The image features a scroll with a central parchment fragment. The scroll is unrolled, showing a light brown parchment fragment in the center. The fragment has a rectangular box containing the title 'PHYSIOLOGY OF SPEECH' in bold, black, uppercase letters. Below the box, the author's name and credentials are listed in a smaller font.

# PHYSIOLOGY OF SPEECH

**Dr Syed Shahid Habib**  
*MBBS DSDM FCPS*  
*Associate Professor*  
*Dept. of Physiology*  
*King Saud University*

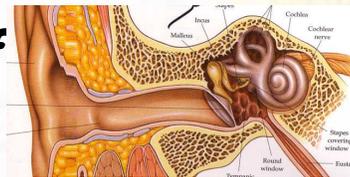
## OBJECTIVES

**At the end of this lecture the student should be able to:**

- *Describe brain speech areas as Broca's Area, Wernicke's Area and Angular Gyrus*
- *Explain sequence of events in speech production*
- *Explain speech disorders like aphasia with its types and dysarthria*

# Function of the Brain in Communication- Language Input and Language Output

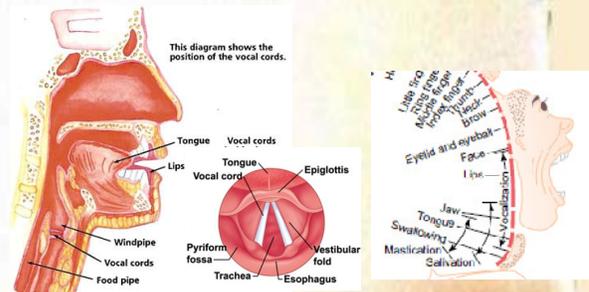
**1. Sensory Aspects of  
Communication.**

