



FOURTH EDITION

# Motor Speech Disorders

DIAGNOSIS AND TREATMENT

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# Contents

<i>Preface</i>		<i>ix</i>
<i>About the Author</i>		<i>xiii</i>
<b>CHAPTER 1.</b>	<b>A Brief Historical Review of Motor Speech Disorders</b>	<b>1</b>
	Case Reports From Ancient Greece	3
	Case Reports From the Middle Ages and Renaissance	6
	Two Early Theories on the Localization of Reason	7
	From the 19th Century to Today	9
<b>CHAPTER 2.</b>	<b>The Motor System</b>	<b>15</b>
	Components of the Motor System	16
	Structure and Function of the Motor System	27
	Summary of the Motor System	53
	Study Questions	53
<b>CHAPTER 3.</b>	<b>Evaluation of Motor Speech Disorders</b>	<b>55</b>
	Goals of a Motor Speech Evaluation	57
	Speech Production Components and Disorders	58
	Standardized Tests for Dysarthria	63
	Standardized Tests for Apraxia of Speech	65
	Conducting a Motor Speech Evaluation	68
	Instructions for the Motor Speech Evaluation	70
	Auditory-Perceptual Evaluations of the Motor Speech Mechanism	78

	Summary of the Evaluation of Motor Speech Disorders	85
	Study Questions	85
	Appendix 3–1: Motor Speech Examination	87
<b>CHAPTER 4.</b>	<b>Flaccid Dysarthria</b>	<b>99</b>
	Definitions of Flaccid Dysarthria	100
	Neurologic Basis of Flaccid Dysarthria	101
	Causes of Flaccid Dysarthria	114
	Speech Characteristics of Flaccid Dysarthria	119
	Key Evaluation Tasks for Flaccid Dysarthria	123
	Treatment of Motor Speech Disorders	124
	Treatment of Flaccid Dysarthria	128
	Summary of Flaccid Dysarthria	142
	Study Questions	142
<b>CHAPTER 5.</b>	<b>Spastic Dysarthria</b>	<b>145</b>
	Definitions of Spastic Dysarthria	146
	Neurologic Basis of Spastic Dysarthria	146
	Causes of Spastic Dysarthria	150
	Speech Characteristics of Spastic Dysarthria	152
	Spastic Dysarthria Versus Flaccid Dysarthria	157
	Key Evaluation Tasks for Spastic Dysarthria	158
	Treatment of Spastic Dysarthria	159
	Summary of Spastic Dysarthria	167
	Study Questions	168
<b>CHAPTER 6.</b>	<b>Unilateral Upper Motor Neuron Dysarthria</b>	<b>169</b>
	Definitions of Unilateral Upper Motor Neuron Dysarthria	170
	Neurologic Basis of Unilateral Upper Motor Neuron Dysarthria	171
	Causes of Unilateral Upper Motor Neuron Dysarthria	174
	Speech Characteristics of Unilateral Upper Motor Neuron Dysarthria	177
	Key Evaluation Tasks for Unilateral Upper Motor Neuron Dysarthria	181

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	Treatment of Unilateral Upper Motor Neuron Dysarthria	181
	Summary of Unilateral Upper Motor Neuron Dysarthria	183
	Study Questions	184
<b>CHAPTER 7.</b>	<b>Ataxic Dysarthria</b>	<b>185</b>
	Definitions of Ataxic Dysarthria	186
	Neurologic Basis of Ataxic Dysarthria	186
	The Cerebellum and Speech	191
	Causes of Ataxic Dysarthria	192
	Speech Characteristics of Ataxic Dysarthria	196
	Key Evaluation Tasks for Ataxic Dysarthria	200
	Treatment of Ataxic Dysarthria	201
	Summary of Ataxic Dysarthria	207
	Study Questions	208
<b>CHAPTER 8.</b>	<b>Hypokinetic Dysarthria</b>	<b>209</b>
	Definitions of Hypokinetic Dysarthria	210
	Neurologic Basis of Hypokinetic Dysarthria	210
	Causes of Hypokinetic Dysarthria	215
	Speech Characteristics of Hypokinetic Dysarthria	218
	Key Evaluation Tasks for Hypokinetic Dysarthria	223
	Treatment of Hypokinetic Dysarthria	223
	Summary of Hypokinetic Dysarthria	239
	Study Questions	240
<b>CHAPTER 9.</b>	<b>Hyperkinetic Dysarthria</b>	<b>241</b>
	Definitions of Hyperkinetic Dysarthria	242
	Neurologic Basis of Hyperkinetic Dysarthria	243
	Causes of Hyperkinetic Dysarthria	246
	Key Evaluation Tasks for Hyperkinetic Dysarthria	264
	Treatment of Hyperkinetic Dysarthria	265
	Summary of Hyperkinetic Dysarthria	270
	Study Questions	271

