

The  
**Adult Dysphagia**  
POCKET GUIDE

*Neuroanatomy to Clinical Practice*



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# Preface

*The Adult Dysphagia Pocket Guide: Neuroanatomy to Clinical Practice* was created because of the need for a concise, easy to carry reference book designed specifically for the dysphagia clinician.

The authors wanted to merge clinical neurophysiology of the swallow directly to assessment and treatment in a clear, easy to understand format. The discussion of laboratory values and medications in Chapters 3 and Chapters 4, and how they can impact dysphagia, add another layer of uniqueness to this guide. The recurring “Clinician’s Note” and “Research to Practice” sections help transform this guide into one that is practical and useful for clinicians based on the current research.

This is not intended to replace continuing education and training, nor is it designed to be a textbook. This guide is also not a panacea. There is no one treatment or approach that will work for everyone. It is up to individual clinicians to think objectively, gather and synthesize the information presented, and apply efficacious research that will benefit each individual patient.

This reference book represents a “quick reference” and answers the need for a practical guidebook that new clinicians, graduate students, and even seasoned clinicians can carry with them and readily access while they are completing their evaluations. The authors believe this is a much-needed resource and hope that it is used with the enthusiasm and passion in which it was created. We can make a difference, one swallow at a time.





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Tiffani Wallace would like to give a shout out to God for making this possible. Thank you to all those who have taught me so much about dysphagia over the years and given me the love to treat swallowing disorders. Thank you to my family for giving me time to work and understanding that my dream is large. Thank you to Yvette for always being my friend and without whom this book would still be a dream.

This project was a labor of love and the authors hope that it will be a valuable resource for the dysphagia clinician for many years to come.



# Reviewers

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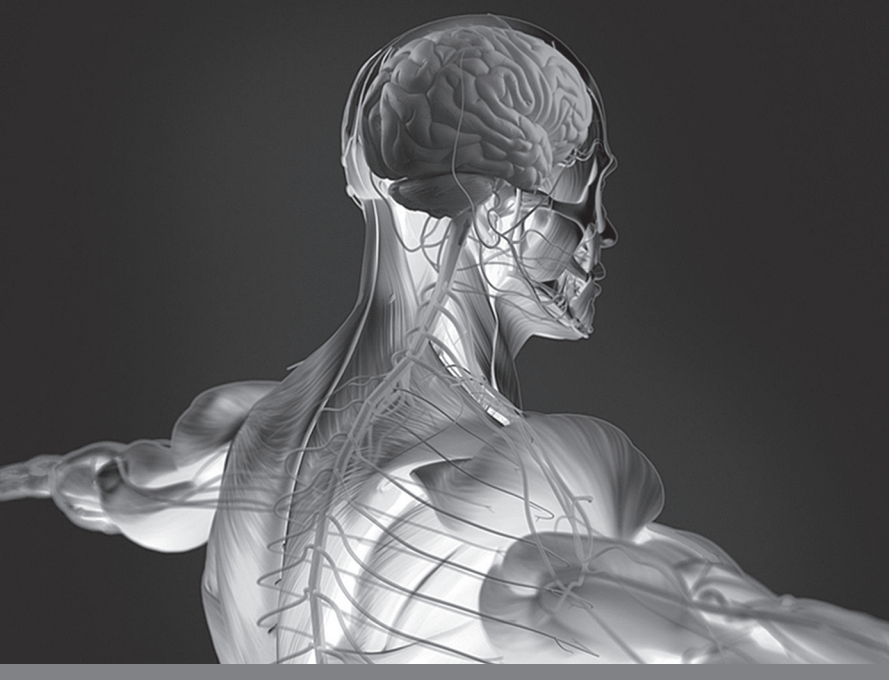
New York-Presbyterian Brooklyn Methodist Hospital

New York, New York



**CHAPTER 1**

**Basic  
Neurophysiology  
Review**



## Why Should Clinicians Care?

- Understanding the basic neurophysiology of the swallow mechanism will help clinicians identify the underlying pathophysiology and the level at which the swallowing system is not functioning properly.
- There are very specific signs/symptoms associated with damage to Upper Motor Neurons (UMN), as well as Lower Motor Neurons (LMN), which are essential for differential diagnosis in the clinical swallow assessment.
- Identification and understanding of neural organization can help clinicians become better diagnosticians and therapists.

## Three Levels of Nervous System Organization

Swallowing takes place at three different levels of the nervous system organization:

1. Peripheral level (cranial nerves) that can be linked to sensory bolus characteristics
2. Subcortical level (brain stem) that executes learned patterns of motor activity
3. Cortical level that responds to needed changes in motor behavior required to modify swallowing; Examples of volitional behavior would be feeling the need to eat faster, eliminating an unwanted bolus, or maybe talking and eating at the same time.

