS) is divided into the Central NS and the Peripheral NS.

Also in this issue:

How to Feel Strong
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Food Allergies
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Greetings

The Bulletin offers skillful means from brain science and contemplative practice – helping you to work with your brain for the benefit of yourself and others.

The Bulletin is offered freely, and you are welcome to share it with others. Past issues are archived at www.WiseBrain.org.

Rick Hanson, PhD and Rick Mendius, MD edit the Bulletin. We welcome your contributions, and to subscribe, please contact Rick at drh@comcast.net.

- In turn, the Peripheral NS is divided into the Somatic NS and the Autonomic NS.

- The Autonomic NS (ANS) contains the sensory and motor neurons that “innervate” – that are woven into and guide – the internal organs and the digestive tract.

Then, the ANS is divided into the sympathetic, parasympathetic, and enteric nervous systems. This article focuses on the first two of these, but as a

parting bow to the enteric system, I’ll mention that it pervades your digestive tract and has enough autonomy that some scientists call it a “second brain.”

The ANS Itself

The ANS is responsible for maintaining the equilibrium of our vital functions, including breathing, the heartbeat, glandular secretions, salivation, and perspiration. On autopilot, it’s directed by the brain stem and spinal cord. That’s why someone with a massive head injury can still keep breathing in a vegetative state for years.

It carries out its responsibilities through three kinds of nerve assemblies:

- Sensory – These bring information in, and are called “afferent.”
- Decision-makers – These process sensory information and decide what to do.
- Motor – These carry out the plan of the decision-makers by sending instructions throughout your body; they’re called “efferent.”

Breathing: Exercise #1

As noted, you have control over certain ANS functions. For example, land animals like humans use breathing for more than oxygen and so they need to be able to turn off the autopilot and take the wheel themselves for things like sniffing the air for smells and making sounds such as speech.

It’s interesting that most spiritual traditions have contemplative practices that work with the breath. Perhaps one reason for this is that the breath is a point where conscious intention meets primal nature – with its poignant reminders of disease, old age, and death.

If you want, you could take a moment to activate the parasympathetic wing of the ANS by exploring our first major method – deep, full breaths:

- When you inhale, fill your lungs fully, hold for a second or so, and then exhale in a relaxed way.
- Try breathing in this way for 60 seconds.

It’s striking that such a simple and brief method is so powerful for most people.

It works because deep, long inhalations expand your bronchioles: the passageways in your lungs to the tiny alveoli where oxygen enters the blood and carbon dioxide leaves it. The PNS is in charge of constricting the bronchioles, so by making them swell up with a big breath, you trigger the PNS to bring them back to their “resting” size.

Parasympathetic and Sympathetic Systems: Structure and Functions

Getting A Sense of Each System

If you tried the deep breathing exercise just above, you got a sense of what lighting up the parasympathetic system feels like. For the sympathetic system, imagine something stressful, like being put on the spot by your boss, or a car cutting in front of you in traffic, or getting upset with a family member. Try to get into the experience, and then notice what it feels like in your body and mind. When you want, take a couple full breaths to get back to center.

That back and forth – calm from breathing deeply, then aroused by stress, and then calm again – illustrates how the parasympathetic and sympathetic systems work in balance with each other, much like the brakes and the gas pedal of a car. By learning how to control them more skillfully, you can increase your positive experiences, reducing negative ones, and – if you like – develop the steadiness of mind and equanimity that are vital for contemplative depth and realization.

The PNS

The PNS conserves energy in your body and is responsible for ongoing, mellow, steady-state activity. The feeling of it is relaxation, often with a sense of contentment. (And signals

for it originate in the Nucleus Ambiguus – love the term – in the brain stem.)

The parasympathetic nervous system:

- Opens (dilates) blood vessels leading to the GI tract, aiding digestion.
- Stimulates salivary gland secretion and accelerates peristalsis, helping the absorption of nutrients.
- Engorges the male and female genitals
- Constricts the bronchioles of the lungs.
- Dampens the sympathetic nervous system.

The primary hormone/neurotransmitter of the PNS is acetylcholine. For example, levels of this rise when we are sleeping, helping to slow the heart and decrease the force of its contraction.

Relaxation: Exercise #2

Relaxation is at the heart of most stress management trainings. Since you use the PNS in order to relax, relaxing engages its circuitry and thus activates the PNS.

Relaxing also has a significant indirect activation of the PNS: relaxed muscles send messages to the alarm centers in the brain that nothing is alerting the body to a threat.

Many people have their own key methods, and here are a few of the most common “quickies” for relaxing without going to yoga camp:

- Relax your tongue
- Relax your eyes
- Relax the diaphragm area
- Imagine being in a very comfortable setting
- Feel everything draining out of you and sinking deep into the earth

You might like to try one or more of these right now, maybe one you’re not so familiar with, and see how it feels.

The SNS

The SNS deals with immediate, rapid responses to changing environmental conditions. It lights up when an organism – a mouse in the field and the cat hunting it, or you and me – has to do something actively to preserve its equilibrium.

