



*Attachment
and the
Development
of the
Nervous System*

By Ray Castellino



**Personal thanks to
John Chitty
for his work, time, & discussion
on the work of Stephen Porges,
and to
Allan Schore
for his work, time, and discussion
on the relationship between
human development
and attachment.**

-Ray Castellino

KEY CONTRIBUTORS



Schore:

**Neurobiological Development
for Attachment**

Porges:

**Phylogenetic Development
Polyvagal Theory
Social Nervous System**

Van der Kolk:

**Neurobiology of memory
Implicit and Explicit**

Phylogeny

Gr.

phylon = tribe+
genesis = generation

Phylogeny

**The complete developmental history
of a race or group of animals.**

CONTRIBUTIONS

Schore:

**Attunement and self regulation
are the keys to
attachment and healthy
relationship**

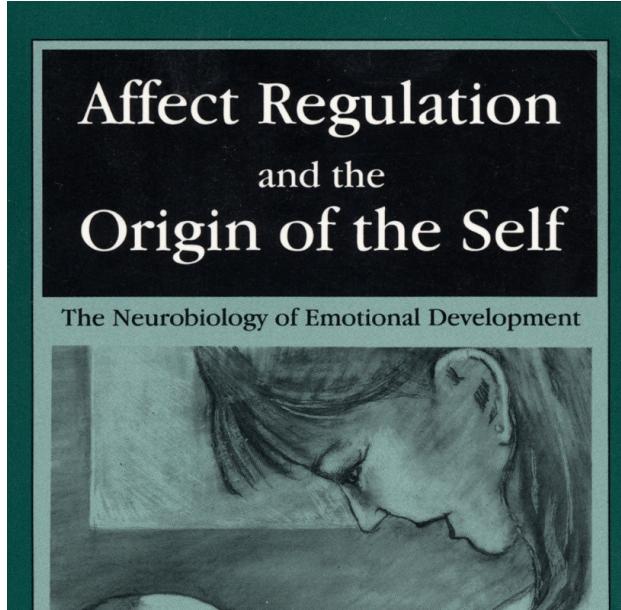
Porges:

**Sound vibration to activate
nervous system areas /
work with autistic children**

Van der Kolk:

**Rebuild the narrative
or coherent story**

**Allan Shore's, Stephen Porges's, Bessel van der Kolk's and other
articles can be found at www.trauma-pages.com**



**EFFECTS OF A SECURE ATTACHMENT
RELATIONSHIP ON RIGHT BRAIN DEVELOPMENT,
AFFECT REGULATION, AND
INFANT MENTAL HEALTH**

ALLAN N. SCHORE
*Department of Psychiatry and Biobehavioral Sciences
University of California at Los Angeles School of Medicine*

ABSTRACT: Over the last ten years the basic knowledge of brain structure and function has vastly expanded, and its incorporation into the developmental sciences is now allowing for more complex and heuristic models of human infancy. In a continuation of this effort, in this two-part work I integrate current interdisciplinary data from attachment studies on dyadic affective communications, neuroscience on the early developing right brain, psychophysiology on stress systems, and psychiatry on psychopathogenesis to provide a deeper understanding of the psychoneurobiological mechanisms that underlie infant mental health. In this article I detail the neurobiology of a secure attachment, an exemplar of adaptive infant mental health, and focus upon the primary caregiver's psychobiological regulation of the infant's maturing limbic system, the brain areas specialized for adapting to a rapidly changing environment. The



International Journal of Psychophysiology 42 (2001) 123–146

INTERNATIONAL
JOURNAL OF
PSYCHOPHYSIOLOGY
www.elsevier.com/locate/ijpsycho

The polyvagal theory: phylogenetic substrates of a social nervous system

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Received 16 October 2000; received in revised form 15 January 2001; accepted 22 January 2001

Abstract

The evolution of the autonomic nervous system provides an organizing principle to interpret the adaptive

THE BODY KEEPS THE SCORE:

Memory and the evolving psychobiology of post traumatic stress

by Bessel van der Kolk

Bessel A. van der Kolk, MD.
Harvard Medical School
HRI Trauma Center
227 Babcock Street
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Jaap van der Wal



THE SPEECH OF THE EMBRYO

A phenomenology
of embryonic existence

Prenate as the
Inner Body

A Child Is Born

Lennart Nilsson

The Completely New Edition

Mother as the
Outer Body

Anatomy Overview

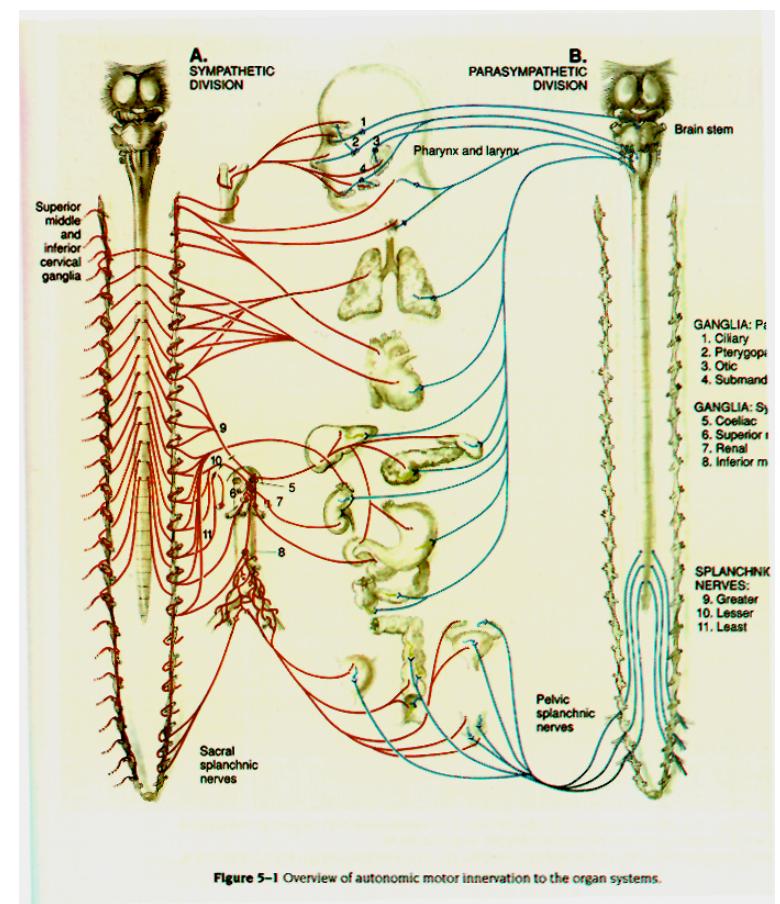
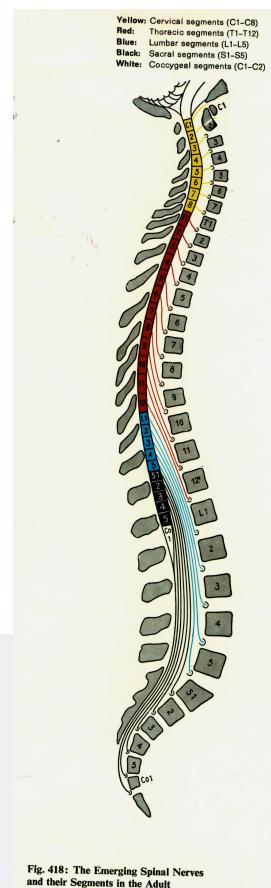
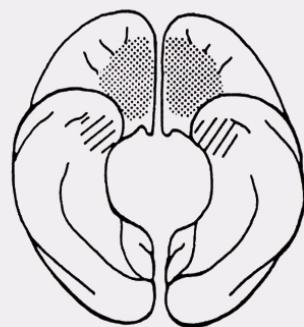
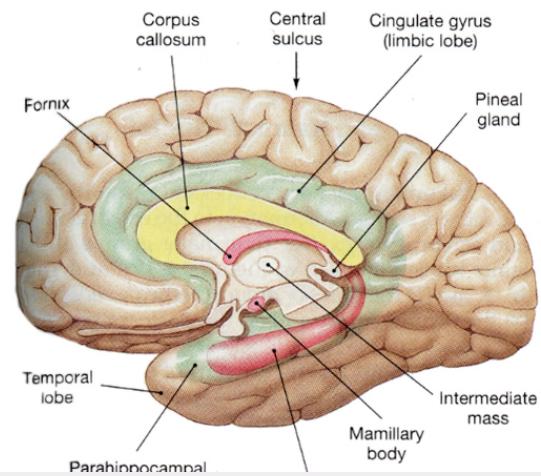
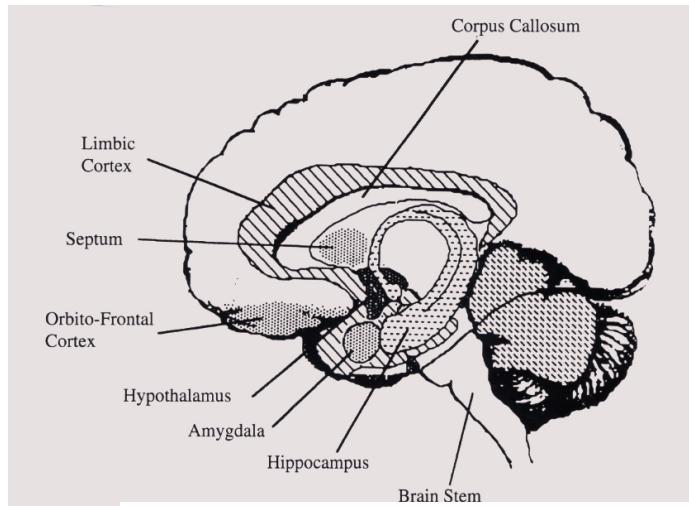
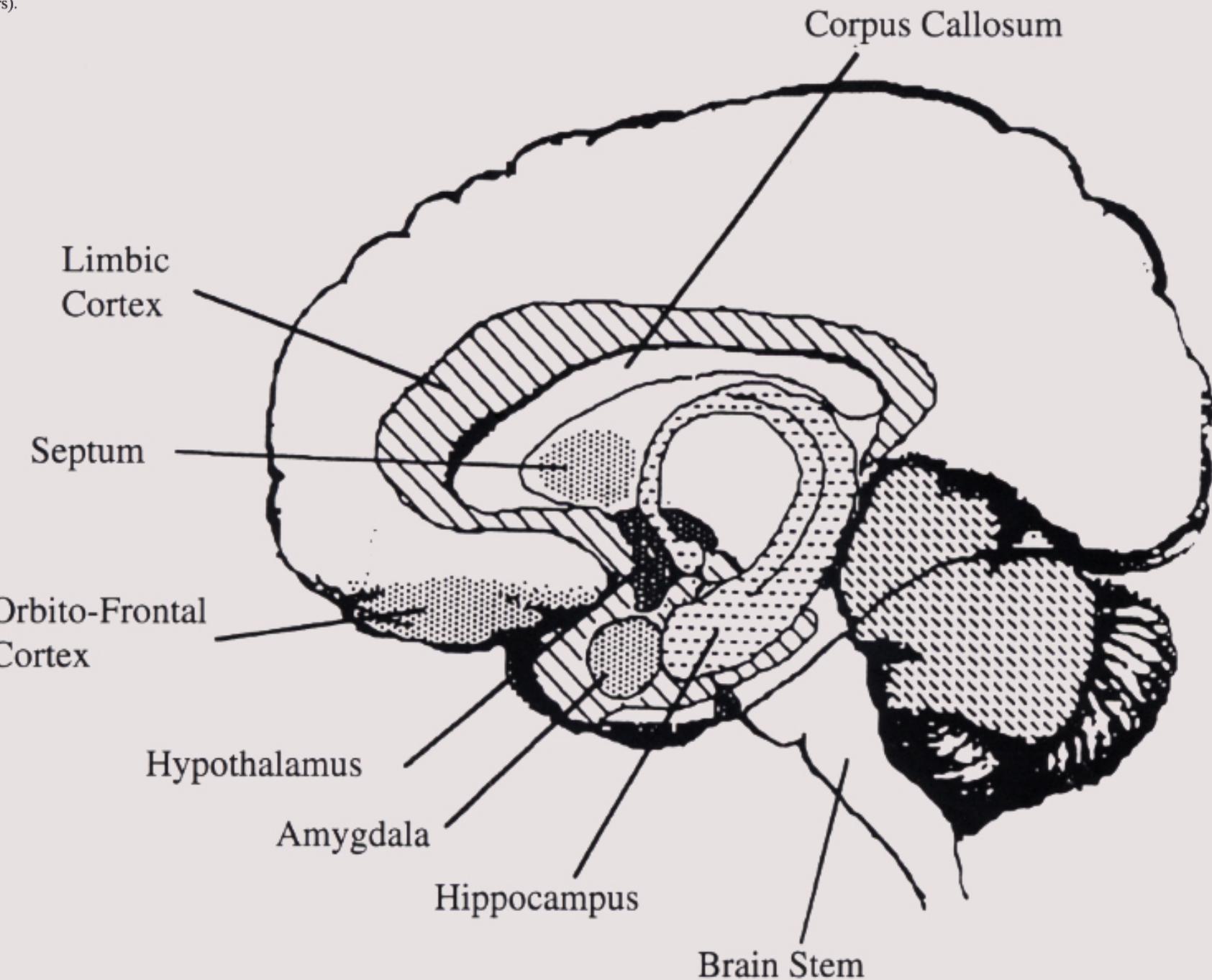
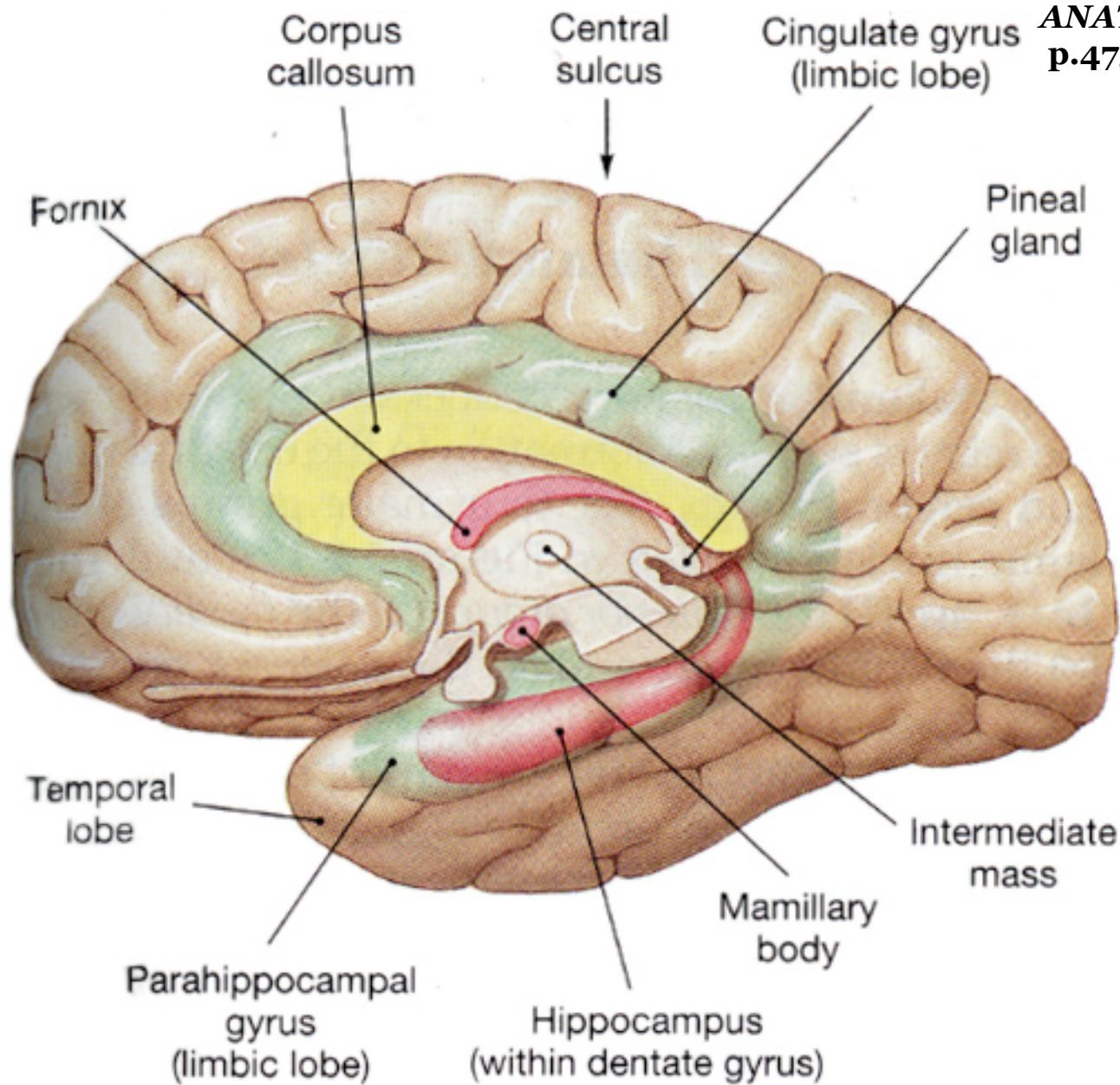