CHAPTER 10.	Mixed Dysarthria	273
	Definitions of Mixed Dysarthria	274
	Neurologic Basis of Mixed Dysarthria	274
	Causes of Mixed Dysarthria	277
	Treatment of Mixed Dysarthria	288
	Summary of Mixed Dysarthria	292
	Study Questions	292
CHAPTER 11.	Apraxia of Speech	295
	Definition of Apraxia of Speech	296
	Overview of the Apraxias	298
	Neurologic Basis of Apraxia of Speech	302
	Causes of Apraxia of Speech	304
	Speech Characteristics of Apraxia of Speech	305
	Assessment of Apraxia of Speech	309
	Differential Diagnosis of Apraxia of Speech	310
	Additional Diagnostic Considerations	313
	Treatment of Apraxia of Speech	318
	Summary of Apraxia of Speech	333
	Study Questions	333
	<i>References</i>	335
	<i>Glossary</i>	353
	<i>Index</i>	365

# Preface

This is the fourth edition of *Motor Speech Disorders: Diagnosis and Treatment*. In the 24 years since the first edition, knowledge about motor speech disorders has evolved quite a lot, and research into this topic continues to be a dynamic area of study. Information about specific conditions associated with motor speech disorders has grown; a number of assessment instruments have become more accurate in diagnosing disorders; and evaluations of treatment procedures appear frequently in the research literature. Perhaps the most exciting development over the past two and a half decades is the creation of new evidence-based behavioral treatments for apraxia of speech and hypokinetic dysarthria. In addition, older treatments have been refined, adapted, or combined to enhance their ability to address motor speech disorders.

This fourth edition remains dedicated to students and beginning clinicians, both in its uncomplicated presentation of neurological conditions and its accessible writing style. Each chapter was written with the author's own students in mind. Their questions during lectures and their performance on tests and in clinics helped shape the content and tone of the book. To further help all students understand the complexity of these disorders, over two hours of clinical videos and case histories are available on the PluralPlus companion website (see the inside front cover for the URL and your access code), along with eFlashcards with all the of the key terms and definitions from the text. For instructors, PowerPoint slides that highlight important details within each chapter and an image bank containing high-resolution images from the book are also included on the website.

## Organization

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The overall organization of the book is the same as the prior edition. Chapter 1 is a historical introduction to the study of motor speech disorders. It examines ancient case reports that might involve dysarthria or apraxia of speech. Chapter 2 is an introduction to the motor system, one of the most remarkable parts of the human body. Clinicians must have at least a basic understanding of the motor system if they are to accurately diagnose and treat motor speech disorders. Chapter 3 discusses the assessment of these disorders. It includes a detailed explanation of the complete motor speech examination that is at the end of the chapter (Appendix 3–1). Chapters 4 through 11 examine the six pure dysarthrias, mixed dysarthria, and apraxia of speech. Throughout these chapters, a consistent organization is maintained to facilitate the reader's understanding of the disorders. Each chapter begins with the neurologic basis of the condition, then continues with the etiologies and causes of the disorder, an examination of the relevant speech characteristics, and key evaluation tasks specific to the disorder; and concludes with treatment procedures.

### *New to This Edition*

This fourth edition includes many updated references and citations in nearly every chapter. Other additions to the book include these items:

- Newly published information on conditions that can cause dysarthria.
- New illustrations that provide insight into how certain diseases affect the motor system.
- Recent developments in assessment of dysarthria and apraxia of speech.
- Recent developments in treatment tasks, with particular attention given to evidence-based procedures.

