

**Introducing the
“Triune Autonomic Nervous System”
and
Stephen Porges’
“Polyvagal Theory”**

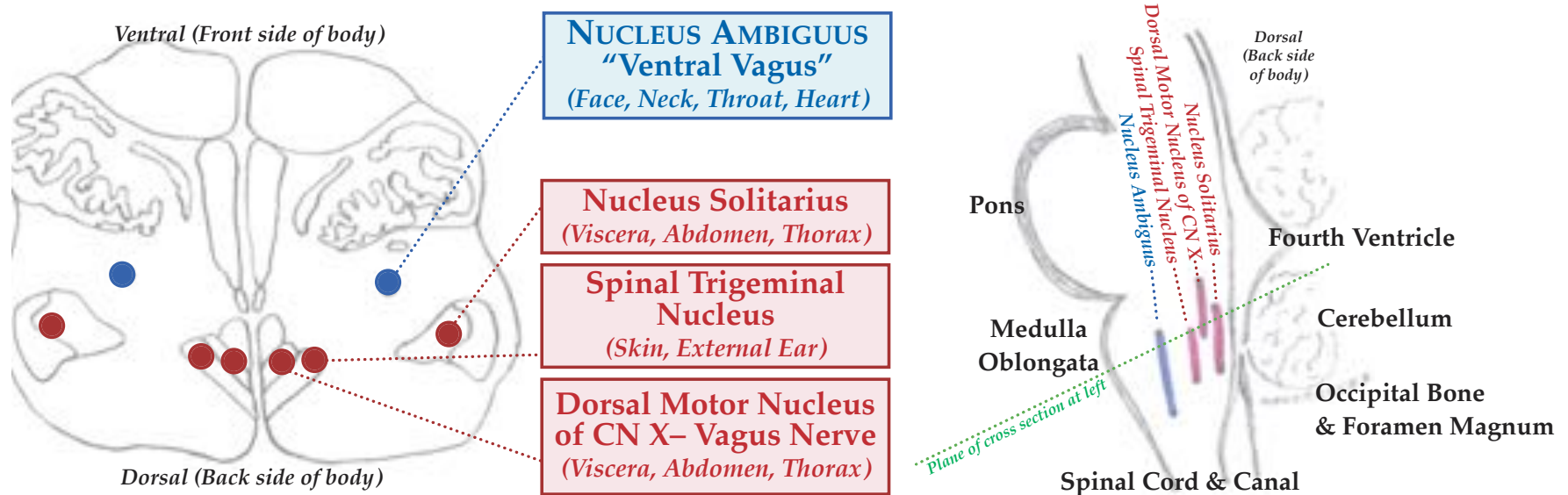
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Stephen Porges & The Origin of the Term “Polyvagal”



“Three neural circuits form a phylogenetically ordered response hierarchy that regulates behavioral and physiological adaptation to safe, dangerous and life-threatening environments.” –Stephen Porges, Polyvagal Theory

“POLYVAGAL”– FOUR NUCLEI OF THE VAGUS NERVE IN THE BRAIN STEM



Polyvagal Theory Evidence #1

Rescuing Hug

This is a picture from an article called "The Rescuing Hug". The article details the first week of life of a set of twins. Apparently, each were in their respective incubators, and one was not expected to live. A hospital nurse fought against the hospital rules and placed the babies in one incubator. When they were placed together, the healthier of the two threw an arm over her sister in an endearing embrace. The smaller baby's heart rate stabilized and her temperature rose to normal.



Polyvagal Theory Evidence #2: Roots of Empathy Program

Founded in 1996, this Canadian program brings young babies and their moms into K-8 classrooms. In 2006 there were 2,000 programs involving 50,000 children. Behavioral problems disappear, test scores go up, and teachers report numerous peripheral benefits. The Dalai Lama has recognized and endorsed the program. See www.rootsofempathy.org



Research projects that have been generated to document benefits from the program:

- Emotional Literacy
- Neuroscience interest
- Temperament
- Curriculum Connection
- Participatory Democracy
- Infant Development interest
- Violence Prevention
- Perspective taking
- Prevention of Teen Pregnancy
- Attachment
- Male Nurturance
- Inclusion
- Infant Safety

Polyvagal Theory Evidence

#3: Therapy Dogs

Numerous studies show that children learn to read more effectively when accompanied by friendly pets, and a small industry is arising to take advantage of the findings.