FIGURE 2. Limbic structures of the right hemisphere, lateral view. Cingulate is labeled limbic cortex (from Trevarthen, Aitken, Papoudi, & Roberts, 1998, and used with permission of Jessica Kingsley Publishers).



From: Frederic H. Martini
FUNDAMENTALS OF
ANATOMY & PHYSIOLOGY,
p.475



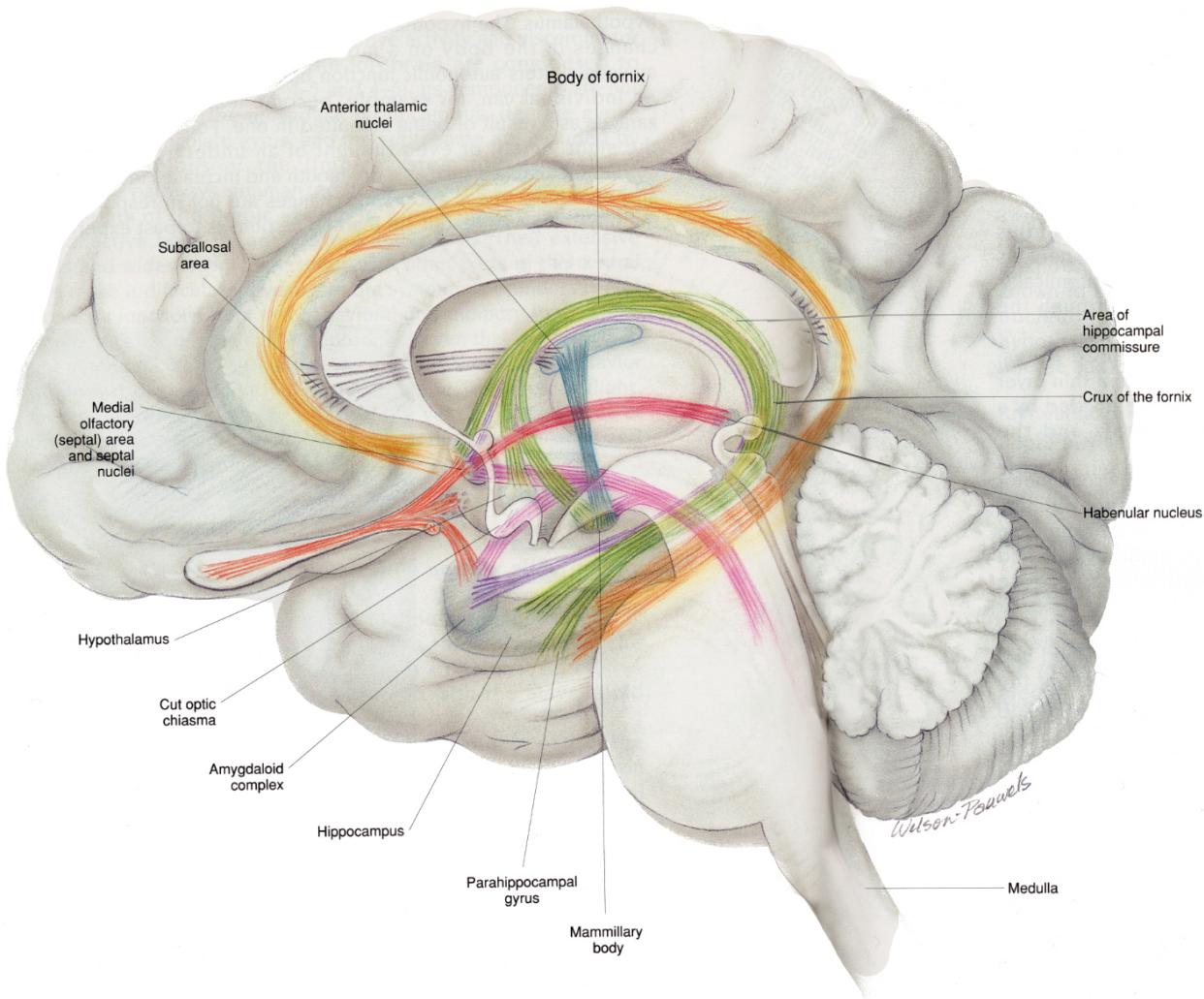


Figure 4–6 Limbic pathways.