Finally, a few extra words need to be added about the videos on the PluralPlus companion website. As has been said in the preface of each edition of this book, grateful acknowledgment must be given to the individuals who allowed themselves to be videotaped.



It takes a special person to face the world while demonstrating a significant neurologic disorder, yet they were all pleased to do it, especially when told that the video would help students learn about these disorders. So, thanks once again to all the generous individuals in those videos.

# About the Author



**Donald B. Freed, PhD**, is a chair emeritus in the Department of Communicative Sciences and Deaf Studies at California State University, Fresno. He received both his MS and PhD from the University of Oregon. Prior to joining the Fresno faculty, he worked as a speech-language pathologist in acute care and rehabilitation facilities and served as a research speech pathologist at the Portland Veterans Affairs Medical Center. His research has concentrated on aphasia and motor speech disorders. He has published articles in journals such as *Aphasiology*, *Clinical Aphasiology*, *American Journal of Speech and Language Pathology*, and *Journal of Speech and Hearing Research*.

# Chapter 1

## A Brief Historical Review of Motor Speech Disorders

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Case Reports From Ancient Greece  
Case Reports From the Middle  
Ages and Renaissance

Two Early Theories on the  
Localization of Reason  
From the 19th Century to Today

**T**he term motor speech disorders is an apt description of the deficits that are examined in this textbook. For readers who are new to the study of motor speech disorders, it will be beneficial to discuss the meaning of each word in this term. First of all, motor refers to the part of the nervous system that controls voluntary movements. Neuroanatomists call this portion of the nervous system the **motor system**. Speech is communication through the use of vocal symbols, sometimes also defined as the physical production of language. Disorders means an abnormality of function; the plural indicates that there is more than one abnormality in this condition. Motor speech disorders, therefore, are a collection of speech production deficits that are caused by the abnormal functioning of the motor system. Altogether, this collection of motor speech disorders consists of seven types of dysarthria and one type of apraxia.

Although the following chapters contain detailed discussions of dysarthria and apraxia, these disorders should be briefly defined now. The literal definition of dysarthria is “disordered utterance” (“dys” means disordered or abnormal; “arthria” means to utter distinctly, from the Greek, arthroun). A more comprehensive definition is that dysarthria is the impaired production of speech because of disturbances in the muscular control of the speech mechanism. The layperson’s concept of dysarthria is someone with slurred speech, but this disorder certainly includes many more speech production deficits than just poor articulation. It can involve respiration, prosody, resonance, and phonation as well.

Apraxia of speech also is a motor speech disorder. Apraxia means without action (“a” means absence of; “praxia” means performance of action, from the Greek, praxis). Actually, apraxia of speech is a deficit in the ability to smoothly sequence and place the tongue, lips, and jaw during speech. Apraxia of speech primarily affects articulation and prosody. Although apraxia of speech occurs frequently when the left hemisphere of the brain is damaged, the general public seems to be less aware of the characteristics of this disorder than they are of dysarthria.

*This chapter reviews a small selection of ancient medical reports that mention speech and language disorders. It is important to examine these early reports because a valuable part of any study is understanding the historical context from which the subject developed. Whether the topic is science or entertainment, a historical perspective adds a sense of depth and continuity that is otherwise difficult to obtain. While reading the following pages, keep in mind that some of the individuals in these case studies experienced their speech and language disorders more than 2,000 years ago.*

*One of the most remarkable aspects of preparing this chapter was the discovery of how “modern” many of these ancient medical writers were. From today’s perspective, it is easy to view them as quaint at best or frightfully ignorant at worst. But when examined in the context of the time in which they lived, these physicians’ conclusions about **anatomy** and **physiology** show that most of them were trying to take an analytical approach to medicine. When reading their descriptions of their medical practice, it is easy to imagine them as today’s state-of-the-art practitioners.*