Similarly, “therapy dogs” have been used effectively in skilled care and similar facilities to reduce anxiety and speed recovery.

Theoretically, being in the presence of a friendly ally shifts the autonomic nervous system back into its natural range of function.



14 NEWSWEEK DECEMBER 11, 2006

Periscope

EDUCATION

A Reader's Best Friend

and Connor has an audience he feels comfortable reading to.

Ruby is one of 16,000 certified therapy dogs participating in reading-assistance programs at schools and libraries across the country, as educators have begun tapping into the calming effect dogs have on us. “He curls up with [the kids] and they read him a story,” says Louisville, Ky., instructor Mary Roberts of a Welsh corgi named Zoom, who is calming worried readers at New Castle Elementary. “You can just see their anxiety disappear.”

As word spreads and test scores improve, requests for visits from therapy dogs have been pouring in. “We get calls every day,” says Ursula Kemp, president of New Jersey’s Therapy Dogs International. Utah-based Intermountain Therapy Animals has close to 1,300 dogs registered in its reading-assistance program, now in 48 states and Canada. That calls for a treat!

—MATTHEW PHILIPS

With a dog’s ear, kids learn to read

A MONTH AGO, 8-year-old Connor Schultz could read 45 words a minute. Today he’s up to 93. The reason? A 4-year-old longhaired dachshund named Ruby who, once a week, visits Connor’s school in Schenectady, N.Y., and sits with him while he reads aloud. She doesn’t judge or correct him,

Phylogeny of Heart Regulation in Vertebrates

Stephen Porges, *The Polyvagal Theory: Phylogenetic Substrates of a Social Nervous System*, Int'l Journal of Psychophysiology 42 (2001) 123-146, 2000.

Key: Arrows indicate the presence of heart regulating functions. **↑** means faster heart rate and **↓** means slower heart rate. Colors indicate which autonomic branch is deployed:
RED means Parasympathetic, **GOLD** means Sympathetic, **BLUE** means Social

DEFINITION OF PHYLOGENY (American Heritage Dictionary) 1. The evolutionary development and history of a species or higher taxonomic grouping of organisms.	MECHANISMS OF HEART REGULATION				
	Chromatin Tissue (CHR*)	Dorsal Motor Nucleus of CN X (DMX)	Sympathetic Nervous System	Adrenal Medulla (Produces Catecholemines)	Nucleus Ambiguus (Ventral motor nucleus of CN X)
Cyclostomes- Jawless fish (Lampreys)	↑				
Elasmobranchs- Cartilaginous fish (Sharks)	↑	↓			
Teleosts (Bony fish)	↑	↓	↑		
Amphibians	↑	↓	↑		
Reptiles	↑	↓	↑	↑	
Mammals	↑	↓	↑	↑	↓

MORE MODERN

* CHR- Chromatin: Non-neural tissue that stimulates the heart by releasing noradrenergic amines directly into blood in the heart.



Note that the Dorsal Motor Nucleus and Ventral Vagus are both slowing the heart, making them easily confused, but they are actually quite distinct, anatomically and phylogenically!

The Polyvagal Theory • Stephen Porges

“Three neural circuits form a phylogenically ordered response hierarchy that regulates behavioral and physiological adaptation to safe, dangerous and life-threatening environments.”
–Stephen Porges, *Polyvagal Theory* (Norton, 2011)

Parasympathetic (most ancient)

“A primitive passive feeding and reproduction system creating a metabolic baseline of operation to manage oxygen and nourishment via the blood.”

Sympathetic (newer)

“A more sophisticated set of responses enabling mobility for feeding, defense and reproduction via limbs & muscles.”

Social Engagement (most modern)

“A sophisticated set of responses supporting massive cortical development—enabling maternal bonding (extended protection of vulnerable immature cortex processors) and social cooperation (language and social structures) via facial functions.”