❑ **Fornix**

The most prominent pathway between the hippocampal formation and the hypothalamus

❑ **Cingulum**

Interconnects the septal area, the cingulate cortex, and the parahippocampal gyrus

❑ **Medial Forebrain Bundle**

Interconnects the septal area, hypothalamus, and reticular areas of the brain stem

❑ **Stria Medullaris Thalami**

Interconnects the septal area and the habenular nucleus

❑ **Olfactory Tracts and Stria**

Interconnect the olfactory area of the cortex with the septal area and the amygdala

❑ **Mamillothalamic Tract**

Interconnects the anterior thalamic nucleus and the mamillary body

❑ **Stria Terminalis**

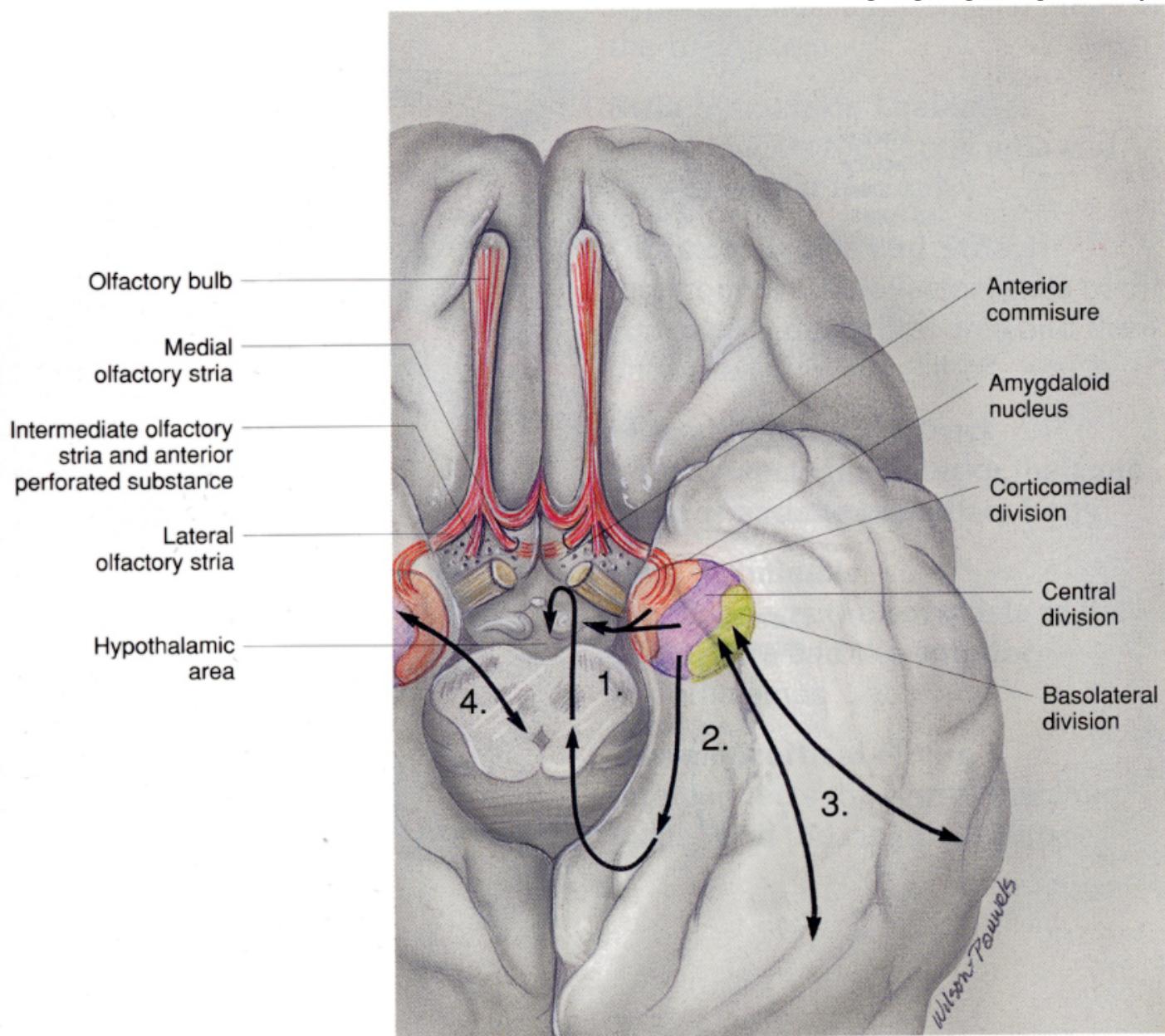
Interconnects the amygdala to the septal area and the anterior hypothalamus

❑ **Thalamocortical Fibers**

Interconnects the dorsal thalamic nuclei with the cingulate gyrus

Limbic System Tracks

From: Wilson-Pauwels, Stewart, Akesson
AUTONOMIC NERVES, p.55



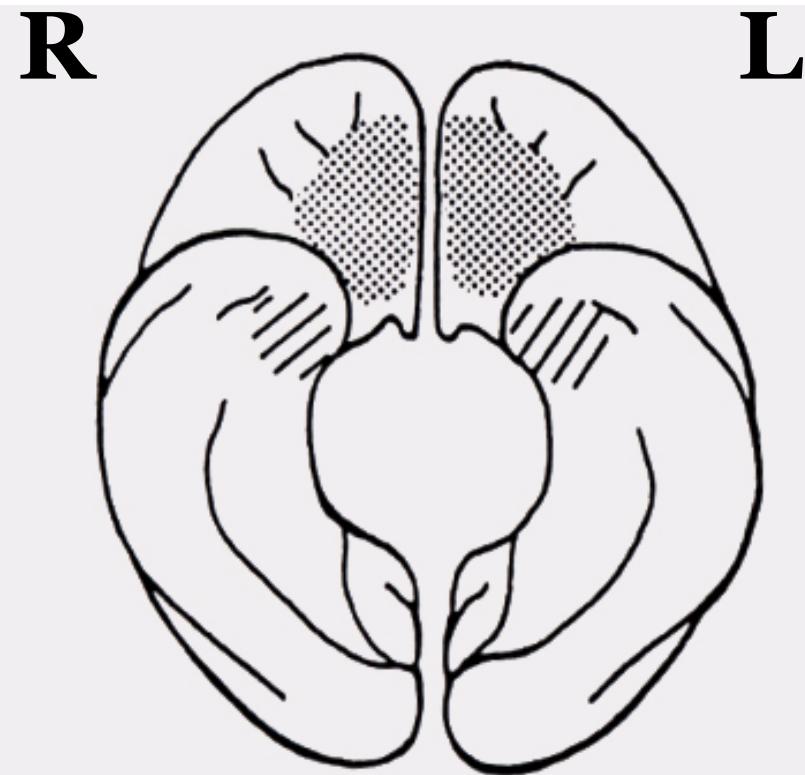


FIGURE 4. Undersurface of the brain. Front of the brain at top. Dotted area: the orbitofrontal cortex. Hatched area: the amygdala (from Baron-Cohen, 1995, and used with permission of the MIT Press).

