Contrary to the prevailing popular idea, the autonomic nervous system can be more accurately conceptualized as having three branches, not two! The three are phylogenically sequential, reflecting increasing survival effectiveness at each stage.

This presentation briefly summarizes the basic information describing the origin and meaning of the “Polyvagal Theory” developed by Stephen Porges, PhD. For Porges info, start with: http://www.stephenporges.info/index.php?option=com_content&task=view&id=1&Itemid=1

This theory is the subject of Chapter 6 in Dancing with Yin and Yang, by John Chitty. It is also described in Chapter 18 in Franklyn Sills’ Craniosacral Biodynamics, Vol. II. This presentation includes diagrams and anatomical images not contained in that book.

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The Poly-Vagal Theory

The Poly-Vagal Theory is based on several premises. Some are firmly grounded in neurophysiological and neuroanatomical data and others are more speculative. The first premise articulates the neural regulation of bradycardia and RSA. Based upon the initial premise, it is hypothesized that the neurogenic bradycardia associated with the orienting reflex are mediated by DMNX and that the suppression of heart rate variability (i.e., reduced amplitude of RSA) is mediated by NA.

Premise 1: Neurogenic bradycardia do not respond in concert.

Physiological support for the hypothesis that NA is independent of NA, is provided by chronic bilateral lesions of NA and chronic bilateral lesions of NA do not cause bradycardia in conscious rats. However with a response latency associated with NA and with a response latency is associated with NA, Mccabe, & Schneiderman (1993) in rabbits, following sinoatrial block, there is a possibility that vagal pathways may be associated with heart rate.

The Listening Project

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Director, Institute for Child Study
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During the past three years our research team, directed by Dr. Olga Bazhenova, has been testing a new biologically-based intervention that uses acoustic stimulation to enhance social interaction and communication behaviors. Our initial research protocol applied the intervention to children between the ages of three and five who had a diagnosis of autism. We have tested more than 65 children in a double-blind randomized control experimental design. Most children experienced noticeable improvements in social behavior and communication skills immediately following the intervention. The improvements persisted when assessed during a three-month follow-up. The intervention consists of five 45 minute sessions. We believe that although the intervention was initially tested with children diagnosed with autism, it will be useful for other populations with difficulties listening, communicating and organizing social behavior. While our technique shares
The origin of the term “Polyvagal”

Vagus Nerve Nuclei Diagram

Dorsal Motor Nucleus of CN X
Nucleus Solitarius
Nucleus Ambigus
Spinal Trigeminal Nucleus

These are long fibers in the brain stem, at and just above the level of the foramen magnum.

Nervous system highlights:
100 about billion neurons in the body, each one with an average of 10,000 connections to other neurons. Collective length of neurons is about 2 million miles (Siegel, 2004). During peak brain development neurons form at the rate of 500,000 per minute. Meanwhile glial cells and Schwann cells are more numerous and less understood, but obviously vital to NS function. In the second and third trimesters, synapses form at the rate of 2,000,000/second. (National Geographic, 2/05)

Art by Renée Peterson, based on Mosby “Brainstorm” CD
### Phylogeny of Heart Regulation in Vertebrates


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.

<table>
<thead>
<tr>
<th>Mechanisms of Heart Regulation</th>
<th>Chromatin Tissue (CHR*)</th>
<th>Dorsal Motor Nucleus of CN X (DMX)</th>
<th>Sympathetic Nervous System</th>
<th>Adrenal Medulla (Produces Catecholemines)</th>
<th>Nucleus Ambiguus (Ventral motor nucleus of CN X)</th>
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<tr>
<td>Cyclostomes - Jawless fish (Lampreys)</td>
<td>↑</td>
<td></td>
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<tr>
<td>Elasmobranch - Cartilagenous fish (Sharks)</td>
<td>↑</td>
<td>↓</td>
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<tr>
<td>Teleosts - Bony fish (Bony fish)</td>
<td>↑</td>
<td>↓</td>
<td>↑</td>
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<tr>
<td>Amphibians</td>
<td>↑</td>
<td>↓</td>
<td>↑</td>
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<tr>
<td>Reptiles</td>
<td>↑</td>
<td>↓</td>
<td>↑</td>
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<tr>
<td>Mammals</td>
<td>↑</td>
<td>↓</td>
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</tbody>
</table>

* CHR- Chromatin: Non-neural tissue that stimulates the heart by releasing noradrenic amines directly into blood in the heart.
Evolution of the Autonomic Nervous System

“The Ultimate Survival Machine”

Stage One: A primitive passive feeding and reproduction system creating a metabolic baseline of operation to manage oxygen and nutrient-rich blood.