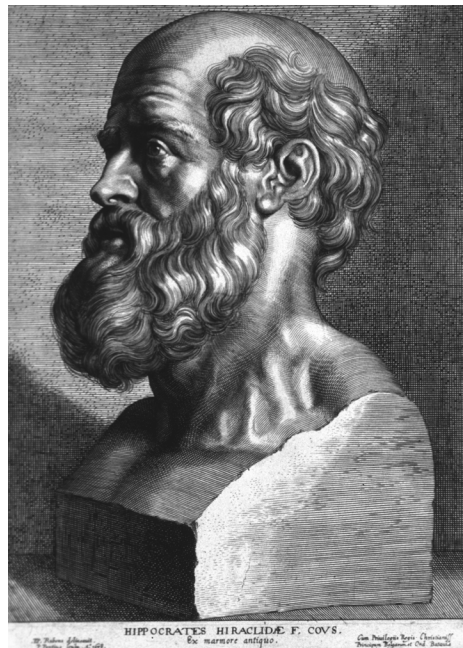
## Case Reports From Ancient Greece

Some of the earliest written accounts of speech and language disorders appear in the Greek texts known as the **Hippocratic Corpus**. Originally, these texts were a collection of 70 volumes that described numerous medicines, diseases, and treatments, as observed by ancient Greek physicians. Only about 60 of these volumes survive to the present, and they contain descriptions of anatomy, explanations of symptoms, and case studies of patients. A sampling of the individual titles gives an idea of the wide-ranging topics covered in these works—“On Ancient Medicines,” “On Fractures,” “The Book of Prognostics,” and “Of the Epidemics.” There are even volumes devoted to ulcers and hemorrhoids. Some of these works were written for educated physicians and contain surprising amounts of specific information about medical disorders and how to treat them. Other volumes were written for the general public and are, accordingly, more plainspoken in their advice.

The authorship of the Hippocratic Corpus is a bit of a mystery. Although it carries his name, **Hippocrates** (ca. 460–377 BC) was not the sole writer of this collection (Figure 1–1). In fact, it is not certain that he wrote any of the volumes. Most experts believe that numerous writers contributed to the collection over a period of at least 100 years. It is possible that the actual writers were physicians who were part of a school founded by Hippocrates on the Greek island of Kos.

Among the many descriptions of disorders in the Hippocratic Corpus are numerous references to patients being “speechless” or having “loss of speech.” A few of these seem to be references to neurologically based speech or language disorders. For example, in Book One in “Of the Epidemics” (ca. 400 BC), there is a description of what could be an instance of **aphasia** and right hemiplegia.

A woman, who lodged on the Quay, being three months gone with child, was seized with fever, and immediately began to have pains in the loins. On the third day, pain of the head and neck, extending to the clavicle, and right hand; she immediately lost the power of



**FIGURE 1-1.** An artist’s representation of Hippocrates (ca. 460–377 BC), who might or might not have contributed to the ancient medical texts that carry his name. *Source:* Image obtained from the History of Medicine database of The National Library of Medicine.

speech; was paralyzed in the right hand, with spasms, after the manner of paraplegia; was quite incoherent; passed an uncomfortable night. (“Of the Epidemics,” ca. 400 BC/1995)

Fortunately, the woman’s speech or language deficit, whatever it might have been, was only temporary because on the next day, she “recovered the use of her tongue,” and on the sixth day, she “recovered her reason.”

Another volume in the Hippocratic Corpus contains descriptions that also could be references to neurologically based speech or language disorders. In the “Aphorisms” (ca. 400 BC/1995), the writer makes an intriguing comment about the rapid onset of a condition that is accompanied by speechlessness: “When persons in good health are suddenly seized with pains in the head, and straightway are laid down speechless, and breathe loudly, they die in seven days, unless fever comes on.” Although it is impossible to determine with certainty, this could be a description of the sudden onset of a stroke or some other neurologic disorder. Garrison (1925/1969) suggested that this passage describes a subarachnoid hemorrhage, a condition that is nearly always accompanied by a sudden, painful headache and the rapid onset of other neurologic signs.

A second intriguing comment from the “Aphorisms” seems to be a reference to the loss of speech after a head injury: “In cases of concussion of the brain produced by any cause, the patients necessarily lose their speech.” As with the prior quote, it is difficult to determine which modern-day condition this might be describing. It could be that the loss of speech is the result of aphasia, severe dysarthria, or merely a temporary loss of consciousness.

One of the more detailed accounts of head injury resulting in a speech or language deficit is found in Book Five of “Of the Epidemics.” It describes what happened to a young woman who was playing with a friend.