**From: Wilson-Pauwels, Stewart, Akesson
AUTONOMIC NERVES, p.53**

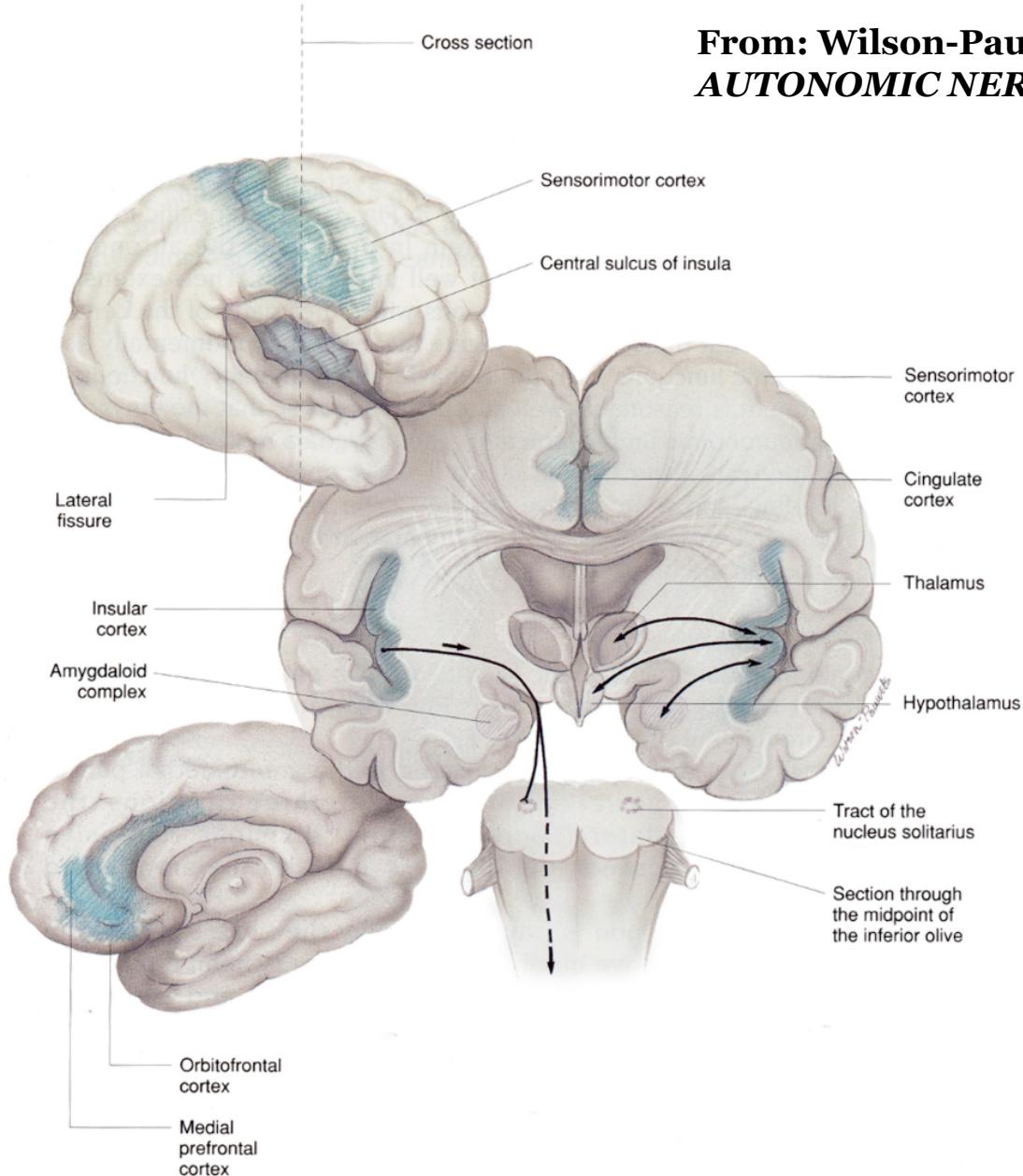
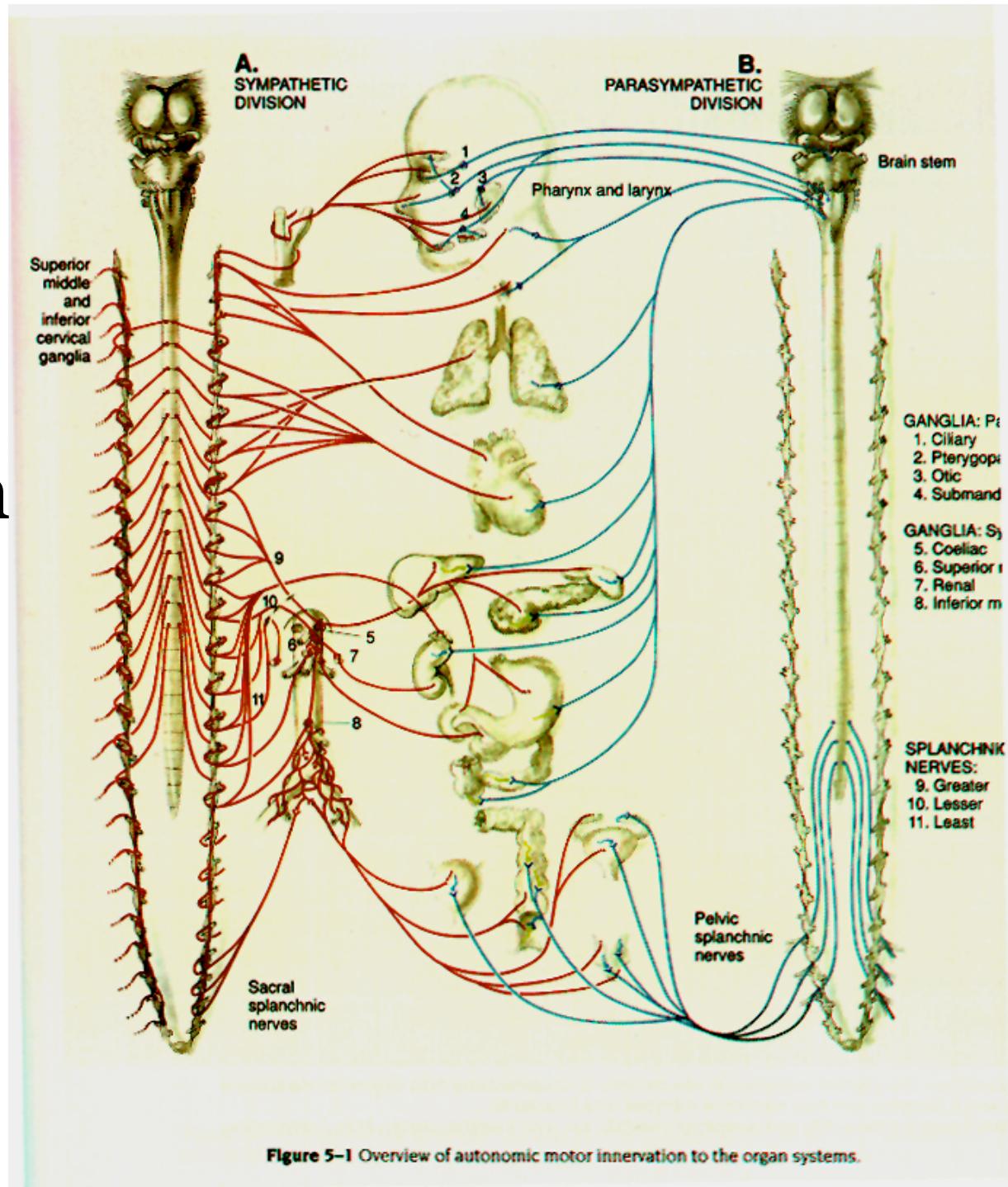
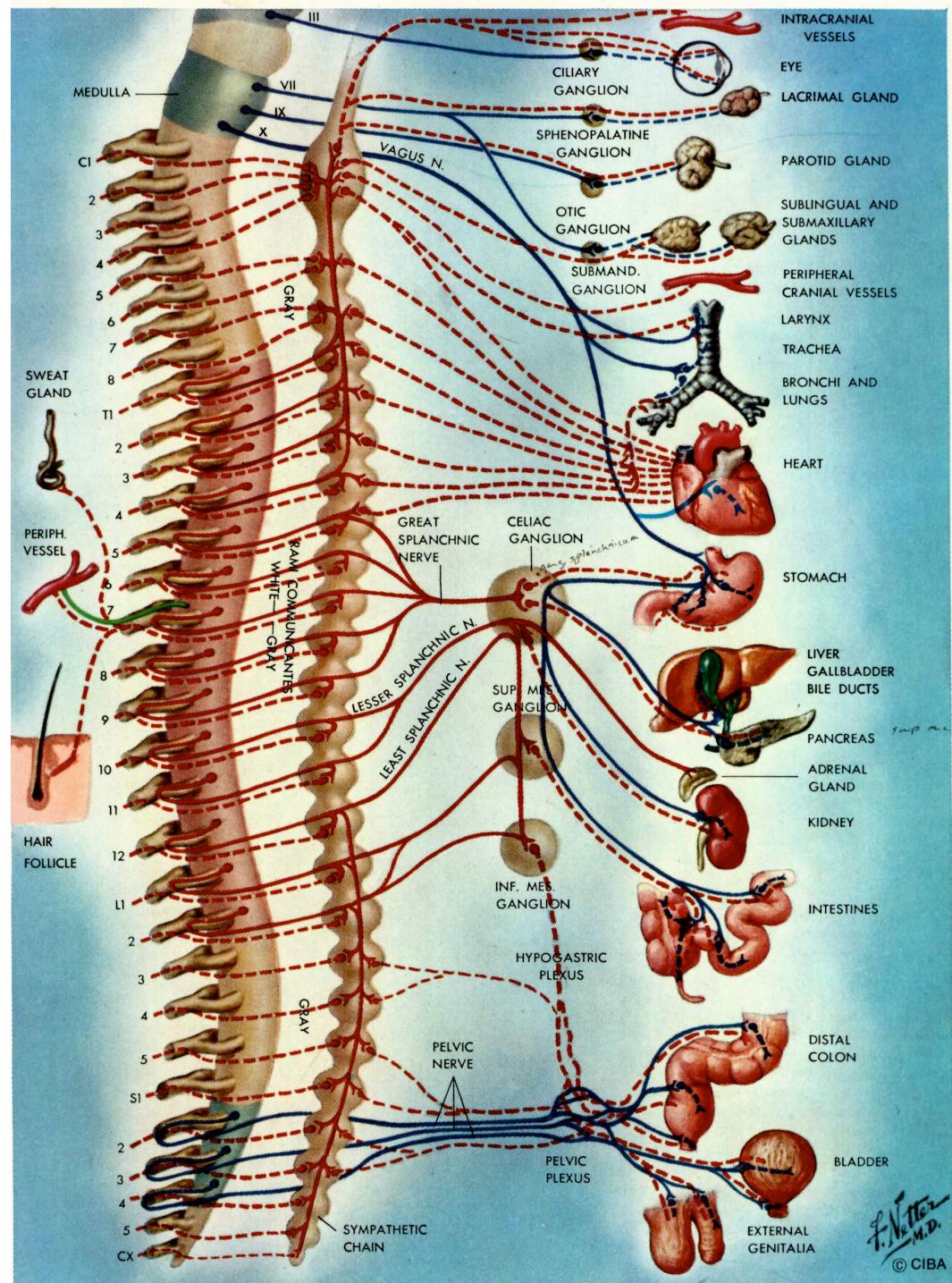


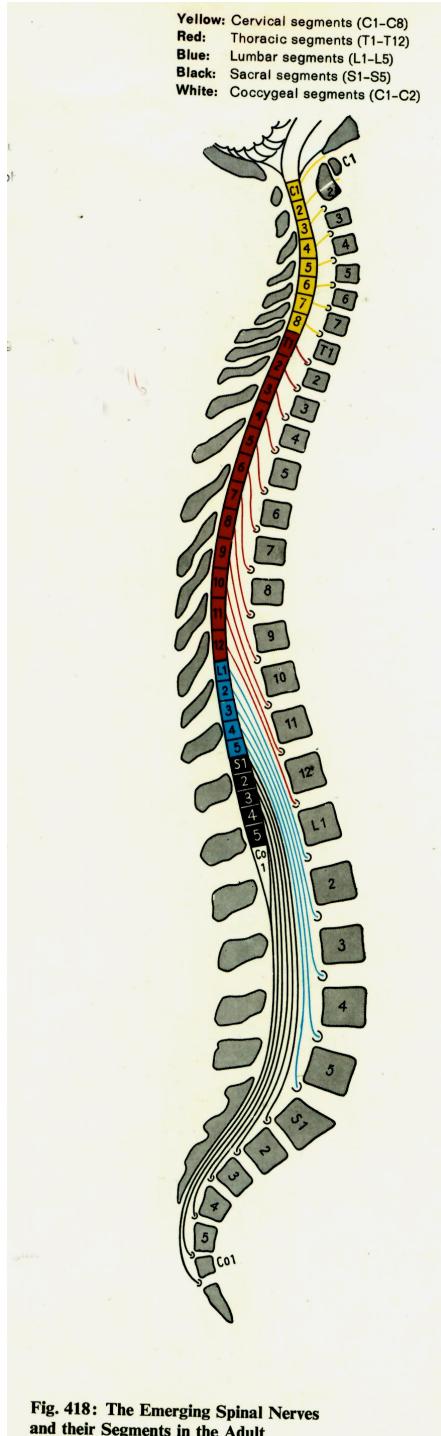
Figure 4-4 The areas of the cortex (insular, medial prefrontal and orbitofrontal, and the sensorimotor cortex indicated in blue) that are thought to play a significant role in autonomic function.

ANS Motor Innervation



ANS Motor & Sensory Innervation





Overview of Spinal Segments

Yellow = Cervical segments (C1- 8)

Red = Thoracic segments (T1-T12)

Blue = Lumbar segments (L1-L5)

Black = Sacral segments (S1-S5)

White = Coccygeal segments (C1-C2)

Overview of the Nervous System

Parasympathetic Nervous System:

Sympathetic Nervous System:

Social Nervous System:

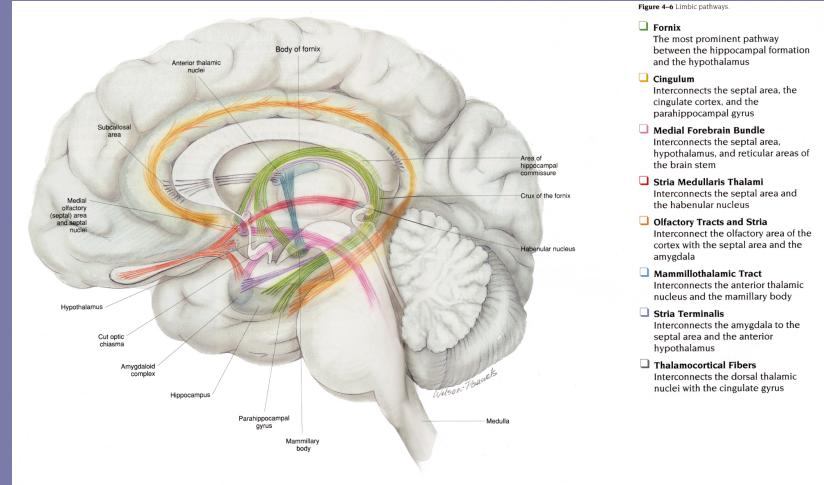


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Survival

Response to Threat

Empowered Cooperative Beings

Social Nervous System

Castellino



*Ability to Perceive Self
and to Perceive Others*

Harmonic Resonance

*Cooperation and autonomy
at the same time*

Social Nervous System

From John Chitty



- Sensation of lower 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

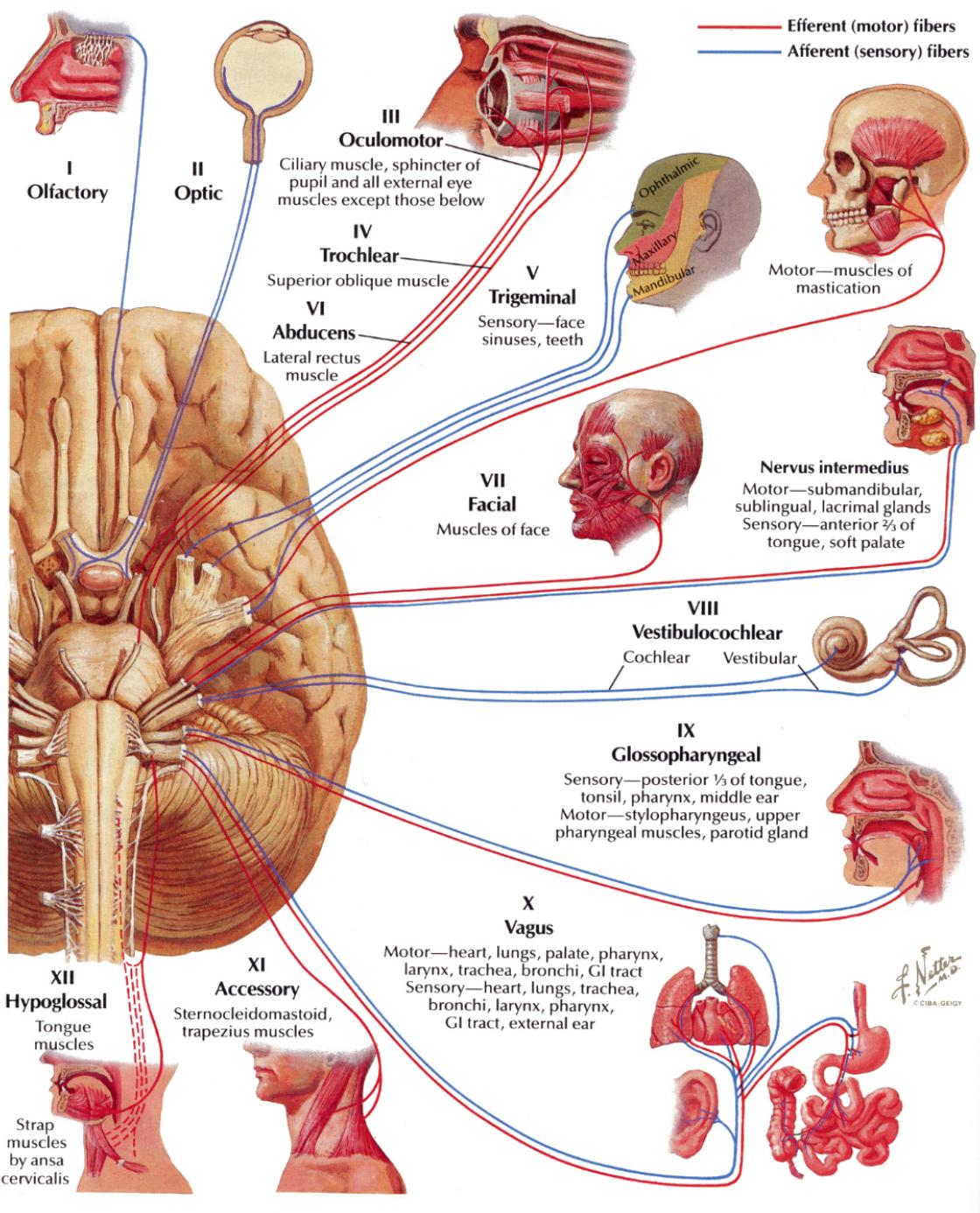
- Feeling tones of sadness, wavelike forms uprising
- Upward sensation
- Connection with others

Social Nervous System

Stephen Porges



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.”



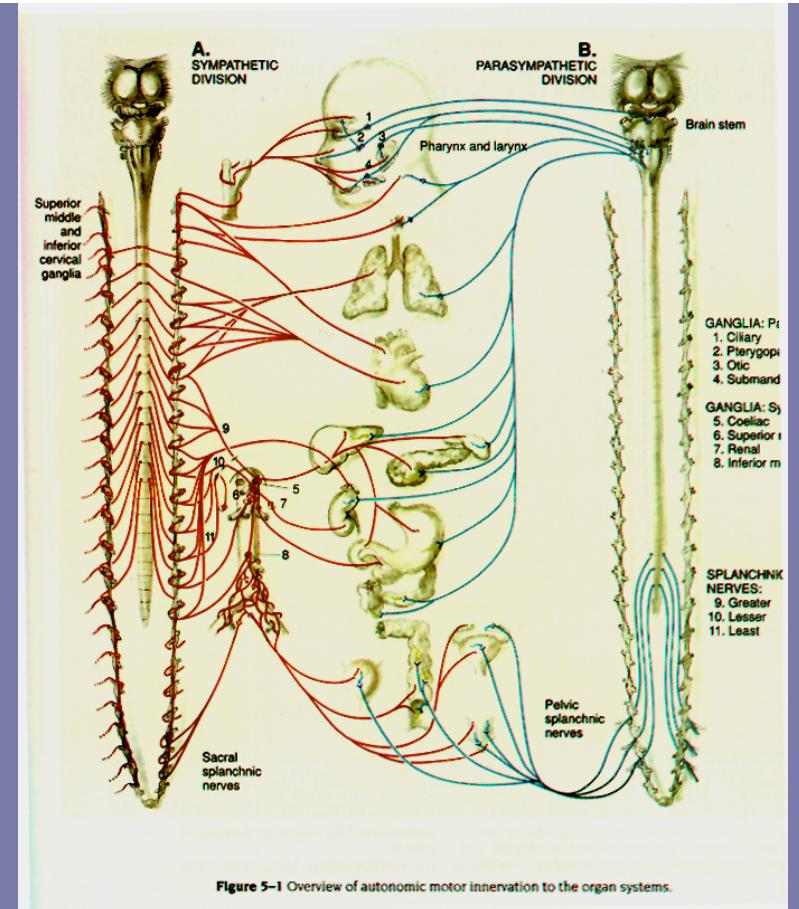
From: Frank H. Netter, MD
ATLAS OF HUMAN ANATOMY,
 plate 112

Social NS Cranial Nerves

- V **Trigeminal**
- VII **Facial**
- IX **Glossopharyngeal**
- X **Vagus**
- XI **Accessory**



Sympathetic Nervous System:



*Fight, Flight, Freeze
in response to a threat
or the perception of threat*

Sympathetic Nervous System:

- Arms & legs sensation
- Impulses to move and stretch
- Cold periphery (hands/feet)
- Diaphragm
- Edge, activation, anxious feeling
- Feeling tones of anger/fear
- Trembling, fibrillation, oscillation
- Eyelids flutter

Rothschild (p.48)

- 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



Parasympathetic Nervous System:

Basic Survival

Cardiopulmonary Function

Digestion

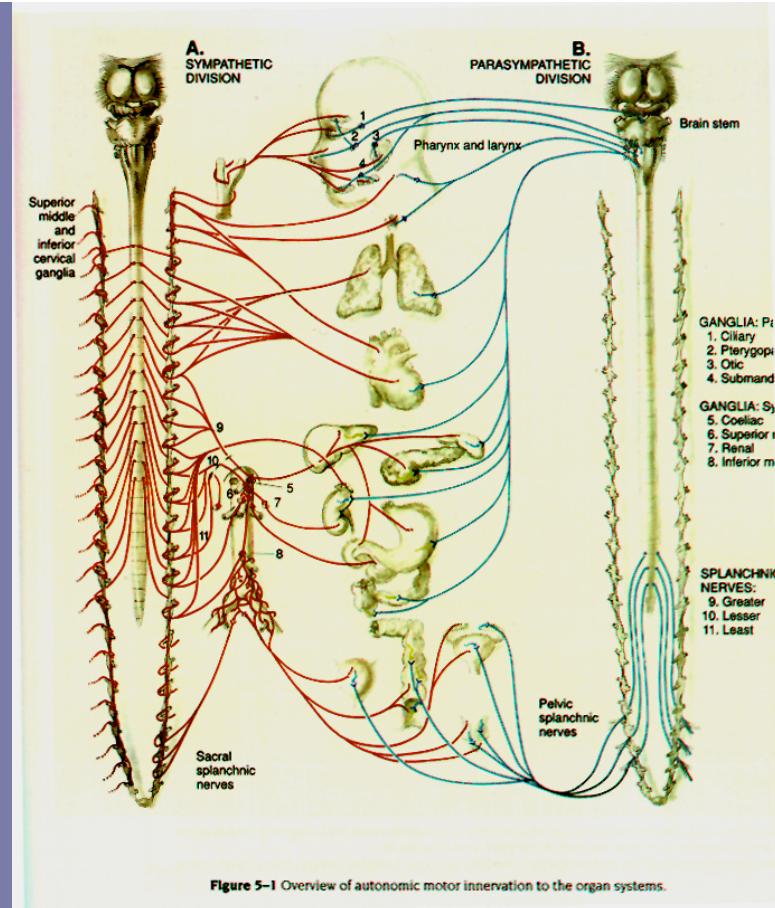


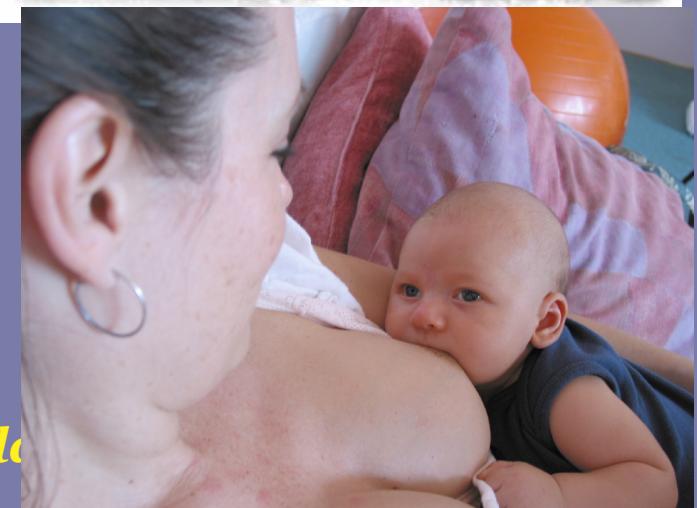
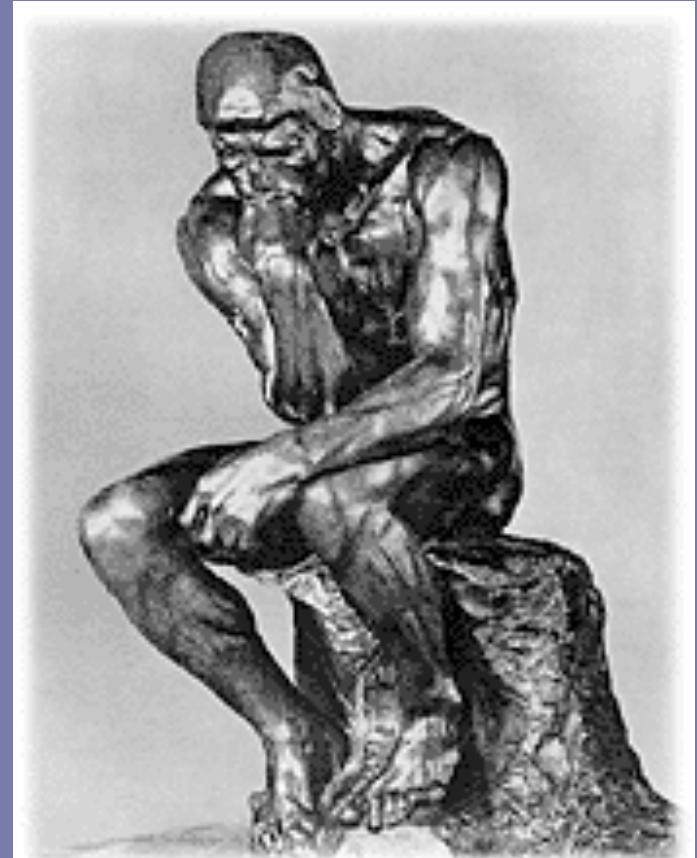
Figure 5-1 Overview of autonomic motor innervation to the organ systems.