Much SNS activity is not particularly dramatic. For ex-

ample, standing up would cause a big drop in your blood pressure if the SNS did not compensate by momentarily increasing it. Similarly, just before you wake up, sympathetic activity increases, getting your body ready to be active.

The sympathetic system deals with “fight or flight” reactions, but it’s more versatile than that. Even in high-drama survival situations, such as a rabbit seeing a snake, the SNS may trigger not fighting nor fleeing . . . but freezing. (This latter response can become increasingly habitual in victims of inescapable trauma, such as mistreated prisoners or children in an abusive home.) In some fish, the SNS can cause a swift change in color. Your SNS activates whenever you’re upset – like irritated at a co-worker, saddened by an unexpected loss, or worried about how to pay the bills

On a happier note, SNS activation in women can be accompanied by a release of the soothing hormone oxytocin and increased “tend-and-befriend” behaviors. Partial or mild SNS activations may lead to negotiation among social animals, or even a kind of play, such as kittens – or preschool boys – tussling with each other.

Working Together

Broadly, the SNS deals with:

- tight engagement with the external environment
- high levels of energy

Train Your Brain

This course teaches practical, down-to-earth ways to activate the brain states that promote: Steady Awareness, Wholesome Feelings, Good Intentions, Caring Heart, and Wise Action. It is taught in a 24-month cycle which you can enter at any time. Talks and materials from past class sessions are archived at www.WiseBrain.org.

The class meets on the 2nd Tuesday of every month, 7 – 9:15 pm, at the Unitarian Universalist church in Terra Linda (San Rafael), at 240 Channing Way. The atmosphere is warm, informal, and focused. The suggested donation for each month of the program is \$40 (and less is gratefully accepted). To register, contact Guisela Luster at drh@comcast.net or simply arrive fifteen minutes early.

Upcoming dates and topics:

- 5/8/07 – Refilling Your Cupboard: Improving your body’s molecular balance sheet of assets and liabilities
- 6/12/07 – Concentration: The neurology of stable attention, and how to activate it
- 7/10/07 – Mindful Presence: Accepting change and being with what is; mindfulness in daily life

San Rafael Meditation Group

Open to beginners and experienced practitioners, we meet on Wednesday evenings at the A Sante day spa in downtown San Rafael. Meditation is available from 6:45, with formal instruction at 7:00, ending at 7:30, with a dharma talk and discussion ending at 8:30. It is co-led by Rick Hanson and Manny Mansbach, and for more information, contact Rick at drRH@comcast.net.

- mainly exteroceptive (external) sensory information

On the other hand, the PNS handles:

- disengagement from the

external environment

- low levels of energy
- mainly proprioceptive (internal) information
- recovery from stressful experiences
- return to homeostasis

In short, the SNS prepares the organism to act upon its environment, while the PNS prepares the organism to act upon itself. Put more dramatically, if the SNS is for “fight and flight,” the PNS helps you “rest and digest.” Both systems evolved to keep animals, including humans, alive in very harsh and potentially lethal environments, and we need them both.

Nonetheless, we live in a culture that prizes the excitement, aggressiveness, high-stress worklife, pace, and general intensity that is fueled by the SNS. Further, unlike most other developed nations, it is a simple fact that our society has chosen not to take steps such as universal health care, family friendly laws, and an economic safety net that would lower much of the SNS-activating anxiety that gnaws at many people.

Yet if anything, the PNS is more fundamental to life. If your sympathetic system were surgically disconnected – as it was in years past as a last-resort treatment for hyper-tension – you would remain alive and pretty much yourself – though unable to cope well with commuter traffic, root for the home team, or have an orgasm. But if your PNS were disconnected, you would die quickly. PNS activation is the resting state of the body-mind: in other words, relaxed contentment is your fundamental home base, your bottom line. Pretty sweet!

Most of us live in a chronic state of SNS over-activation. Conscious attention to the parasympathetic system brings the pendulum back to center.

Increasing and Balancing “Heart Rate Variability”: Exercise #3

The HeartMath Institute has pioneered a number of research-based techniques for influencing the heart rate in ways that improve physical and mental health. Most if not all of their methods engage the parasympathetic nervous system. For more on this, go to their website (www.HeartMath.com) and check out our adaptation of their techniques in the Methods article on our website, www.WiseBrain.org.

In brief, here’s a simple, three-part method:

- Breathe in such a way that your inhalation and exhalation are the same duration; for example, count 1-2-3-4 in your mind while inhaling and 1-2-3-4 while exhaling.
- At the same time, imagine or sense that you’re breathing in and out through the area of your heart.
- Meanwhile, bring to mind a heartfelt emotion like gratitude or love.

Try this for a minute or two, and you will probably be struck by the results. Technically, you are both increasing and harmonizing the natural, tiny changes in the interval between heart beats: what’s called “heartrate variability.” Fairly large changes in that interval, and changes that vary smoothly from one beat to the next, link to cardiovascular health, improved immune system function, and elevated mood.