The pretty virgin daughter of Nerius was twenty years old. She was struck on the bregma (front of the head) by the flat of the hand of a young woman friend in play. At the time she became blind and breathless, and when she went home fever seized her immediately, her head ached, and there was redness about her face. On the seventh day foul-smelling pus came out around the right ear, reddish, more than a cyathus [one-fifth of a cup]. She seemed better, and was relieved. Again she was prostrated by the fever; she was depressed, speechless; the right side of her face was drawn up; she had difficulty breathing; there was a spasmodic trembling. Her tongue was paralyzed, her eye stricken. On the ninth day she died. (Smith, 1994, p. 191)

This description indicates clearly that the author believed that the cause of the woman's speechlessness was the blow to her head. However, the type of speech or language disorder she had is difficult to determine. A modern-day reader might assume that dysarthria was a part of the problem because of the reference to a paralyzed tongue and facial contractions, but this conclusion would be little more than a guess.

Numerous examples of disordered voice are found in Book Seven of "Of the Epidemics." One of the more interesting reports describes a woman with arthritis whose "voice was checked during the night and up to midday." Although she could not talk, "she could hear, her mind was clear; she indicated with her hand that the pain was around the hip joint" (Smith, 1994, p. 399). That her auditory comprehension was functional and that she could gesture appropriately suggests that her speechlessness was from a laryngeal disorder, although it is difficult to say with certainty. Another case report tells of a man in Olynthus who had a "fever" for 17 days. The writer described him as having a "dreadful disorganization of body" and that his "voice [was] broken, a task to hear it, but intelligible" (Smith, 1994, p. 377). Once again, the author's imprecise description of the man's deficits makes it difficult to know what was wrong with his speech or voice. The man might have been demonstrating the effects of a neurologic speech impairment such as dysarthria or, perhaps, his voice was only soft and breathy from his weakened condition.

All of these case studies from the Hippocratic Corpus show that the ancient Greeks understood that speech difficulties could be the result of physical injury. Most important, these writings indicate that the Greeks knew that injury to the head could cause speechlessness (O'Neill, 1980). It is less certain whether they had a modern-day understanding of how voice, speech, and language differ, as can be seen in their vague medical descriptions of these communicative processes. Nevertheless, the influence of the Hippocratic Corpus on Western medicine was long-lasting; it was part of the standard medical curriculum for nearly 2,000 years. As late as the 18th century, some physicians were still studying and practicing the Hippocratic teachings on medicine.

### Case Reports From the Middle Ages and Renaissance

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Early descriptions of speech and language disorders did not end with the Greeks. The Byzantine physician, Paulus Aegineta (625–690), included numerous references to conditions that could result



in speechlessness in his *Medical Compendium in Seven Books*. Later medical texts from the Middle Ages and Renaissance also provide various examples of these problems. For instance, in the early 1300s, a physician named Bernard of Gordon described individuals who omitted and added syllables to their speech (O'Neill, 1980). His examples of their spoken words (e.g., saying “Aristoles” for “Aristoteles”) are intriguing and have characteristics that are similar to those in apraxia of speech or aphasia. As with the case studies from the Hippocratic Corpus, though, the exact nature of these patients’ speech disorders cannot be determined from the writer’s descriptions.

Another example of a speech or language disorder from the medieval era comes from an Italian physician, Lanfranc. He wrote about an incident in which a man fell from a horse and injured his head. After regaining consciousness, the man’s initial attempts at speech were filled with what Lanfranc described as a child’s babble—something that today might be labeled neologistic jargon or perhaps language of confusion. The man did survive the accident, and his speech eventually became intelligible again. Unfortunately, the recovery was not complete, because Lanfranc reported that the man never regained all of his mental abilities.

In the mid-1500s, a physician named Niccolo Massa recorded the details of another head injury that resulted in disordered speech. His case report is of a young man who was hit in the head with a spear, which apparently pierced deeply into his skull.