Parasympathetic Nervous System:

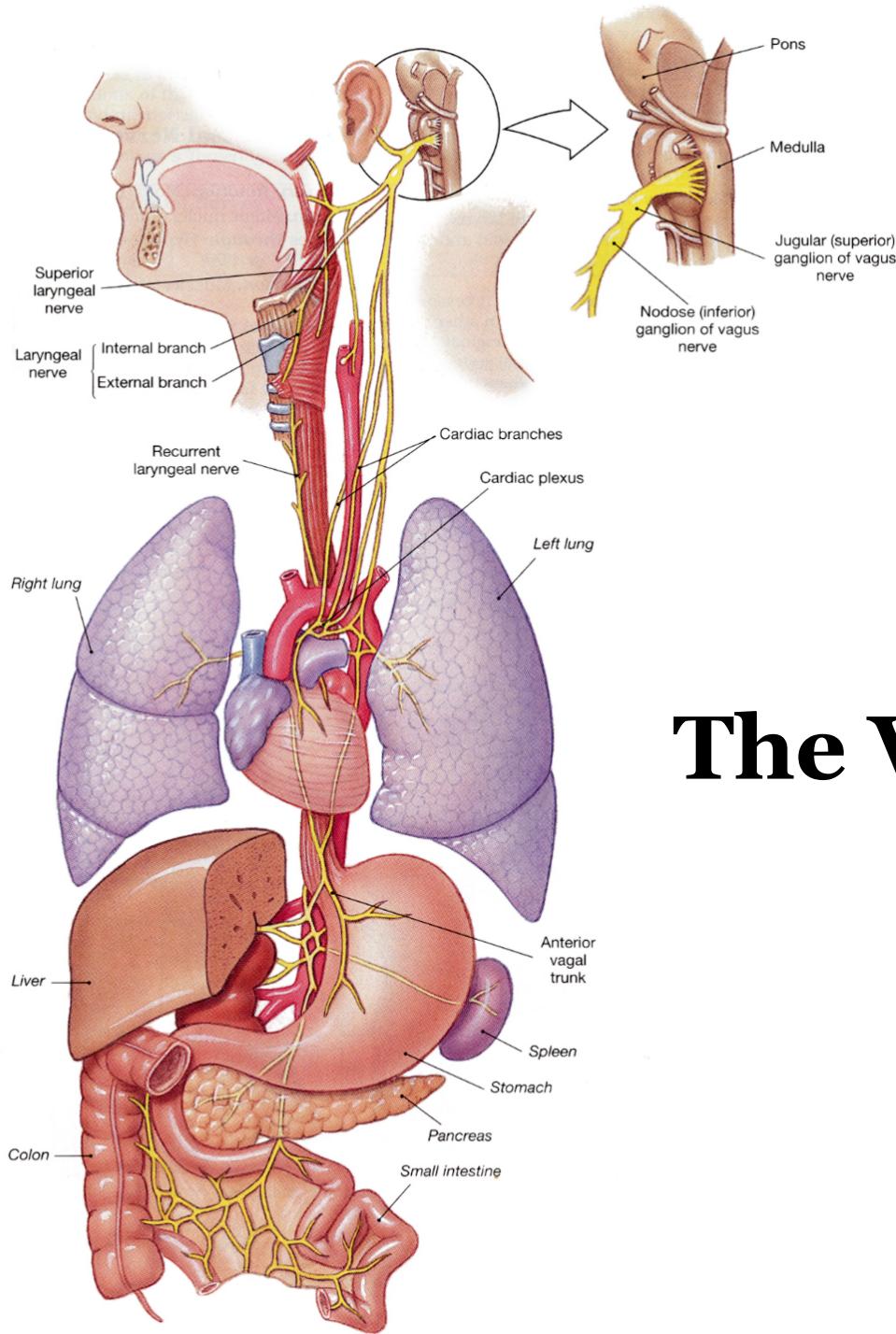
- Belly awareness
- Slowing to quiet state
- Digestive - gurgling, etc.
- Diaphragm activity/sensation
- Deep breath/yawning
- Primitive simplicity
- Downward sensation
- Heavy feeling, immobility

Rothschild (p.48)

- 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, happiness, anger, grief, sadness*



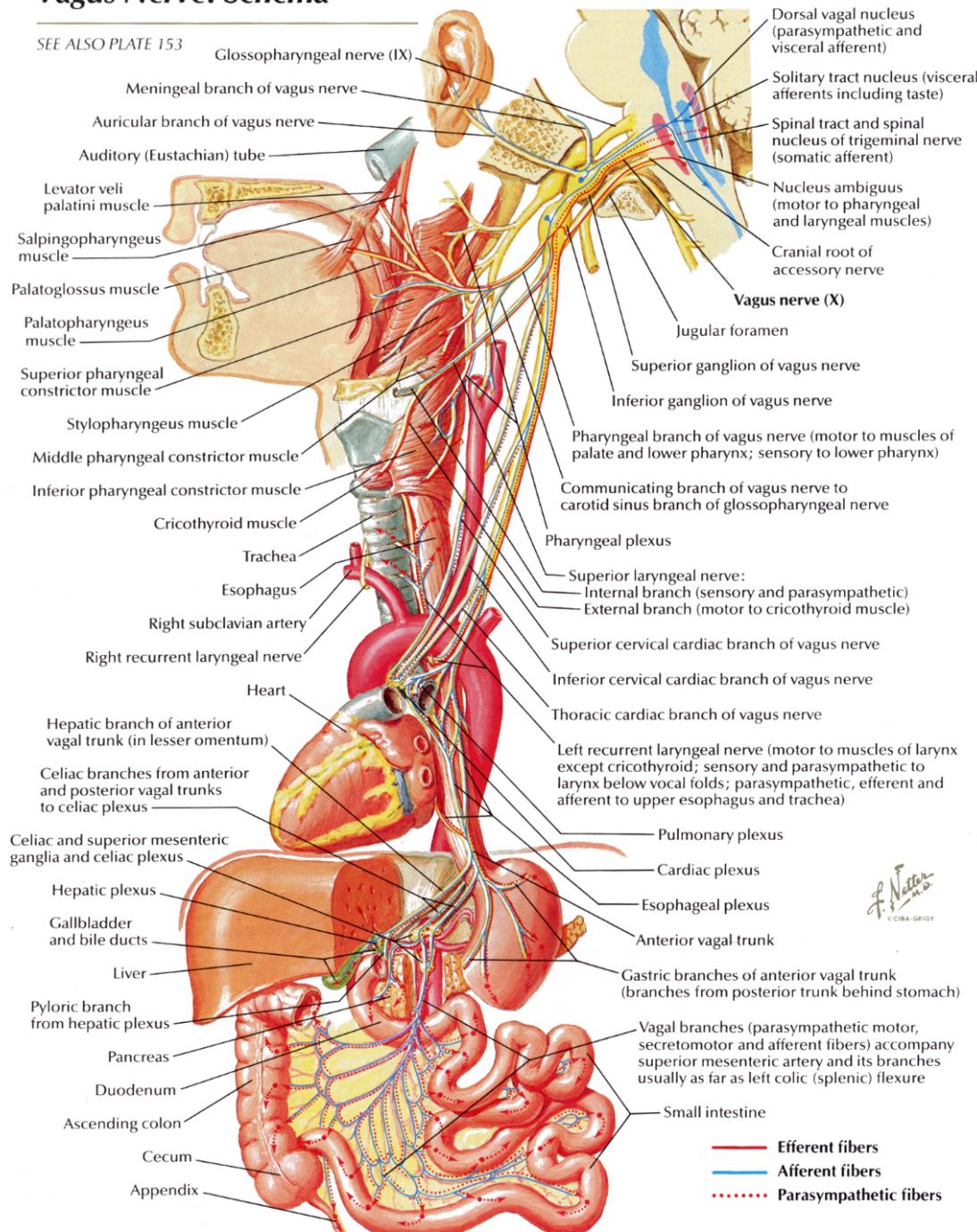
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p.491