How the Sympathetic System Gets Triggered

Introduction

Since PNS activation is the baseline of your body, with SNS activation being a change in that baseline in order to cope with something “perturbing,” it’s really useful to understand the answers to these questions:

- What triggers the SNS?
- What happens then?

Activation Signals

As noted, much of the routine activation of the SNS is quiet and in the background (like maintaining blood pressure when you stand up). As usual, it’s the fireworks that get noticed! Still, it is those fireworks that cause us the most trouble – in our experience of living, in our health, and in our relationships – so we’re going to focus here on them.

Here’s a survey of the different sorts of things that signal the SNS to WAKE UP AND TAKE CARE OF BUSINESS!!:

- Imagine an extreme situation, such as you’re driving along and suddenly a tire blows and your car starts to spin into on-

From Our Contributors

Clean Sweep Meditation

Clean sweep...
Clean sweep...
Clean sweep the garden of weeds...
And the dirt from the kitchen floor,
And the bathroom, too,
While I'm at it...
And those little nooks and crannies
Of my leaning mind...
As I cultivate, meditate,
And sweep, sweep...
brushing off the dust and continue...
Always continuing to continue...
Because then there's always this new dust,
Accumulating... in my leaning mind...
And in the bathroom,
And on the kitchen floor,
...to say nothing of this garden's
weeds...

Rosemary Grady

coming traffic. Or you get a call from school and your child has had a terrible fall and is being rushed in an ambulance to the hospital. Or you're walking down a dark street and suddenly you feel someone grabbing you and trying to take your wallet or purse. These are mortal threats to yourself or people you love.

- Imagine less extreme situations, such as stubbing your toe (pain) or getting into an argument with your partner (emo-

tional upsets).

- Imagine just having low blood sugar: you had a donut and a diet Coke for breakfast, it's 11:00 o'clock, and you're stuck in a boring meeting at work.
- Imagine something really exciting, in a wonderful way: you get the envelope saying you're accepted into the college of your choice, or your beloved asks you to marry him, or the Red Sox finally win the World Series (that one sure pumped me up).
- Imagine being trapped in stop-and-go traffic. Or having to write a difficult report under a tight deadline. Or being blasted with a bright light or a loud noise. Or having to do a lot of multi-tasking, or getting constantly interrupted (a description of raising young children . . .). Or anything else that's significantly stressful.

Danger, pain, upsetting feelings, low blood sugar, excitement – and stress in general – all activate the sympathetic nervous system.

And so does the anticipation of something bad (or really wonderful) . . . even if that anticipation is exaggerated or flat wrong.

Or even simply seeing the name of someone who we're upset with on an email.

Exacerbating Factors

This last effect of an internal, psychological variable – such as anticipation – points to the powerful role of psychological factors in modulating the impact of events.

For example, if we expected a job interview to be serious and demanding, then when it is, it's (probably) not that stressful. But if we expected a mere formality, a cakewalk, but it's actually serious and demanding, then that could be quite stressful. The violation of an expectation activates the SNS, which deals with novelty; the violation of a positive expectation is especially stressful.

Additionally, studies have shown that the impact of events is increased when we:

- Do not have emotional outlets
- Feel like we've got little or no control
- Are not supported by others
- Lack hope that there's a light at the end of the tunnel

As Robert Sapolsky, PhD wrote in Scientific American (8/10/03):

“. . . a rat will be less likely to develop an ulcer in response to a series of electric shocks if it can gnaw on a bar of wood throughout, because it has an outlet for frustration. A baboon will secrete fewer stress hormones in response to frequent fighting if the aggression results in a rise, rather than a fall, in the dominance hierarchy; he has a perception that life is improving. A person will become less hypertensive when exposed to painfully loud noise if she believes she can press a button at any time to lower the volume; she has a sense of control.”

So, with or without one of these of these exacerbating factors, let's say something has disturb your equilibrium. What happens then? (And we'll focus here on reactions to negative stimuli, since that's where most of the action is.) As we go through this discussion step by step, try to get a sense of this process actually happening in your own body. It's also a vivid way to learn about your nervous system.

Initial Arousal

First, within a fraction of a second, your brain orients to the novelty of whatever has occurred: “Oh, something new, something different, compared to my prior equilibrium.”

Then, there is a deepening attentiveness to the stimulus. The nerve circuitry involved in processing a particular sort of information – let's say a troubling noise in the night, or the avalanche of thoughts about the audit notice you just got

Grateful Wonder

“Cha – cha – cha – changes . . . !”

Whether it’s Bowie or Buddha pointing it out, change is everywhere, from fountains on the sun to goofy toys to your life and ours.

- #1 <http://antwrp.gsfc.nasa.gov/apod/ap070402.html>
- #2 http://www.youtube.com/watch?v=TdMIsCF_7p0

What difference would it make for you to live in the ongoing awareness of impermanence?

from the IRS – becomes physically more sensitive and active when attention is paid to that kind of information.