Initial Applications of the Triune ANS Concept

- **Support the Social Nervous System:** With this understanding, the protection and support of the newest and most powerful ANS division, the Social Engagement System, is anatomically and physiologically confirmed as a top priority in health treatments and child care.
- **Emphasize interpersonal rapport:** In health care and educational settings, feelings of social warmth will optimize inner autonomic processes for maximum immune system performance, self-healing efficiency and learning capacity.
- **Focus on Betrayal Trauma:** Traumas involving betrayal (overwhelmingly painful actions from a trusted person) are known to have particularly deep effect. Recognition of the Social Nervous System explains these effects. In betrayal PTSD the highest and most modern ANS function (Social) is damaged at a sub-conscious, implicit memory level, with long-lasting, but reversible, effects on wellness and resilience

Anatomy of the Triune Autonomic Nervous System

The ANS is commonly defined as the part of the nervous system that is involuntary and maintains essential functional balance. The ANS is usually divided into two complementary branches, sympathetic and parasympathetic.

In the new triune theory, a third set of mainly involuntary survival functions is identified and described.

This new theory recognizes an additional nerve group because its actions are also involuntary and critical for survival. In addition to being a dual reciprocal action between Sympathetic and Parasympathetic, the ANS now becomes triune and sequential, with a regulatory hierarchy from new to old.

Parasympathetic (most ancient)

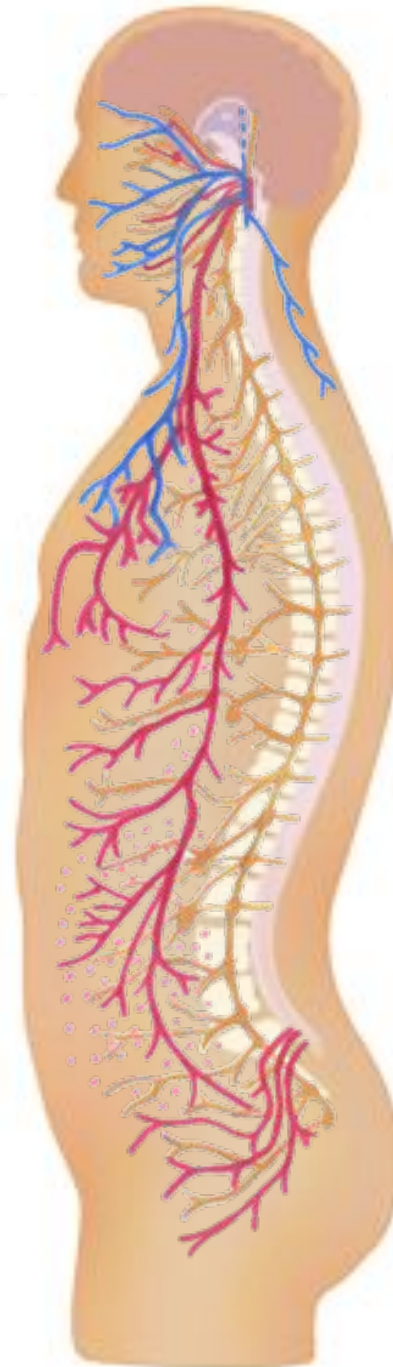
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Parasympathetic: For the torso, CN X (Vagus Nerve–Dorsal Branch); For the pelvis, the Sacral Plexus; For the head, Cranial Nerves III, VII, IX.

These nerves operate baseline survival functions including heart/lungs, digestion and reproduction.

Sympathetic: Sympathetic Trunk plus Cervical, Celiac and Mesenteric Ganglia.

These nerves go to all organs and operate smooth muscles during daytime alertness and mobilization, and fight/flight responses.

Social: Special Efferent pathways within Cranial Nerves V, VII, IX, X- (Vagus Nerve–Ventral Branch), XI; Corticobulbar Tract; also afferent pathways in Vagus.