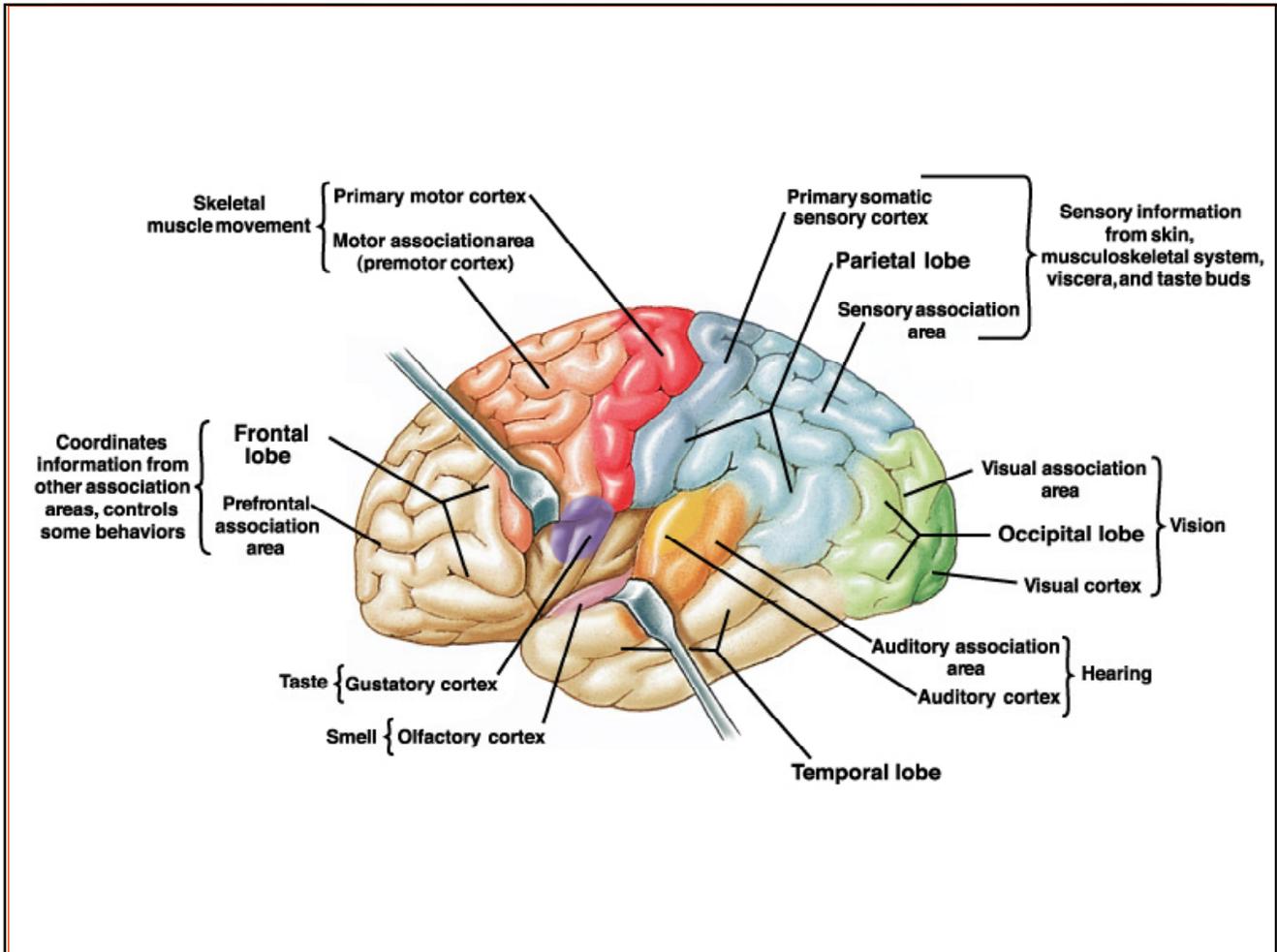


**2. Integration**

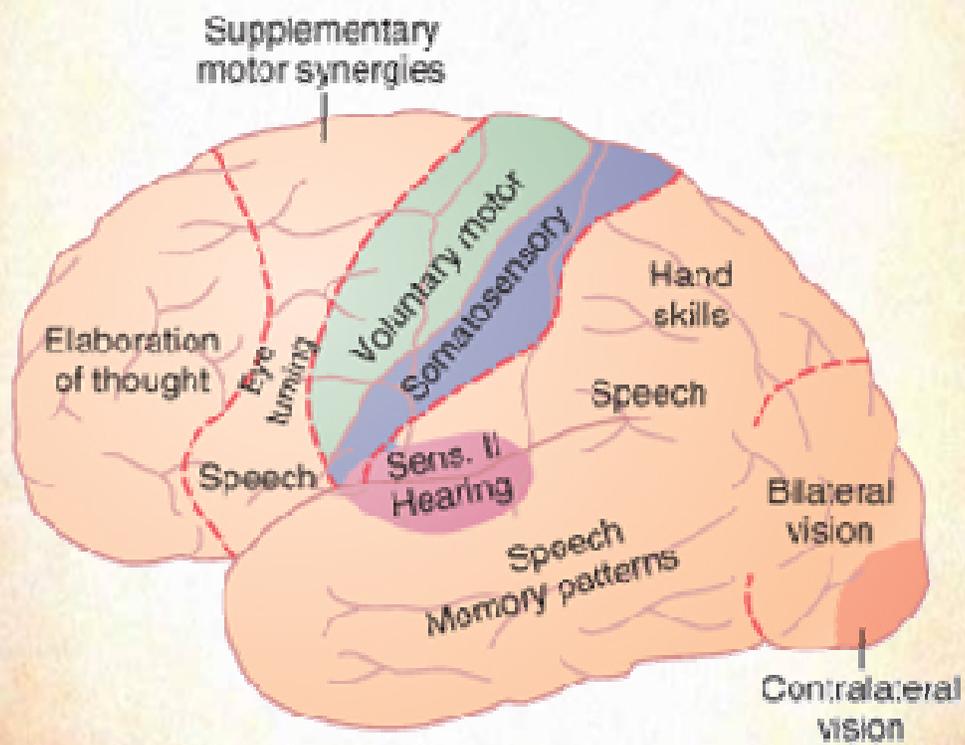
**3. Motor Aspects of  
Communication.**