Feeling and Perception

Next, the stimulus gets flagged by the hippocampus and amygdala as “pleasant, unpleasant, or neutral.” This is the “feeling tone” in Buddhism, the second of the Five Aggregates of existence. And with that feeling tone comes the related behavioral inclination: approach, avoid, move on.

So far, typically less than a second has elapsed. Jump first. Ask questions later. Notwithstanding the sometimes problematic effects today, this hard-wiring in the brain helped our great-great-grandparents survive in the wild.

Coming quickly on the heels of the feeling tone, there is a labeling – often culminating in a verbal tag – of what the stimulus is, and this is known as “perception” in Buddhism, the Third Aggregate.

Bringing up the rear, but hopefully gathering in influence as the seconds tick by, comes the analysis and commentary of the frontal lobes. This enriches, shapes, and edits the initial take by the hippocampus and amygdala. In Buddhism, this wave of activity is known as the “mental {or volitional} formations,” the Fourth Aggregate. (To round out the picture, the First Aggregate is all of physical reality and the bare sensation of it, and the Fifth Aggregate is consciousness.)

Primary Reactive Cascade

As soon as the amygdala and hippocampus register that something significantly unpleasant is happening – or threatened (including anticipated) – they trigger a primary cascade of changes throughout your body. All often in less than a second, sometimes much less.

Note that the follow-on waves of perception and mental formations that come seconds and minutes – or hours and days –

afterwards can also influence the primary reactive cascade, but they are playing catch up, trying to slow down or redirect primal currents of neuronal information and hormonal/neurotransmitter discharges after the floodgates have already opened.

This primary cascade works both through the sympathetic nervous system, and through what is called the hypothalamus-pituitary-adrenal (HPA) axis of your endocrine (hormone) system. While the SNS and HPA are anatomically distinct, they are so intertwined that they’ll be described together.

So here we go:

- The thalamus – the major relay station smack in the middle of your head – sends a “Wake Up!!” signal to the locus ceruleus, a cluster of just a few hundred neurons in your brain stem that plays a central role in arousal and alertness.

The norepinephrine-releasing neurons of the locus ceruleus spread throughout your brain, and when the LC lights up, those neurons disperse this activating neurotransmitter/hormone far and wide.

- Amygdala neurons extend (“project”) down into the mid-brain and brain stem, and they activate the control centers of the sympathetic nervous system – whose major trunk lines run down your spine and send wiring into every major organ and muscle group of your body – and that makes the SNS light up.

- Meanwhile, within the HPA axis, the amygdala has also released a neurotransmitter called “corticotropin releasing hormone” (CRH). This, and other signals from that axis and the sympathetic nervous system, cause surges of the major “stress hormones”: Epinephrine and, to some extent, norepinephrine (adrenaline and noradrenaline), plus glucocorticoid hormones, particularly cortisol.

Interestingly, both physical stress and social stress activate the HPA axis, though through different pathways. But this gives a neurological explanation for why getting rejected or shamed can feel as stressful as a root canal.

And you can see the central role of the amygdala,

The Heartwood Institute for Neuroscience and Contemplative Wisdom

The Institute is a 501c3 non-profit corporation, and it publishes the Wise Brain Bulletin. The Institute gathers, organizes, and freely offers information and methods – supported by brain science and the contemplative disciplines – for greater happiness, love, effectiveness, and wisdom. For more information about the Institute, please go to www.WiseBrain.org/Heartwood.html.

since it triggers both the SNS and the hormones of stress.

- In all, there are multiple, redundant pathways to get the organism ready to “do or die.” (That’s why it’s complicated to describe – and understand.) It’s that important to survival.

Secondary Reactive Cascade

OK, so now your brain is on red alert, your sympathetic nervous system circuitry is lit up like a Christmas tree, and tidal surges of stress hormones are washing through your blood. Great! Now what happens?

- Epinephrine makes your heart beat faster and stronger, makes your pupils dilate to gather more light, improves your visual acuity a bit, and makes you sweat to cool the body.
- Norepinephrine constricts the blood vessels in the skin, which makes the skin a little cooler.

Triggered by the locus ceruleus, norepinephrine also excites – in the neurological sense – your brain as a whole, making it more susceptible to stimulation and priming it for activation. By the way, this could be one of the primary sources of the experience of slowing your perceptual time clock in an emergency (e.g., car crashes, falls in rock climbing): since your brain speeds up, the world seems to slow down.

- Epinephrine and norepinephrine – called “adrenal hormones” – act quickly, while the glucocorticoids have slower effects. They suppress the immune system, perhaps to reduce inflammation from wounds.

Glucocorticoids also add to the activation of the locus ceruleus, making it release more norepinephrine into the brain. In a circular feedback loop, the locus ceruleus sends projections back to the amygdala, which tell it to release more CRH, which leads to more glucocorticoids, which activate the locus ceruleus further, and so on.

Unfortunately, glucocorticoids in pregnant women can cross the placenta to reach their young, and very high levels of these stress hormones can permanently alter the hippocampus of the fetus, with effects discernible in adulthood. (But please know that this refers to really, really high levels of stress hormones, not the normal fears and hassles that accompany many pregnancies.)