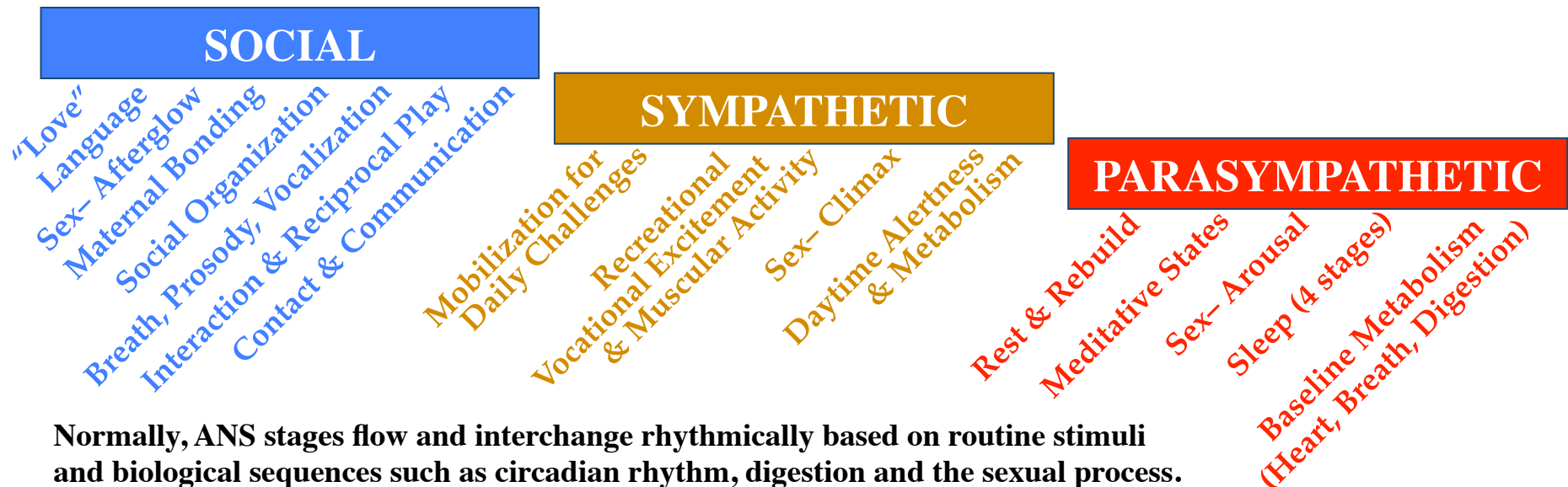
These nerves operate involuntary actions of the face, voice, hearing and related functions. Ventral vagus also affects the heart.

Differentiating Normal ANS Functions from Stress Responses

Although commonly used, “Fight or Flight vs. Rest and Rebuild” is a confusing characterization of Sympathetic and Parasympathetic Branches; Fight/Flight is a stress response whereas Rest/Rebuild is a normal function

A high percentage of health conditions center on the Autonomic Nervous System, including immune system disorders, attention deficit conditions, psychosomatic issues, post-traumatic stress effects and others.

Normal Functions of the ANS



Normally, ANS stages flow and interchange rhythmically based on routine stimuli and biological sequences such as circadian rhythm, digestion and the sexual process. ANS fixation or loss of flow is a sign of PTSD.

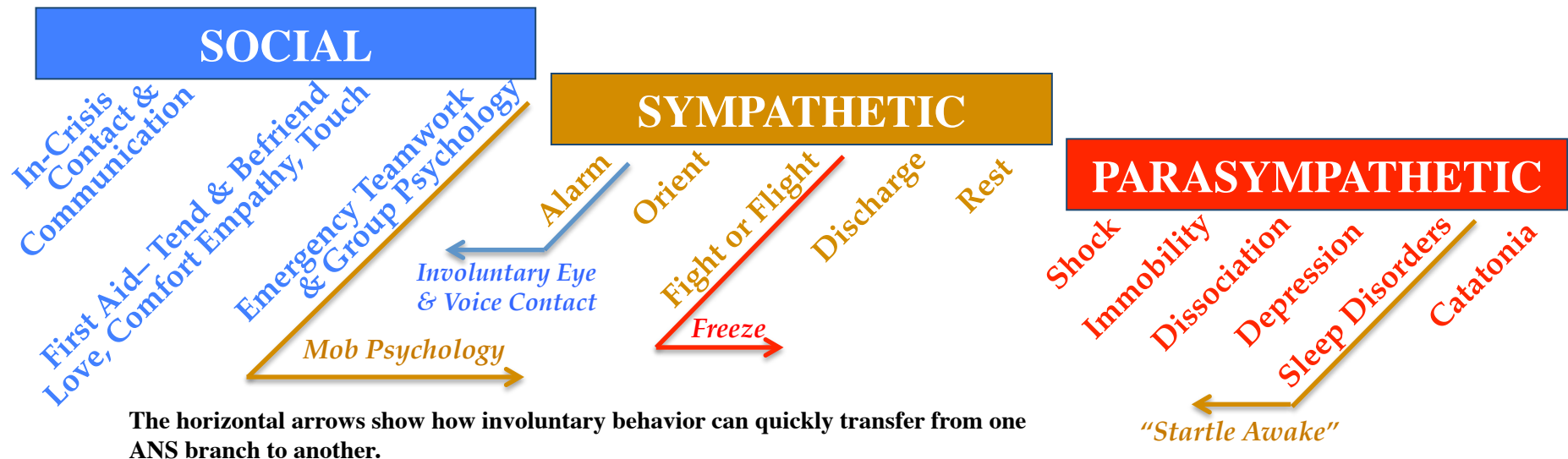
Voluntary and involuntary functions overlap significantly– most of the actions listed here could be either– but they can be identified by close observation. Autonomic responses are immediate and universal across differences of age, gender, education and culture. The conscious mind cannot fully control face and body expressions; the ANS itself seems to be mainly incapable of inauthenticity or deception (Paul Ekman, 2009).