Stage Two: A more sophisticated set of responses enabling mobility for feeding, defense and reproduction via limbs & muscles.

Stage Three: A sophisticated set of responses supporting massive cortical development (i.e., enabling maternal bonding (extended protection of vulnerable immature cortex processors) and social cooperation (language and social structures) via facial functions).

“Three neural circuits form a phylogenically ordered response hierarchy that regulates behavioral and physiological adaptation to safe, dangerous and life-threatening environments.”

-Porges 8/05

Social

Transactions
Social Structures & Hierarchies
Language
Empathy
Contact

Social Engagement occurs via eyes, ears, mouth, voice, touch, facial expression

Sympathetic

Sexual Climax
Recreational & Vocational Excitement
Daytime alertness & muscular activity

Rest & Rebuild
Meditative States
Sleep (4 stages)
Baseline Metabolism (Heart, Breath, Assimilation)

Parasympathetic

Mobilization
Muscular metabolism
Stress Responses of the Autonomic Nervous System

Stage One: A primitive passive feeding and reproduction system creating a metabolic baseline of operation to manage oxygen and nutrient-rich blood.

Stage Two: A more sophisticated set of responses enabling mobility for feeding, defense and reproduction via limbs & muscles.

Stage Three: A sophisticated set of responses supporting massive cortical development (i.e., enabling maternal bonding (extended protection of vulnerable immature cortex processors) and social cooperation (language and social structures) via facial functions).

Parasympathetic Indicators:
- Slower, deeper respiration
- Slower heart rate (pulse)
- Decreased blood pressure
- Pupils constrict
- Flush skin color
- Skin dry (usually warm) to touch
- Digestion & peristalsis increases

States of activation include: rest and relaxation, sexual arousal, happiness, anger, grief, sadness

Neurotransmitters: Serotonin, Dopamine, Endorphin

Sympathetic Indicators:
- Faster respiration
- Quicker heart rate (pulse)
- Pupils dilate
- Pale skin color
- Increased sweating
- Skin cold (possibly clammy)
- Digestion & peristalsis decreases

Activates during positive or negative stress states, including sexual climax, rage, desperation, terror, anxiety/panic, trauma

Neurotransmitters: Oxytocin, Vasopressin

Social Indicators:
- Eye contact
- Voice contact
- Feeling of sympathy
- Sensation of face, mandible, lips & mouth, throat; Warmth, tingling in facial areas
- Temporal bone shapes
- Interpersonal awareness arises- thought of a person, etc. Sense of interpersonal contact via eyes, ears, mouth, arms
- Feeling tones of sadness, wavelike forms uprising
- Upward sensation?

Note: In the sympathetic orient phase, females are predisposed to go to contact, males to fight/flight (Klein, Penn State, quoted by Houston)

Social

Communication
Love, empathy, comfort
Teamwork, Group Action
Group Psychology
Contact
Mob Action

Sympathetic

Alarm
Orient
Fight/Flight
Discharge
Rest
Immobility
Disassociation
Catatonia
“Voodoo Death”

Arrows indicate links between levels by which one response group shifts directly to another

Parasympathetic

Freeze

“Freeze”

Note: In the sympathetic orient phase, females are predisposed to go to contact, males to fight/flight (Klein, Penn State, quoted by Houston)

Sympathetic Indicators:
- Faster respiration
- Quicker heart rate (pulse)
- Pupils dilate
- Pale skin color
- Increased sweating
- Skin cold (possibly clammy)
- Digestion & peristalsis decreases

Activates during positive or negative stress states, including sexual climax, rage, desperation, terror, anxiety/panic, trauma

Neurotransmitters: Cortisol (CRF), Adrenaline, Epinephrine, Noradrenaline & Norepinephrine

Parasympathetic Indicators:
- Slower, deeper respiration
- Slower heart rate (pulse)
- Decreased blood pressure
- Pupils constrict
- Flushed skin color
- Skin dry (usually warm) to touch
- Digestion & peristalsis increases

States of activation include: rest and relaxation, sexual arousal, happiness, anger, grief, sadness

Neurotransmitters: Serotonin, Dopamine, Endorphin
“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)
Father of English Neurology
Quoted by Stephen Porges 11/01