- Lots of changes occur in the cardiovascular system. For example, blood gets shunted from the interior of the body to the major muscles, dilating the blood vessels there for maximum strength. In fact, in the skeletal muscles in the core of your body, blood flow can increase by as much as 1200%.

Interestingly, the emotion of fear tends to increase blood flows to the legs, while the emotion of anger tends to increase them to the arms . . . the one to run away, the other to turn and fight.

- The bronchioles of the lungs get dilated, for more gas exchange . . . enabling you to run farther and hit harder. We also tend to hold our breath when we are anxious, to extract as much oxygen from it as possible.
- Blood sugar rises, to get more fuel to cells that need to burn hot.
- Sometimes you get goose bumps – the fancy term for this is “piloerection” – raising the hairs on your skin, a vestige of an ancient reaction that made our animal ancestors look bigger when they felt threatened.

- Reproduction is sidelined. The production of reproductive hormones in women decreases, and erections in males are suppressed. No time for sex when a lion is charging! And the effects of chronic stress on libido are apparent even without a



Mindful Mary Oliver

Every day
I see or hear
something
that more or less

kills me
with delight,
that leaves me
like a needle

in the haystack
of light.
It was what I was born for -
to look, to listen,

to lose myself
inside this soft world -
to instruct myself
over and over

in joy,
and acclamation.
Nor am I talking
about the exceptional,

the fearful, the dreadful,
the very extravagant -
but of the ordinary,
the common, the very drab,

the daily presentations.
Oh, good scholar,
I say to myself,
how can you help

but grow wise
with such teachings
as these -
the untrimmable light

of the world,
the ocean's shine,
the prayers that are made
out of grass?

mortal threat at hand; just ask those caring all day long for young children.

By the way, male arousal involves a delicate minuet between the SNS and PNS, charmingly explained by Robert Sapolsky in his marvelous book, *Why Zebras Don't Get Ulcers*. In brief, men need some SNS activation to get sexually excited in the first place, but then the SNS needs to take a back seat for awhile to the PNS, which dilates (opens) blood vessels in the sex organs (though the SNS is responsible for dilating them in much of the rest of the body). Then, as orgasm approaches, the SNS is responsible for ejaculation. This complexity is one of the reasons why erectile dysfunction is not uncommon, and why stress and anxiety can have such an effect on sexual performance.

- Digestion is suppressed. Salivation is reduced, the reason for a dry mouth when you're afraid. Peristalsis (the rippling of the intestines that moves food along) slows down, which is why stress leads to constipation.

- Related emotions intensify – like fear, disgust, and anger – which sensitize your sensory circuits to threatening information, so they will pick it out more quickly. From an evolu-

tionary perspective, emotion is a very effective development.

But emotional reactivity also has its drawbacks. It makes you prone to over-estimate threats and not see positive resources. Also, circular and snowballing processes often reinforce any initially distorted perspectives. For example, if your original appraisal of the other person's action was that it was a "5" on the Badness Scale (but actually it was really just a "2"), then you're likely to get extra huffy . . . which in turn could irritate

the other person, who's probably thinking: "Hey, that was barely a '1'!" And that irritation could reactivate him or her further, seeming to confirm your original – but actually exaggerated – appraisal.

Mindfulness of the Body: Exercise #4

Since you've been reading about the body, maybe you've been bringing your attention to it a little – a good segue to mentioning another method for PNS relaxation: mindfulness of the body.

Since the PNS deals mainly with internally directed activities, bringing attention inwardly – especially when not related to something alarming, like worrying if you have an ulcer – activates PNS networks. Plus mindfulness is generally relaxing, which also activates the PNS (as we discussed above).

Probably you've already had some formal practice with mindfulness of the body (e.g., while meditating, doing yoga, in a stress management class). It's simple: just be attentive to physical sensations. And you can focus, if you like, on some sensations in particular, such as the breath in general or even localized to the area around the outer nostrils and upper lip.

Conclusion

In the next issue of the *Wise Brain Bulletin* (Vol 1, #6), we'll finish Part Two of this article, and cover:

- The long-term effects of chronic stress
- Perspectives on working with the sympathetic and parasympathetic nervous systems
- Major methods for activating the PNS, including meditation, cultivating positive emotion, and (truly) fiddling with your lips.

Offerings

Rick Hanson, PhD, and Rick Mendius, MD

We've been bowled over by the wonderful interest of many people in the tools for well-being and spiritual depth found in the intersection of psychology, neurology, and the contemplative traditions. So we'd like to let you know how you can learn more about what we call "applied neurodharma" and how it could benefit you and those you touch.

If you live in the San Francisco Bay Area, please consider the weekly meditation group in San Rafael, and also coming to the monthly Train Your Brain class. Outside the area, you can listen to our talks and read all our materials on the www.WiseBrain.org website, plus check out other features, such as interesting news about the brain, or the new pages going up soon on Contemplative Christianity and on neuropsych research with implications for everyday well-being and/or spiritual growth.