Also returned to health by my work is the noble youth, Marcus Goro who was wounded by the sharp point of a spear. . . . There was fracture of not only the cranial bone, but of the **meninges**, and of the brain substance as far as to the basilar bone. . . . Besides all his other difficulties, the young man had been speechless for eight days. . . . Since the physicians declared they had seen no bone, I thought that the reason for the extinction of the voice was that there was a piece of bone fixed in the brain, and taking an instrument from a certain surgeon who was there, I extracted the bone from the wound, and immediately, he began to speak, and said, “Praise God, I am healed.” (O'Neill, 1980, p. 185)

## Two Early Theories on the Localization of Reason

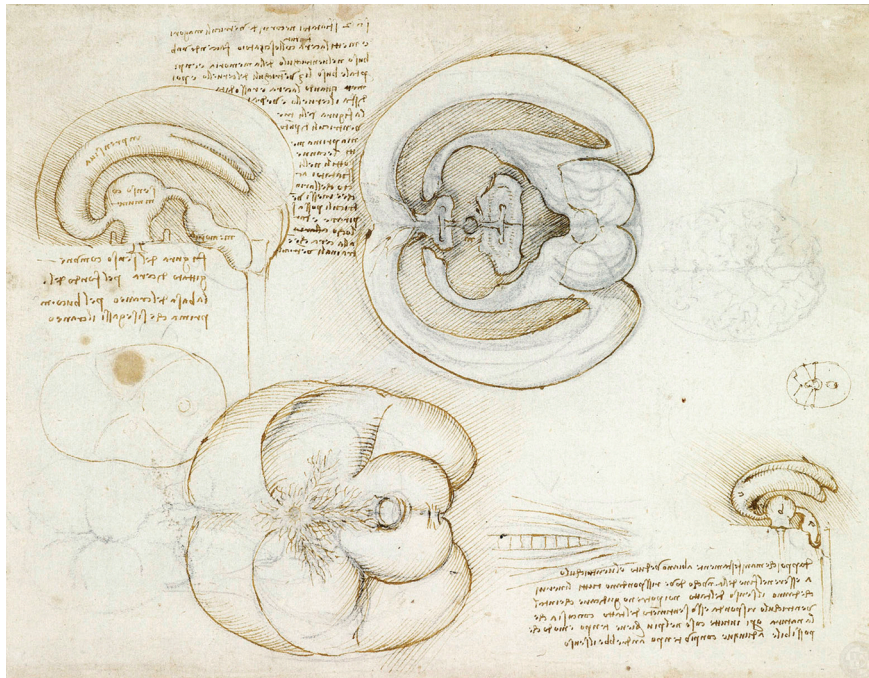
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Early medical writings were not confined to case reports of injuries. Many of them also included the authors’ thoughts on how the human body functioned. Some of the most interesting of these

are the theories of where human reasoning (and by implication, speech and language) was located in the body. One of the most long-lasting theories stated that reasoning was housed in the four cerebral ventricles. It was thought that the two lateral ventricles were where the body received sensory information from the outside world. This sensory information was believed to then move to the third ventricle, which contained the intellect. It was thought that the intellect analyzed the information and extracted meaning from sensory information. The fourth ventricle was responsible for memory—storing sensory information once it had been analyzed.

Evidence for this theory was described by such writers as Galen (ca. 130–200 BC), who observed that the closer a wound was to the ventricles, the more serious were the consequences for the patient. For instance, a surface wound to the brain usually did not result in deficits that were as significant as a wound that penetrated deeply into cerebral tissue. Because the deeper wound caused more serious damage and was closer to the ventricles, it was hypothesized that the ventricles must play an important role in cognitive abilities. Although this theory of ventricular localization was incorrect, it was nevertheless nearer to the truth than an earlier theory that placed the centers for speech and emotion in the heart. The ventricle hypothesis was an enduring one. It lasted from ancient times to the 16th century. This theory also had many noted followers, such as Leonardo da Vinci (1452–1519), who included the ventricles in many of his anatomical drawings of the nervous system (Figure 1–2). It finally was discredited when Vesalius (1514–1564) reasoned that because the cerebral ventricles in animals' brains were so similar in shape and number to those in human brains, it was unlikely that the ventricles played an especially important part in human reasoning.