The Vagus Nerve

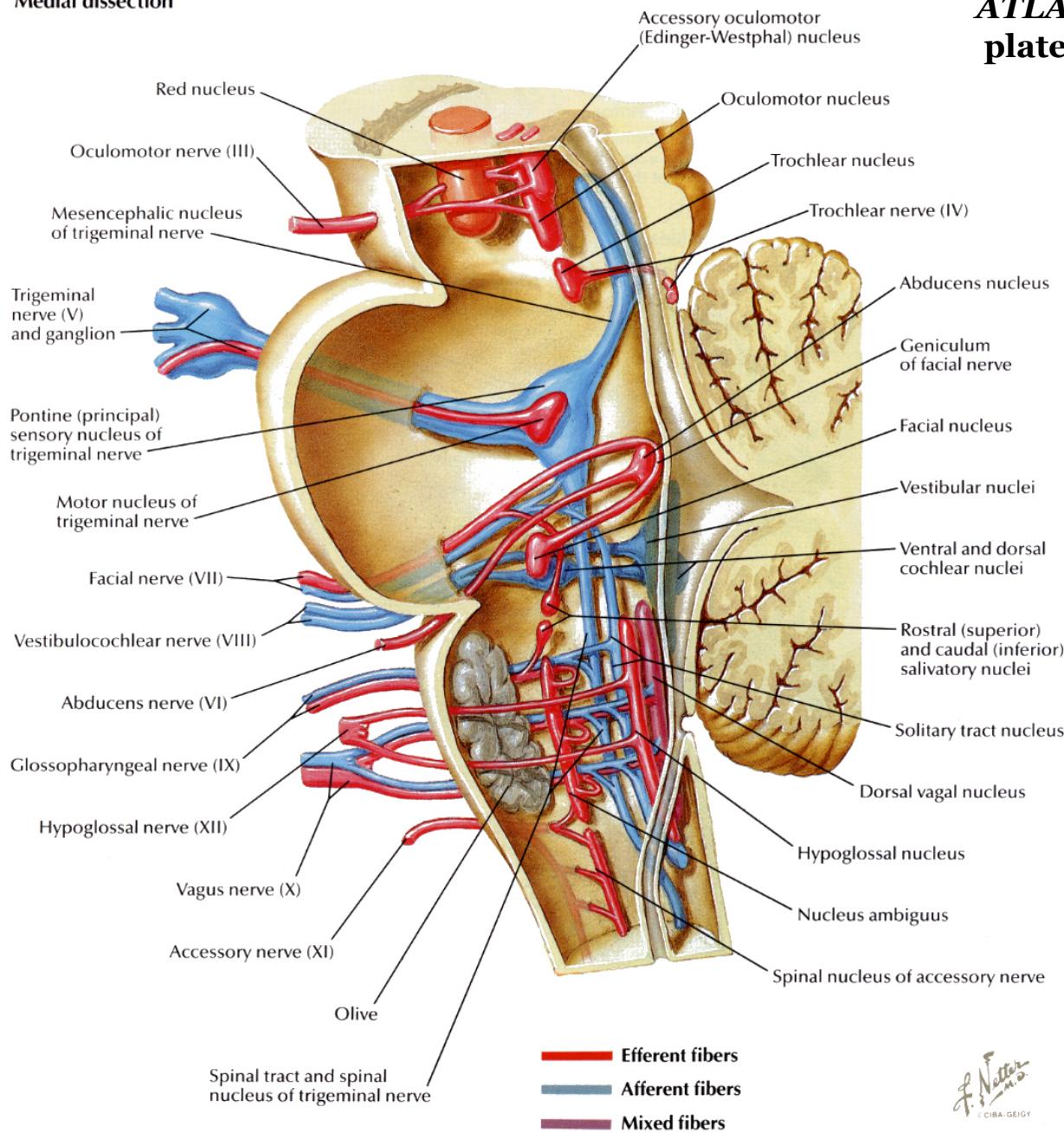
Vagus Nerve: Schema

SEE ALSO PLATE 153



From: Frank H. Netter, MD
ATLAS OF HUMAN ANATOMY,
plate 120

Medial dissection

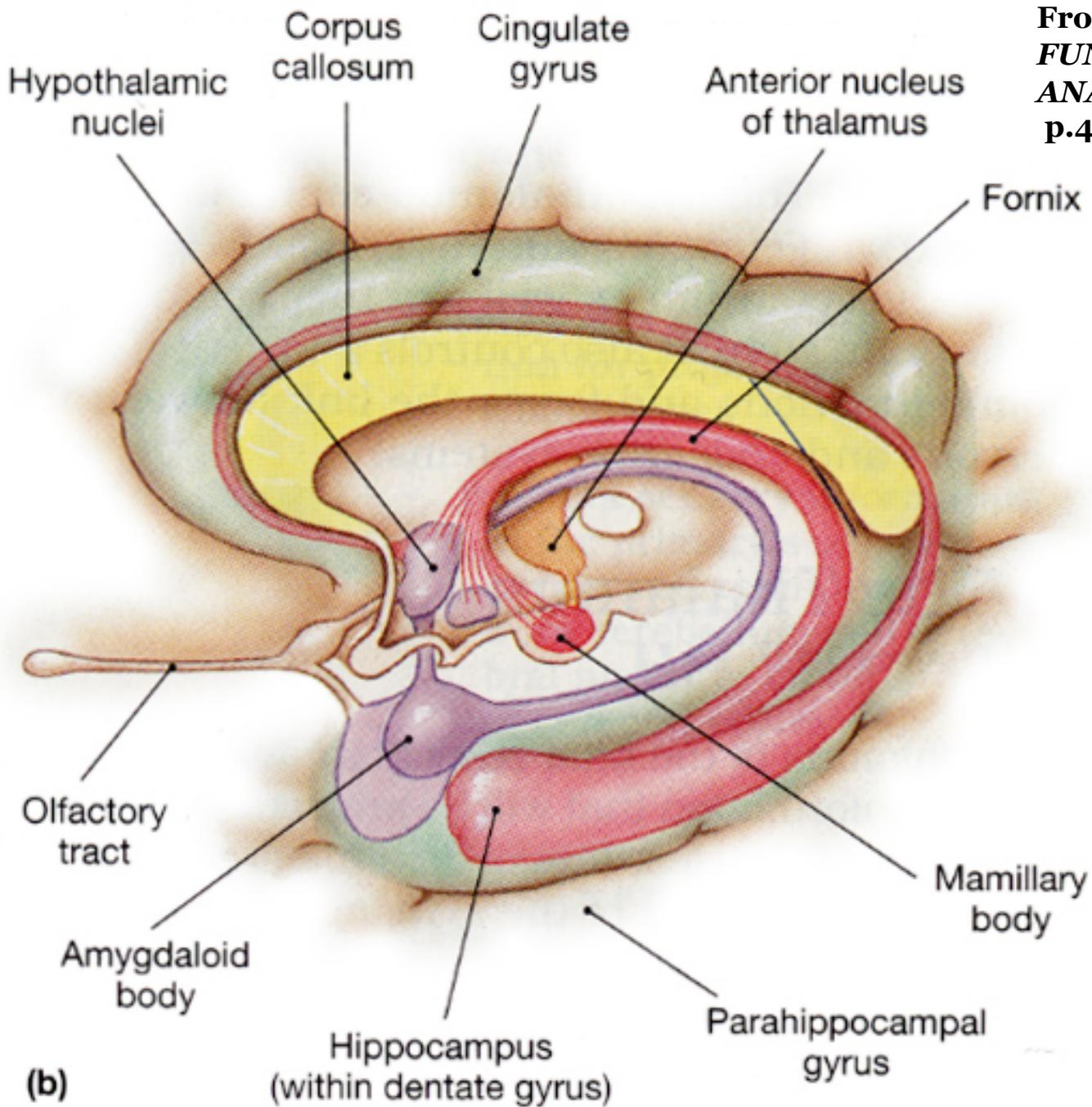




Making Eye Contact

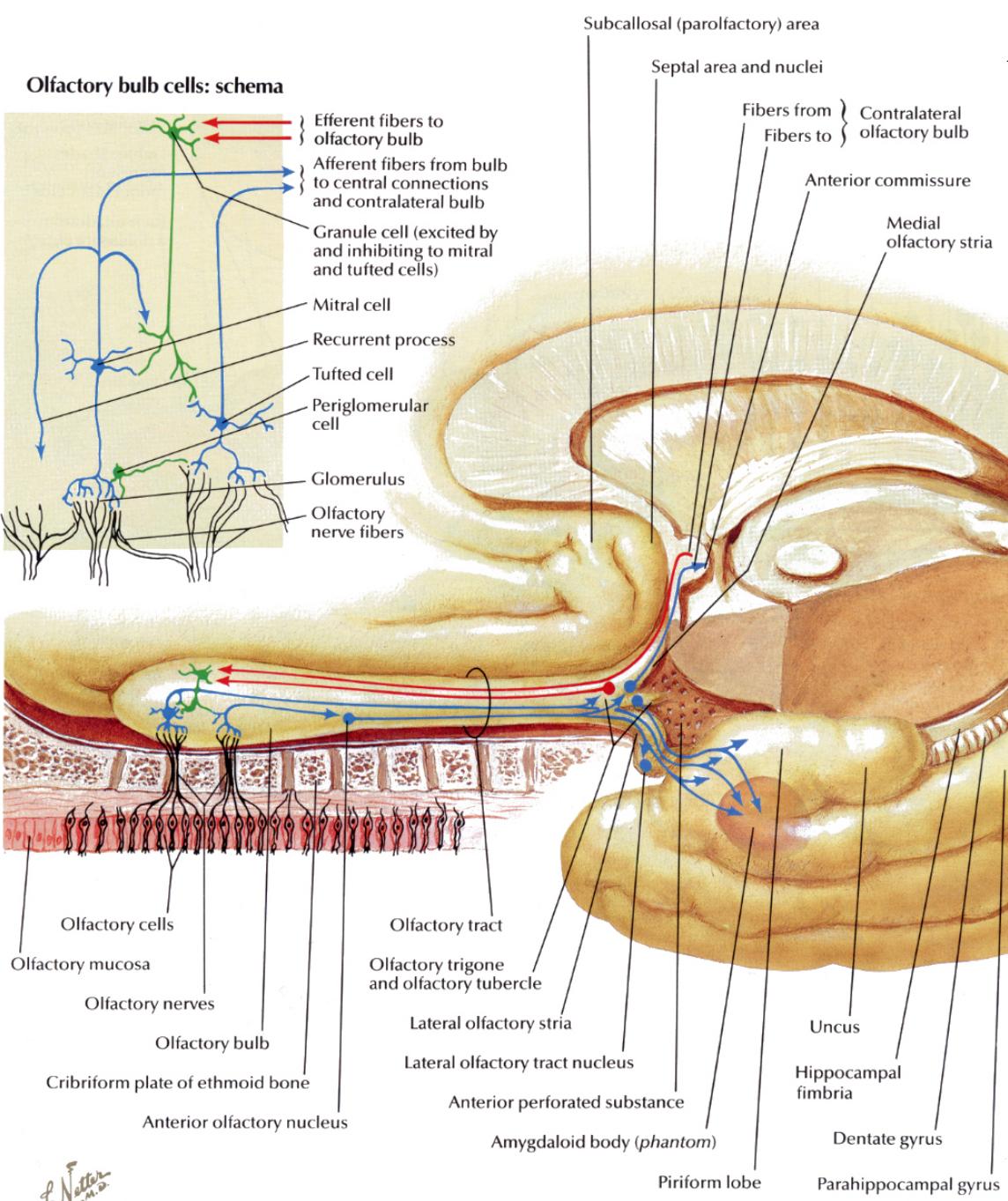
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p.475



(b)

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ATLAS OF HUMAN ANATOMY,
plate 113



Amygdala Highlights

From John Chitty

- Sorts experience to identify threat, based on earlier experiences
- Central role in stress response
- Can it be “reset?” This is the holy grail of body-centered trauma work! Some osteopaths and cranial therapists say, “Yes!”
- “From the point of view of survival, it is better to respond to potentially dangerous events as if they were the real thing, than to fail to respond.” (LeDoux, 165)
- Individuals who lose the amygdala and associated inferior portions of the temporal cortex exhibit the Kluver-Bucy syndrome, which was a syndrome first described in animals. These individuals are characterized by a loss of fear and increased and inappropriate sexual activity. --*Social Neuroscience Laboratory, Institute for Mind and Biology, University of Chicago* (<http://socialpsy.uchicago.edu/snsl.htm>)