Additionally:

1. You might enjoy a short video clip of Rick Hanson talking about the brain on the Starfish Health website, at <http://www.starfishpartners.com/provider/profile/videos.php?providerUId=175&clipUId=19>

2. We will be teaching two daylong workshops at Spirit Rock Meditation Center in 2007, and you can go to www.SpiritRock.org for information and to register:

- August 11 - *The Neurodharma of Love: Using Brain Science and Buddhist Wisdom to Illuminate the Heart of Important Relationships* – Through integrating profound contemplative teachings about healthy relationships with current neurological research, we intend to offer practical tools for activating the brain states underlying wholesome mind states of empathy, compassion, and lovingkindness. Additionally, we'll explore ways to preserve your equanimity in rough-and-tumble relationships, and to ride (gracefully) the roller-coaster of romance, sexual desire, and the long-term shift to a calmer love.

- November 10 – *On One Wing and Two Prayers: Practicing with a Wounded Brain* – This will be taught with James Baraz, a founding teacher of Spirit Rock and the source of the fantastic Awakening Joy course. It is for people interested in well-being and contemplative depth who are also grappling with depression, significant anxiety (or trauma), ADD/ADHD, head injury, or dementia – and for caregivers who work with them.

3. On September 8, we will do a small "dress rehearsal" of what will become an annual, inter-faith conference – working title: "This Is Your Brain on God" – applying neuropsychology to the similarities and differences in contemplative practice in Buddhism, Christianity, Judaism, Islam, Hinduism, and shamanism. We'll use the dress rehearsal (and maybe another one) to plan the first official conference, scheduled for the Fall, 2008, in partnership with major institutions. The principal organizer of the conference is Dr. Andrew Dreitcer, a professor at the Claremont School of Theology and the Graduate University.

4. On October 6, with Christina Feldman – a senior Vipassana teacher and a wonderful person – we'll present a workshop on deepening equanimity from psychological, neurological, and dharma perspectives. Yes, equanimity is definitely not a sexy topic. But it is a profound one, at the heart of both handling painful experiences and liberating the mind from clinging. Please let us know if you're interested in this subject, and we will keep you posted with the details.

5. On Thursday evening, October 25, we will be presenters at the annual 108 Blessings fund-raiser for the Spirit Rock scholarship fund. We feel very humbled by this honor, and we encourage you to come to this event and support this worthy cause; more information will be available on the Spirit Rock website.

6. On October 26, we will be presenting a daylong workshop on "The NonDual Brain" at the Conference on Nondual Wisdom and Psychotherapy, which is co-sponsored by The Center for Timeless Wisdom, the California Institute of Integral Studies (CIIS), and other organizations. Continuing ed units will be offered, and you can register by contacting CIIS. While there will be a focus on using nondual brain tools in caregiving settings, this workshop is appropriate for anyone.

7. Probably, in 2008 and at Spirit Rock, we will co-lead the Neurodharma of Love workshop with Sylvia Boorstein. Sylvia, as you may know is quite extraordinary – sort of a cross between a Jewish grandmother and the Dalai Lama – and this workshop is likely to be quite remarkable. We'll let you know the date when it's solid.

When You're Feeling Strong

Rick Mendius, MD

All of us have had the experience of feeling strong: that sense inside of being energized, determined, and even powerful. For example, you might take a moment to recall one or more experiences you've had of feeling strong in situations like these:

- You realize you have a ton of work to do over the next several days, and you take a big breath and put your shoulder to the wheel (figuratively) and just plow forward.
- You stick up for a person or cause (e.g., you are firm with an emergency room clerk about getting a doctor to see your child immediately)
- You assert yourself with someone who's hassling you.

• You're caught in a physically tough situation – perhaps driving long distance through a storm, swimming in the ocean when the surf suddenly gets rougher, or hiking in the mountains a long way from your car as night falls – and just bear down and fight your way through it.

What could be going on in your nervous and endocrine (hormone) systems at these times? There isn't a lot of data about the physiology of these complex positive states – and generally more data about negative conditions – but we can speculate a little, given what we know.

For starters, feeling strong has several core features:

- A sense of knowing where you are and what faces you
- A conscious intention to survive, succeed, prevail; a related plan, even if only for the first step (e.g., make a To Do list, float for awhile on the waves to rest up for the swim to shore)
- An energized activation of the fight-or-flight, sympathetic wing of the autonomic nervous system
- Mental representations of yourself as capable and related recollections of feeling strong, often linked to specific experiences (e.g., just before needing to make an important presentation you recall successful speeches at Toastmasters)
- An overall coherence or integration; all systems are go, working together

Each of these has its own neurophysiology (though, in the extraordinary network of the brain, this is a simplified explanation of processes that interact dynamically with each other, and which occur in many ways simultaneously, not sequentially):

- Knowing where you are and what faces you – This begins with an initial orienting response in the attention circuitry of the brain (which particularly draws upon the prefrontal cortex and the cingulate gyrus). The verbal equivalent of this could be something like: "Holy moly, I'm in deep doo-doo and better get to work!"