(Love & Webb, 2001)

## ***Nervous System Organization***

The nervous system is divided into the central nervous system (CNS) and the peripheral nervous system (PNS). The CNS integrates information it receives from all parts of the body, and coordinates the activity of all of that information. The cortical components are composed of the two cerebral hemispheres of the brain. The subcortical portions of the CNS are composed of the brainstem, cerebellum, and spinal cord.

The PNS's main function is to connect the CNS to the limbs and organs; it is the relay station between the brain and the body's extremities.

The PNS is further divided into two subsystems. The autonomic system includes involuntary responses that influence the function of the internal organs. The somatic system communicates with sense organs, and is primarily responsible for voluntary muscle movements. The autonomic nervous system is further divided into the parasympathetic nervous system and the sympathetic nervous system. The autonomic nervous system, in general, is responsible for regulating the body's unconscious actions. More specifically, the parasympathetic nervous system is responsible for the "rest and digest" action that occurs when the body is at rest, especially after eating, and also includes salivation. The somatic nervous system is divided into afferent (sensory) and efferent (motor) divisions (Bieger & Neuhuber, 2006; Bradley & Sweazey, 1992; Jean, 2001; Kern, Jaradeh, Arndorfer, & Shaker, 2001; Mosier, Patel, Liu, Kalnin, Maldjian, & Baredes, 1999).

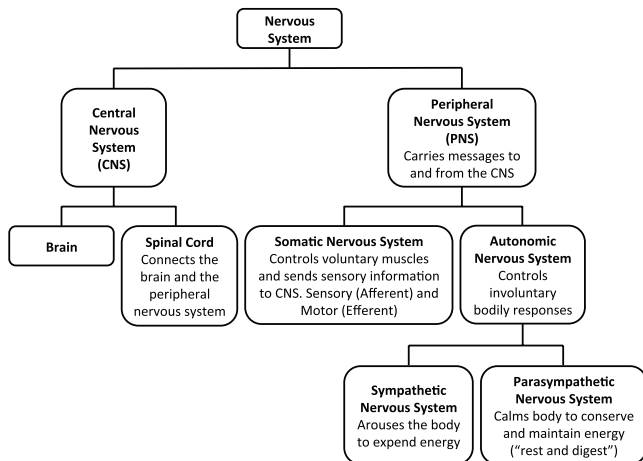


### ***Quick Definitions***

- **Afferent**—(sensory) impulses from peripheral tissues toward brain stem
- **Efferent**—(motor) impulses from brain stem to muscles

Peripheral nerves detect sensory information and send that information to the brain. That information is processed and sent out as signals to the effectors (muscles) to tell them what to do and how fast or slow to do it. Sensory input, in turn, drives motor output (Yoshida, Tanaka, Hirano, & Nakashima, 2000).

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## Neural Control of Swallowing

### ***Nucleus Tractus Solitarius (NTS), Nucleus Ambiguus (NA), Central Pattern Generator (CPG)***

The cranial nerves involved in swallowing send sensory information to the NTS. Motor components are organized in the NA, and together, the NTS and NA comprise the swallowing center located in the medulla in the brainstem, which is called the central pattern generator (Jean, 1990; Jean & Dallaporta, 2006). This network of neurons within the brain stem is hardwired to produce a series, or sequence, of activities that is always the same in swallowing that is nonvolitional. The same set of events will happen all the time. It is important to note that although there are some volitional aspects of swallowing, the CPG network CAN BE activated by input from the cerebral cortex.



### **Clinician's Note**

The brain stem is primarily responsible for the involuntary aspects of the swallow. Swallow function is represented on both sides of the brain stem. These sides are interconnected, and the normal function depends on intact function of BOTH sides, so a patient with a unilateral brain stem lesion could have bilateral pharyngeal dysfunction.



## Clinical Relevance

- Nucleus Tractus Solitarius (NTS) processes general sensory information in the pharynx, larynx, as well as esophageal mucosa. Special sensory (taste) also synapses predominantly in the NTS.
- The highest density of laryngeal sensory receptors is located in the supraglottic mucosa, near the arytenoid cartilages.
- Silent aspirators quite likely have impairment in the NTS.
- NTS integrates sensory input with several reflexes, including coughing, apnea, and pharyngeal swallowing.
- The Nucleus Ambiguus (NA) houses significant motor nuclei, and the Central Nervous System (CNS) uses sensory information from the oral cavity to inform and guide both tongue shape and the associated pressures, which are generated to squeeze the bolus successfully toward the pharynx (sensory input driving motor output).