A second, contemporaneous theory about the center for human reasoning held that the senses and movement were controlled by the meninges—the membranes that cover the brain and spinal cord. In brief, this theory was based on the observation that whenever the meninges were damaged by an injury, there almost always was some deficit in a patient's reasoning abilities, whether it was memory, movement, sensation, speech, or some other mental faculty. The wide acceptance of this theory is reflected by the fact that many early case studies of head injury frequently mentioned whether there was damage to the meninges, as seen in the prior quote from Massa. Another example of this can be found in a 1514 medical text by Giovanni da Vigo. He described a nobleman who was seriously injured when he fell from a horse and was kicked in the head. The man's subsequent speechlessness was attributed to sharp bone fragments that had pierced his meninges. No mention

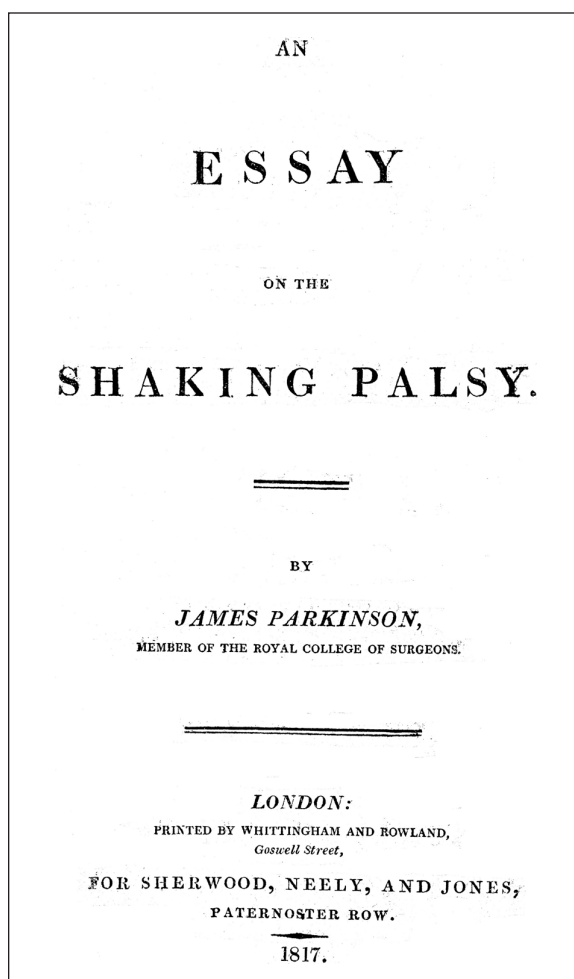


**FIGURE 1-2.** Leonardo da Vinci (1452–1519) believed that the cerebral ventricles were the containers of human intellect, and he featured them prominently in many of his anatomical drawings. This drawing is almost certainly of an ox's brain. *Source:* Image obtained from the History of Medicine database of The National Library of Medicine.

was made that the fragments might have damaged the underlying brain tissue. The meningeal theory was accepted widely for many centuries. Some physicians were still ascribing to it as late as the 16th century (O'Neill, 1980).

## From the 19th Century to Today

Before the 19th century, most descriptions of speech and language disorders were too vague to be identified as definite historical instances of motor speech disorders. Reports that seemed to describe a motor speech disorder had to remain intriguing possibilities because details were lacking. This began to change in the early 1800s, when case reports and medical descriptions became much more specific. Numerous descriptions of modern-day motor speech disorders can be found in medical texts from that period. For instance, in his 1817 account of his patients' "shaking palsy,"



**FIGURE 1-3.** The title page from James Parkinson's (1825–1824) 1817 essay on the disease that now bears his name. *Source:* Image obtained from the History of Medicine database of The National Library of Medicine.

James Parkinson (1755–1824) described their symptoms, including speech, with stark and surprising clarity (Figure 1–3). Here is an excerpt about a middle-age gardener with the shaking palsy:

As the debility increases and the influence of the will over the muscles fades away, the tremulous agitation becomes more vehement. It now seldom leaves him for a moment; but even when exhausted nature seizes a small portion of sleep, the motion becomes so violent as not only to shake the bed-hangings, but even the floor and sashes of the room. The chin is now almost immoveably bent down upon the sternum. The slops with which he is attempted to be fed, with