That orienting response sends out a cascade of signals which alerts and sensitizes the rest of the brain to the demands of the situation, creating a general state of readiness to deal with what's happening. For example, motor sequences and other action plans related to the initial perception of the situation start "warming up." Those circuits and their associated thoughts and feelings often shape the direction of the processing that follows, sometimes helping it "cut to the chase" and sometimes prematurely sending it down blind alleys . . . or over cliffs.

As the milliseconds tick by, there is a crystallizing awareness of "self and world," of where you are and what you're facing. This usually has a lot of sensory material in it, even when you are dealing with a rather abstract matter, such as needing to figure out how to structure a messy piece of writing (I know about that first-hand!). The parietal lobes, located to the sides and the back of the cerebral hemispheres, represent the location of the body in space and its boundaries (i.e., "where" "you" are). They also handle the sensory representations of your situation, including the visual aspects of the orienting response (most of the rest of visual processing is handled by the occipital lobe in the back of your head).

Last, there is a selective attention. The neurological circuits that address the type of situation you are facing are becoming increasingly sensitized to inputs (this is the neurochemical operationalization of "attention"), while the ones that deal with different situations could have their activities relatively suppressed. In terms of conscious experience, this could mean downplaying or ignoring extraneous information, including your own pain or discomfort.

- Conscious intentions and plans – The frontal lobes produce your intentions, which are then represented in multiple ways by the brain. For example, the right side of the frontal lobes forms visual representations of your goals (e.g., standing safely on the sand of the shore). The language centers in the left frontal lobes put your intentions into words, often murmured in the background of conscious awareness (e.g., "No way." "Keep going." "Don't push my kid around." "Basta!"). The parietal lobes provide the sense of what goal-attainment will feel like, plus the subtly powerful physical sensations associated with frontal lobe representations of resolve, determination, and commitment.

In terms of plans, the frontal lobes deal with general considerations, strategic principles, values, rules of thumb, etc. that shape your plans. Additionally,

the frontal lobes plus the parietal lobes, cerebellum, hippocampi, and basal ganglia store and develop specific plans of action, whose architecture ranges from very specific motor acts – such as leaning forward toward your keyboard to begin plowing through a major backlog of emails – to assemblages of sub-routines containing complex sequences like skiing down a black diamond run in a snowstorm without breaking your leg.

These intentions and plans need to have a sense of realism to them, or they will be undermined by a nagging, anxious sense that you're fooling yourself. In other words, the skills they call for need not be completely overlearned, but they should be within the competency range of your experience. The internal evaluation of that fact then translates into a kind of "good to go, cleared for take-off" feeling.

- Energized activation – In the emotional centers of the brain, the amygdalae (there are two of these almond-shaped nodes) code for positive states such as excitement as well as for negative ones like fear and anger. Signals from the amygdalae trigger an overall sympathetic system activation. As Rick Hanson's article above describes, that entails a surge of norepinephrine in the brain that increases alertness and responsiveness, an increased heart rate and blood pressure, and releases of "stress hormones" such as adrenaline and cortisol. There's also typically increased oxygenation; notice how you take a deeper breath just before you begin something that's

Words of Wisdom

"Raising a teenager is like nailing Jello to the wall."

Anonymous

People are not disturbed by events, but by the views they take of them.

Epictetus

Keep a green bough in your heart,
and a singing bird will come.

Lao Tzu

Positive emotions . . . produce flourishing. They do so not simply within the present, pleasant moment but over the long term as well. The take-home message is that positive emotions are worth cultivating, not just as end states in themselves but also as a means to achieving psychological growth and improved well-being over time.

Barbara L. Frederickson, PhD in *American Psychologist*

Life is fragile, like the dew hanging delicately on the grass, crystal drops that will be carried away on the first morning breeze.

Dilgo Khyentse Rinpoche

difficult, like a weightlifter about to heave a record-breaking barbell.

The sympathetic activation should be moderate in the everyday situations that are the focus of this article (distinct from intense, do-or-die crises). It's interesting that the sense of "feeling strong" – especially when it is sustained over time – often has a relaxed and emotionally positive quality to it, which means that some parasympathetic nervous system activation is probably present as well. Further, if your efforts start being successful, the recognition of that could activate the internal reward circuitry of the brain, which relies heavily on the energizing neurotransmitter, dopamine, which is (no surprise) released in quantity by drugs like cocaine.

Moderate anxiety (also intertwined with sympathetic arousal) may arise alongside the sense of strength, but it is a separate matter. Further, excessive anxiety – such as panic or terror or dread – has effects that undermine the sense of strength, including paralysis or freezing, numbing, dissociating, or disorganizing; think Hamlet at the bridge, caught in immobilizing ambivalence. (The Letting Go article on our website covers ways to release disabling or uncomfortable anxiety.)

In the muscles, including those of the viscera (the "gut"), increased blood flows triggered by the sympathetic system improve muscle tone, which then feeds back to the brain signals of – literally – strength and vitality. This gut feeling is actually represented deep within your brain, in the insular cortex, located inside the Sylvian fissure that separates the frontal and temporal lobes.