Differentiating Normal ANS Functions from Stress Responses

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The higher nervous system arrangements inhibit (or control) the lower, and thus, when the higher are suddenly rendered functionless, the lower rise in activity. – John Hughlings Jackson (1835-1911), Neurology Pioneer

Stress Responses of the ANS



*In the presence of novelty or threat, we try our phylogenically **newest, best strategy (Social)** first. If that does not work or has not worked in the past, we try our **older, second strategy (Sympathetic)**. If that does not work, we try our **most primitive, last strategy (Parasympathetic)**. If that does not work we are in danger, appearing as immobilization, deep depression or parasympathetic shock.*

Recognizing ANS Phenomena

SNS & PNS Reference: Babette Rothschild, *The Body Remembers* (Norton, 2000), p 48.

SOCIAL

Eye and voice contact
Capacity for empathy & social interaction; Spontaneous feelings in social contexts
Involuntary motor actions of face, mouth, throat
Facial warmth, tingling
Interpersonal responses & awareness; involuntary physical responses to contact with, or memories of, significant people and events.

SYMPATHETIC

Faster respiration
Quicker heart rate (pulse)
Pupil dilation
Pale skin color
Increased sweating
Cold skin (possibly clammy)
Decreased digestion & peristalsis
Mobilization behaviors including anxiety, anger and fear.

PARASYMPATHETIC

Slower, deeper respiration
Slower heart rate (pulse)
Decreased blood pressure
Pupil constriction
Flat affect
Dry skin (usually warm) to touch
Increased digestion & peristalsis
Immobilization behaviors including indecisiveness, seclusion, depression.

Recognizing ANS states has great value in therapy and child care. By accurately identifying the state, the practitioner or parent can apply an appropriate strategy to re-establish ANS equilibrium, especially by supporting the Social Nervous System.

“Body-Low-Slow-Loop” for Sympathetic NS First Aid

- **Body**

- Direct the attention into the body to notice a sensation
- This effectively means present-tense orientation, countering trauma’s past-future tendency

- **Low**

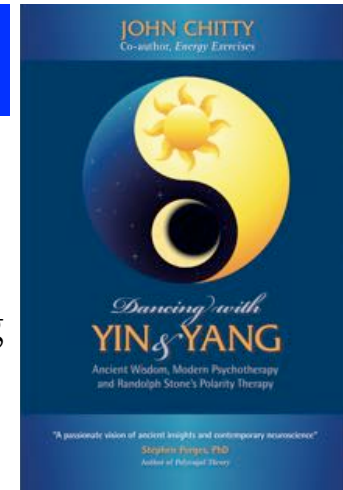
- Direct the attention to the lower border or downward generally
- This effectively counters the upward effect of trauma (alarm & orienting responses)

- **Slow**

- Ask about the details of the sensation
- This effectively slows down the awareness, countering trauma’s tendency to speed things up

- **Loop**

- Direct the attention somewhere else for a minute or so, then back to the first site. Repeat as needed, slowly and gently.
- This effectively re-establishes Polarity movement and counters the trauma’s tendency towards fixation.



See DYY, p. 187; also note three free podcasts on CSES site