From: Graphique de France by Bob Willoughby 1956

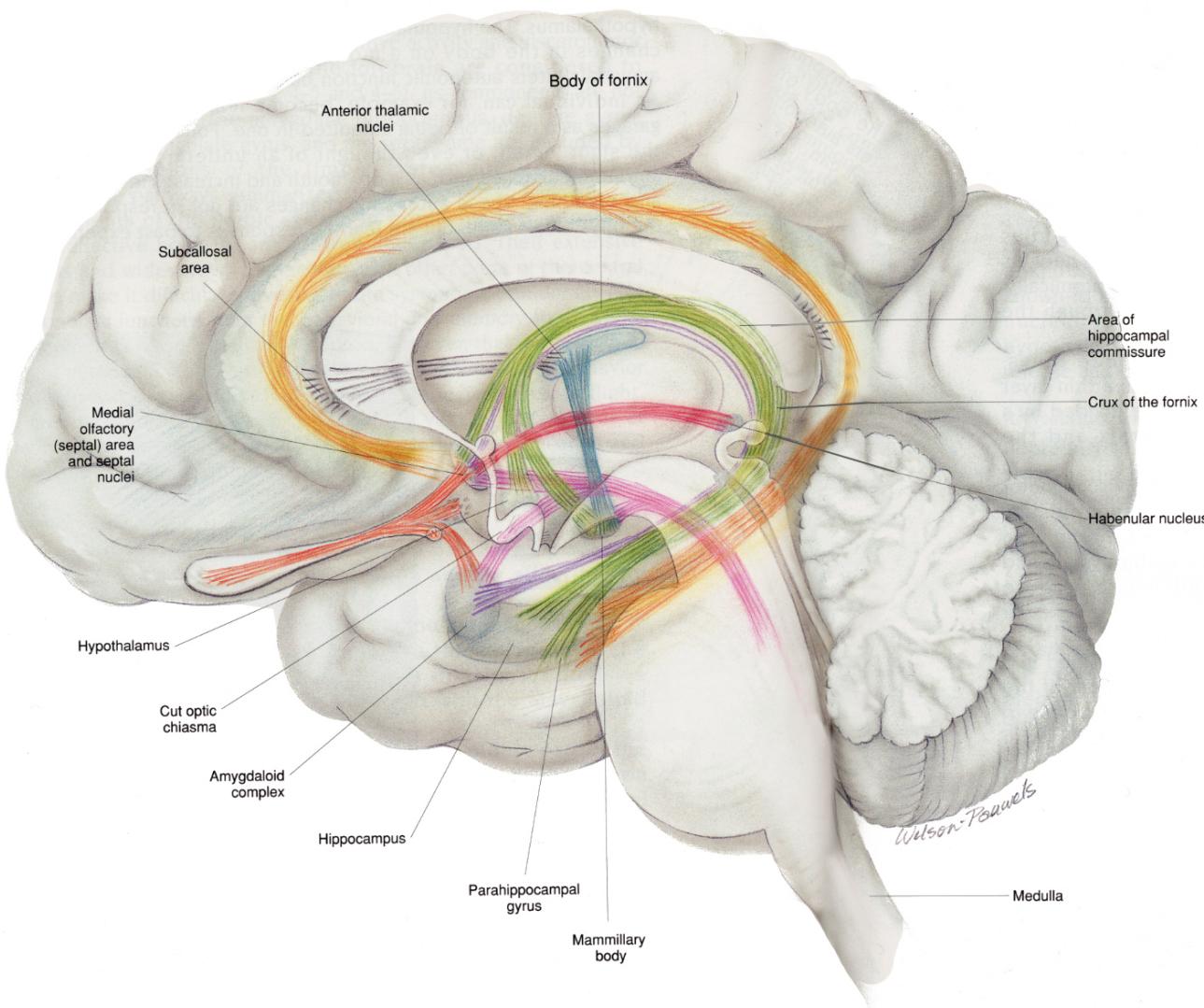


Figure 4–6 Limbic pathways.

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**From: Wilson-Pauwels, Stewart, Akesson
AUTONOMIC NERVES, p.56-57**

**From: Allan N. Schore
*AFFECT REGULATION
AND THE ORIGIN OF
SELF*, p.86**



A



B



C



D



E



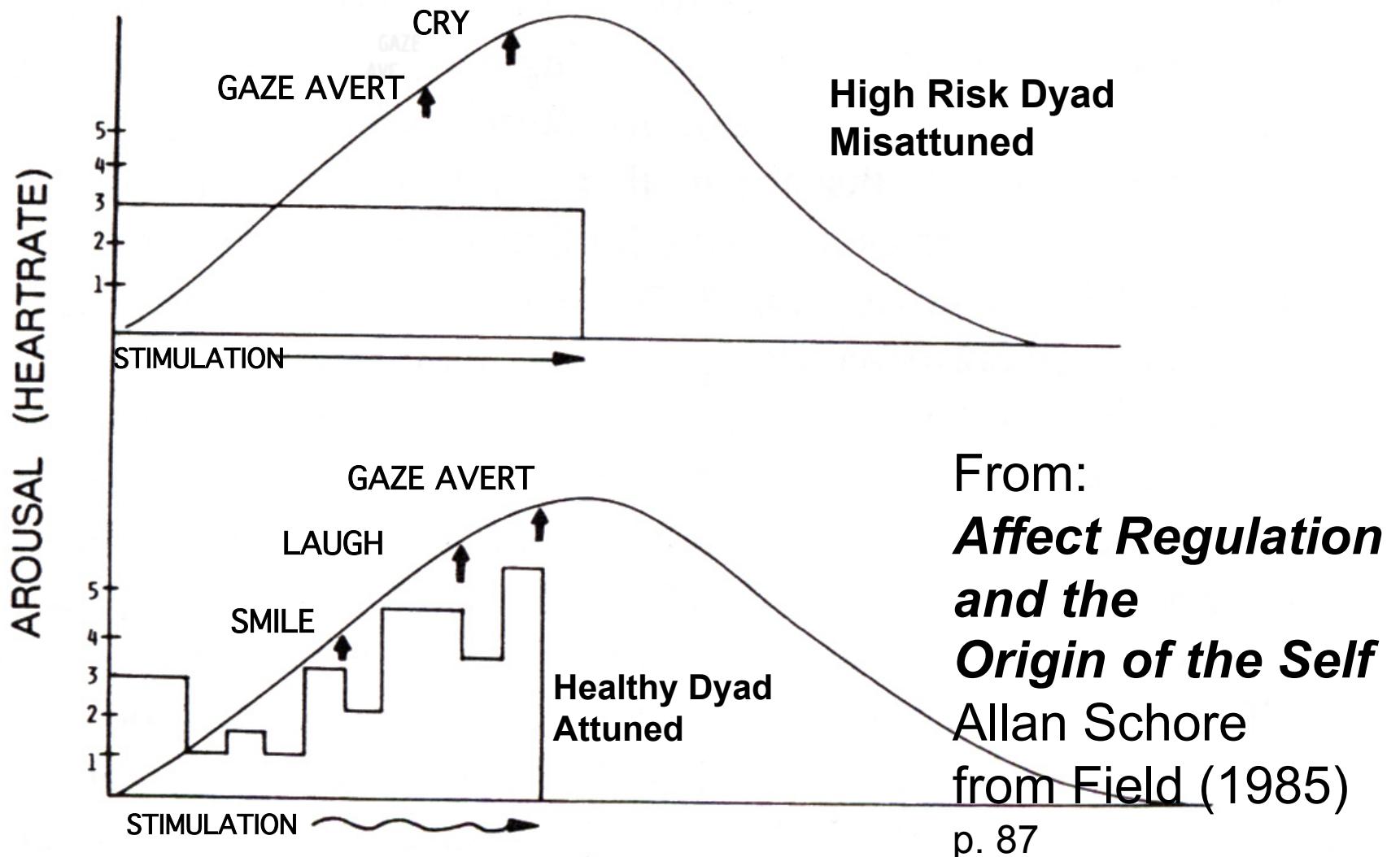
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**From: Allan N. Schore
*AFFECT REGULATION
AND THE ORIGIN OF
SELF*, p.82**

FIG. 6.4. A typical sequence observed during "attuned" interactions of normal infants and their mothers: (A) the infant looks at the mother and the mother shows an exaggerated facial expression (mock surprise); (B) the infant and mother smile; (C) the infant laughs, the mother "relaxes" her smile; and (D) the infant looks away, the mother ceases smiling and watches her infant. From Field and Fogel (1982). Reprinted by permission of Lawrence Erlbaum Associates

VISUAL EXPERIENCES AND SOCIOEMOTIONAL DEVELOPMENT







SCHORE'S RIGHT BRAIN DUAL CORTICOLIMBIC-AUTONOMIC CIRCUITS

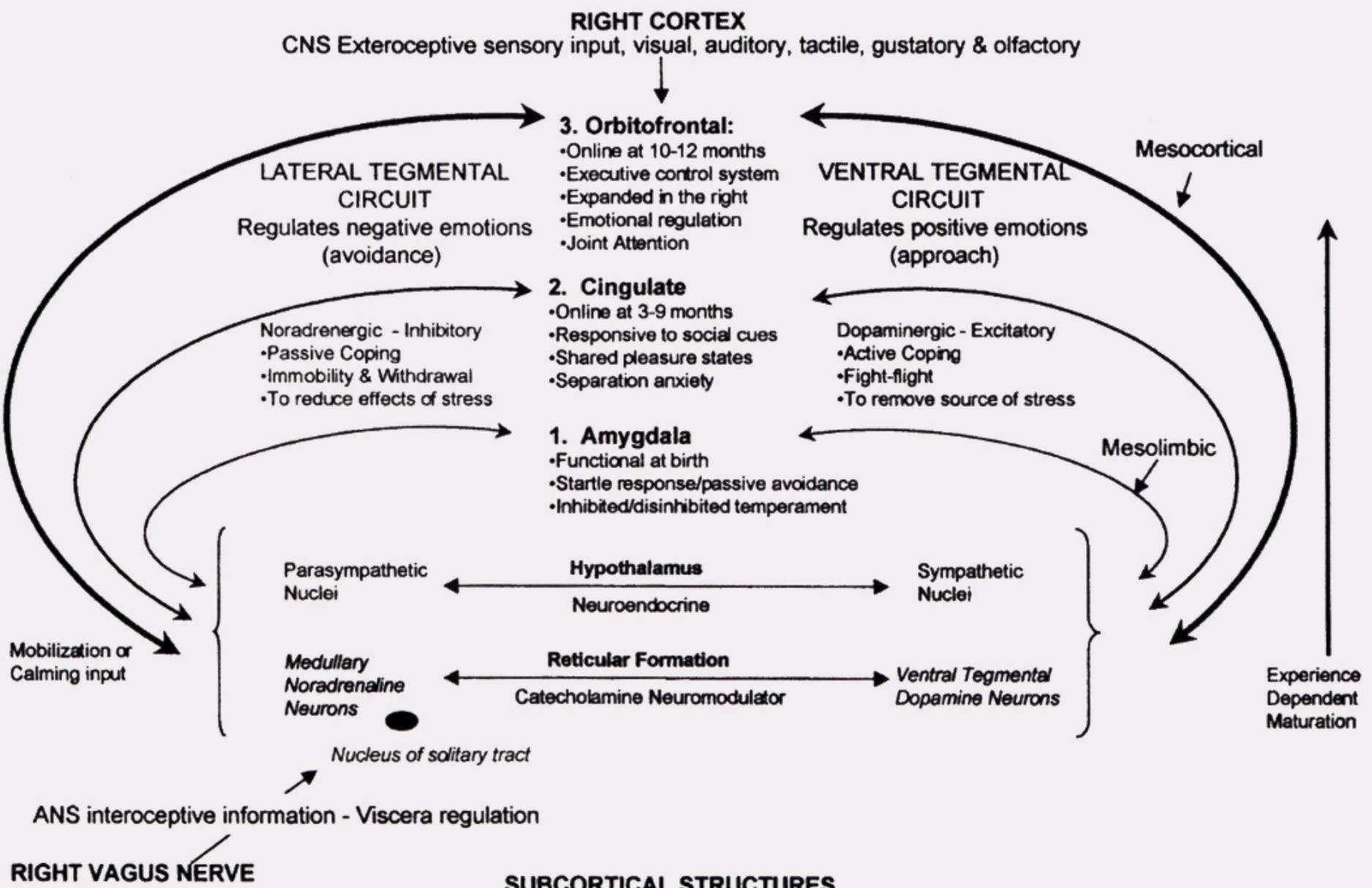


FIGURE 3. Schematic of right brain dual cortical-limbic circuits.



From: Alex Grey
*The Visionary Art of
Alex Grey, "Nursing"*







Activation and Settling Cycles

Session 8/1/01

ANS
Sympathetic /
Parasympathetic
Cycling



Forrest / Dad Bonding



Forrest shows Dad



Dad follows
Forrest's cue



Eye to Eye Contact

Show video clip

Session 8/22/01



- **Low affect**
- **Differentiate the visceral sensations that she has associated with her ancestors**
- **Associate those sensations in a way that increases her daily moment to moment functional ability.**

10/9/01



Older brother joins this session. This is a new behavior for this family. They are not used to playing together in high arousal states having fun in harmonic resonance. Forrest's headaches have long since resolved. His cranial field does not carry the same tension pattern. His head is physically reshaping itself. Mom has more work to do with her ancestral pattern.