- Representations of self – When you are feeling strong, there is an associated representation of "self" as substantial, as big, vis a vis the task at hand. To put that graphically, the circle representing self must not be dwarfed by the circle representing "world" or "the problem." That's one reason why it is effective to break problems (or world) down into parts, and then focus on tackling each part, one step at a time; then the scale of the problem is more "self-sized."

At the same time, the memory and emotional systems of your brain could call up a sense of others being with you, being

supportive, encouraging, inspiring, etc. Humans are social animals, so it's natural to derive much of what we might think of as personal strength from our relationships with others. These "evoked others," to use Daniel Stern's phrase, are crucial to normal child development and a sign of secure attachment. And as an adult, you might notice a subtle remembrance of supportive individuals when you face something difficult. For some people, this sense of evoked supportive others is a particularly important aspect of the feeling of strength; as a generalization with many exceptions, it's probably more prevalent among women compared to men, and in some cultures compared to others.

Accompanying these self-world representations – in psychology, called "object relations" – the temporal lobes will both be remembering past successes and setting the emotional tone of the moment, which support self-confidence. As noted above, overcoming challenges feels good in the present (= pleasure centers tickled by dopamine), and so does remembering past successes. Those emotional residues of previous times of successful strength are a vital resource for resilience and coping right now.

That's why it is important to consciously "take in the good" – one of the five essential inner skills – when you manage difficult things in your life today. And if you really want to help yourself, you could repeatedly call to mind a sense of strength, have that experience swell in your mind (and thus activate millions of neurons), and then intend and sense that it's sinking deeply into you (thus getting stored in emotional memory and increasing your predisposition toward feeling strong).

- Overall coherence – As the research of Wolf Singer and others has shown, there's an overall resonance and coherence that is system-wide in the brain where we make a decision, such as resolving to face a challenge. More broadly, all of your neurologically structures are working in concert and in readiness to act, with internal reward systems of neurotransmitters and hormones activated and "humming" along.

This seems to be a picture of how the brain would be when it's feeling "strong."



Food Allergies and the Nervous System

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Food allergies – often called food sensitivities – can have chronic, low grade effects on people. Not something acute and intense like anaphylactic shock or hives, but chronic, milder symptoms, such as: reduced concentration, irritability, gastro-intestinal distress, fatigue, restlessness, skin irritation, and other maladies. It's also possible that food sensitivities can predispose a person to develop an autoimmune disorder through continually reactivating and sensitizing the immune system.

We have food sensitivities because for various reasons the immune system in the body labels certain food molecules as “foreign invaders” to be attacked and repelled by antibodies, white blood cells, and other guardians at the gates. That leads to inflammation, which is a whole body process; in other words, if your gastrointestinal tract has inflamed as a reaction to a particular food, that inflammatory process can spread to your joints, throat and nose, and other parts of your body.

The foods that most commonly trigger an immune system reaction are the ones that humans have had the least time to adapt to during our evolutionary history, namely those that come from grains and milk. Eggs and (alas) chocolate also sometimes lead to reactions. Paradoxically, people often crave the foods that are the worst for them.

Children are particularly affected by food sensitivities, and if a child seems unaccountably mopey, irritable, spacey, or underperforming in school – sometimes with dark circles under the eyes, or intermittent runny nose, or frequent ear infections – then you might want to look into food sensitivities as a possibly contributing factor.

Although there are now fairly good blood tests for food sensitivities, you can also assess yourself informally through a “pulse test,” which naturopaths have been using for many years. It's really simple to do:

1. Before eating, relax for a minute or so, and then take your pulse. To detect your heartbeat, perhaps the best way is to place your fingers on the side of your throat, up close to the edge of your jaw, and find the pulsing there. Get a watch or clock with a second hand, and count the beats for 15 seconds, and then multiply by 4.

2. Eat a significant serving of the food in question. In other words, if you are wondering about milk, drink a large glass of it or have several large slices of cheese. The best time to do this is in the morning, before you have eaten anything else, so your stomach is more of a “blank slate.”

3. 15 minutes after you are done eating, relax again and re-take your pulse. Repeat 15 minutes later (30 minutes after the end of your meal).

If your pulse has increased by 10 or more beats per minute, that's a pretty good sign that your body was reacting negatively to that particular food.

My recommendation is to stay away from the foods that your body reacts to in this way. If you find that you react to many, even all, foods with a significantly elevated heart rate, it is likely a sign of generalized distress in your digestive system, and you should definitely speak with a licensed healthcare provider about that.

Stepping back and looking at the big picture, it is interesting to note that if your heartbeat increases after eating certain foods, it is a sign that your sympathetic nervous system is activated. In other words, food sensitivities are stressful! And finding a diet that is right for your particular biochemistry is going to help you to stay more grounded in the parasympathetic nervous system. Eating in harmony with your own type of body, responding to what it considers to be friend or foe, is a nice way each day to help yourself stay “relaxed and contented.”



Fare Well

May you and all beings be happy, loving, effective, and wise.