We play our **newest, best card** first, if that doesn’t work (or has not worked in the past as determined by the amygdala), we try our **older, second card**. If that doesn’t work, we play our **oldest, last card**. If that doesn’t work we are in extreme danger of death.
<table>
<thead>
<tr>
<th>Phylogenic Sequence &amp; Autonomic Layer</th>
<th>Function</th>
<th>Anatomy &amp; “Portal”</th>
<th>Experimental Hand Position &amp; Visualization</th>
<th>Client Participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Parasympathetic</td>
<td>Basic supply of nutrient &amp; oxygen-rich blood to brain</td>
<td>Torso, Vagus N.; Cervical-Sacral Plexus</td>
<td>Index finger at Vagus N., view path and torso as one unit of function</td>
<td>Track sensations of “Belly Breathing”</td>
</tr>
<tr>
<td>2 Sympathetic</td>
<td>Mobility for “4 F’s” &amp; more sophisticated survival strategies</td>
<td>Sympathetic chain, five appendages; Thoracic-Lumbar Plexus</td>
<td>Index finger at superior cervical ganglion, view path down to coccyx, up to pineal gland</td>
<td>Flex arm and leg muscles, track subsequent sensation</td>
</tr>
<tr>
<td>3 Social</td>
<td>Bonding to secure extended development time for cerebral cortex</td>
<td>Pharyngeal arches (CNs V, VII, IX, X, XI), corticobulbar tract</td>
<td>Embryological pharyngeal arches, Temporal bone (petrous portion),</td>
<td>Visualize “easy acceptance childhood resource,” track subsequent sensation</td>
</tr>
<tr>
<td>Amygdala</td>
<td>Sorts experience to identify threat based on early imprinting</td>
<td>Bilateral, 1” deep at temples, at the anterior floor of dorsal horn of the lateral ventricles</td>
<td>Light contact at temple, palm above ear to palpate the dorsal horn of the lateral ventricle</td>
<td>Visualize amygdala with feather-light tickle-pull, anteriorly toward frontal cortex</td>
</tr>
</tbody>
</table>

Slide prepared by John Chitty, Colorado School of Energy Studies, www.energyschool.com
In Polarity Therapy, Stone used two-handed above-and-below contacts (light, stimulating or deep touch) on various combinations of these “autonomic x-points” and waited for pulsation in the two contacts to synchronize and shift into a unified coherent rhythm. Results were excellent (clients self-adjusted out of hyper- and hypo- states and chiropractic adjustments lasted longer), but only anecdotal evidence exists and the method remains obscure for several reasons, including inconsistencies in Stone’s own writings.
Parasympathetic 1: Visceral Tube

- The torso of the body may be visualized and palpated as a “single unit of function” incorporating the most primitive survival functions.
- The diaphragm often seems to be a key organizer for the whole autonomic system (Stone, 1948).
- Connective tissue continuity may provide additional access.
PORGES: “A primitive unmyelinated vegetative vagal system that fosters digestion and responds to novelty or threat by reducing cardiac output to protect metabolic resources. Behaviorally, this is associated with immobilization behaviors.”
The Vagus Nerve and Superior Cervical Ganglion may serve as “portals” for interacting with the autonomic nervous system’s parasympathetic and sympathetic levels, respectively.
PORGES:
“A spinal sympathetic nervous system that can increase metabolic output and inhibit the primitive vagal system’s influence on the gut to foster mobilization behaviors necessary for “fight or flight.”

“...with the exception of work by Cannon, which focused on the sympathetic-adrenal system as the physiological substrate of emotion, the presumed neural regulation of affective state has not been investigated…”
PORGES: “Unique to mammals, characterized by a myelinated vagal system that can rapidly regulate cardiac output to foster engagement and disengagement with the environment... [it] fosters early mother-infant interactions and serves as a substrate for the development of complex social behaviors... In addition the mammalian vagal system has an inhibitory effect on sympathetic pathways to the heart and thus promotes calm behavior and prosocial behavior.”

Pharyngeal Arches-5 & 20 weeks

Art by Renee Peterson & John Chitty, based on Larsen, Human Embryology, p. 362
“HPA Axis” (Hypothalamus-Pituitary-Adrenal)

Chart by Franklyn Sills

Slide prepared by John Chitty, Colorado School of Energy Studies, www.energyschool.com
Sympathetic NS First Aid: BLSL

• **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.