**4. Articulation**

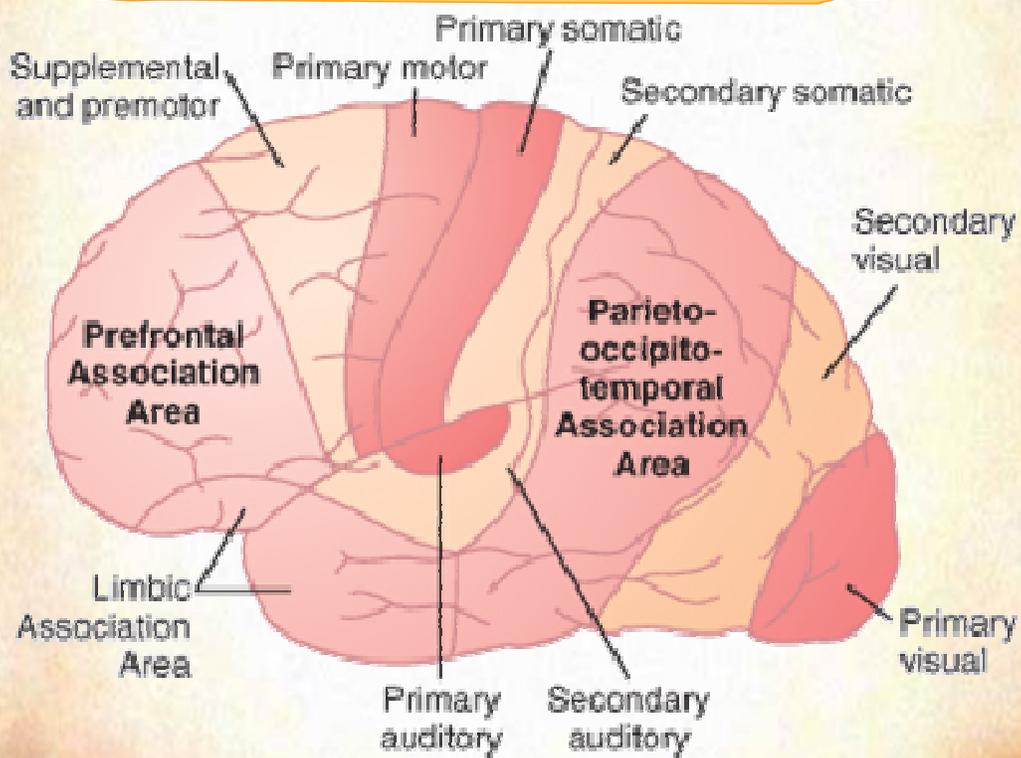




# BRAIN AREAS AND SPEECH



# PRIMARY, SECONDARY AND ASSOCIATION AREAS

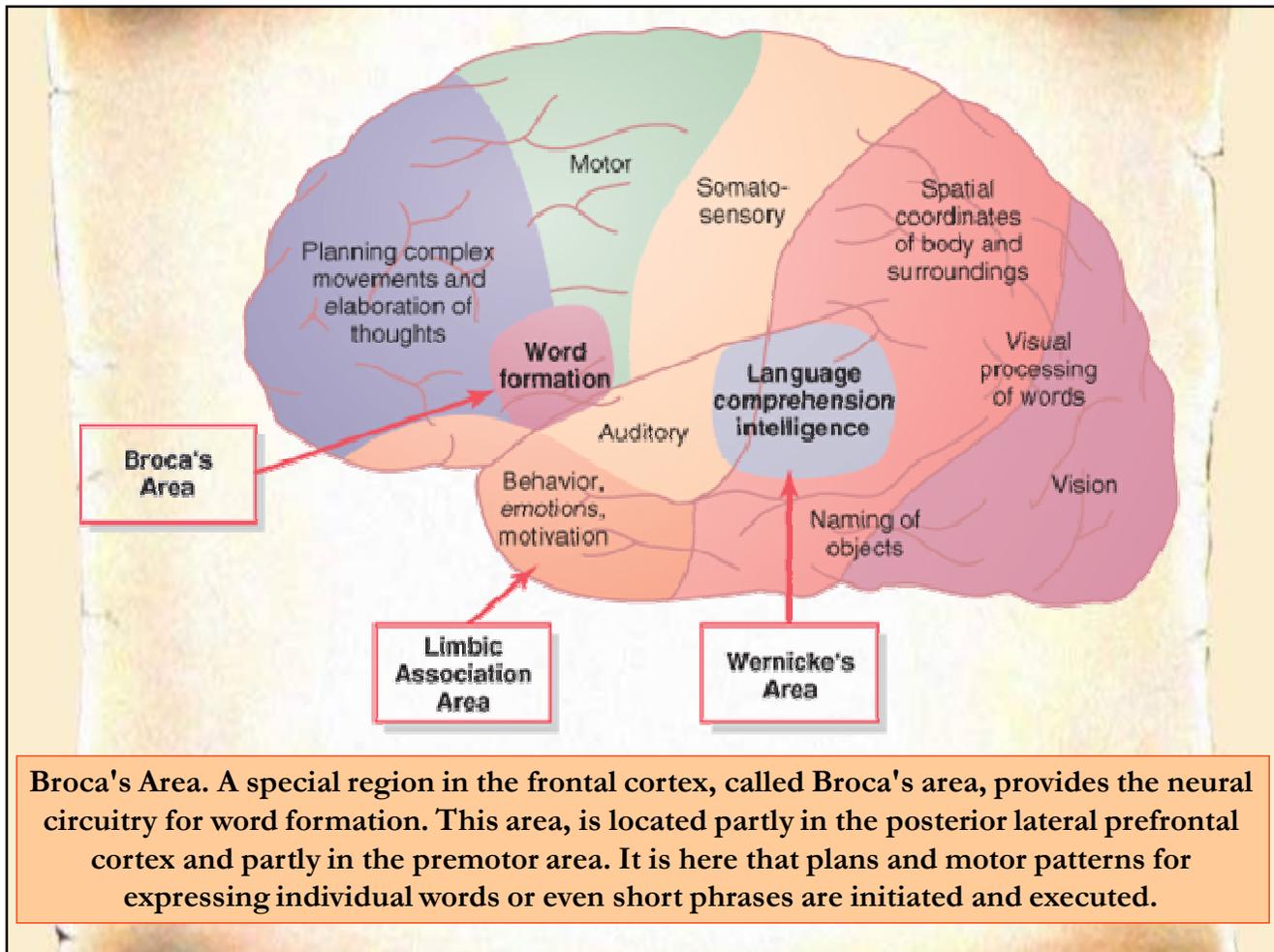


## **ASSOCIATION AREAS**

**These areas receive and analyze signals simultaneously from multiple regions of both the motor and sensory cortices as well as from subcortical structures.**

**The most important association areas are**

- (1) Parieto-occipitotemporal association area**
- (2) prefrontal association area**
- (3) limbic association area.**



## PARIETO-OCCIPITOTEMPORAL ASSOCIATION AREAS

- 1. Analysis of the Spatial Coordinates of the Body.
- 2. Language Comprehension.
- 3. Initial Processing of Visual Language (Reading).
- 4. Area for Naming Objects.



## PARIETO-OCCIPITOTEMPORAL ASSOCIATION AREAS

AREA	SITE	FUNCTION
Analysis of the Spatial Coordinates of the Body.	beginning in the posterior parietal cortex and extending into the superior occipital cortex	computes the coordinates of the visual, auditory, and body surroundings.
Area for Language Comprehension	Wernicke's area, lies behind the primary auditory cortex in the posterior part of the superior gyrus of the temporal lobe.	higher intellectual function
Area for Initial Processing of Visual Language (Reading).	angular gyrus area	make meaning out of the visually perceived words (Dyslexia or Word Blindness)
Area for Naming Objects.	angular gyrus area	naming objects.

## FASCIAL RECOGNITION AREAS

One wonders why so much of the cerebral cortex should be reserved for the simple task of face recognition?

Facial recognition area

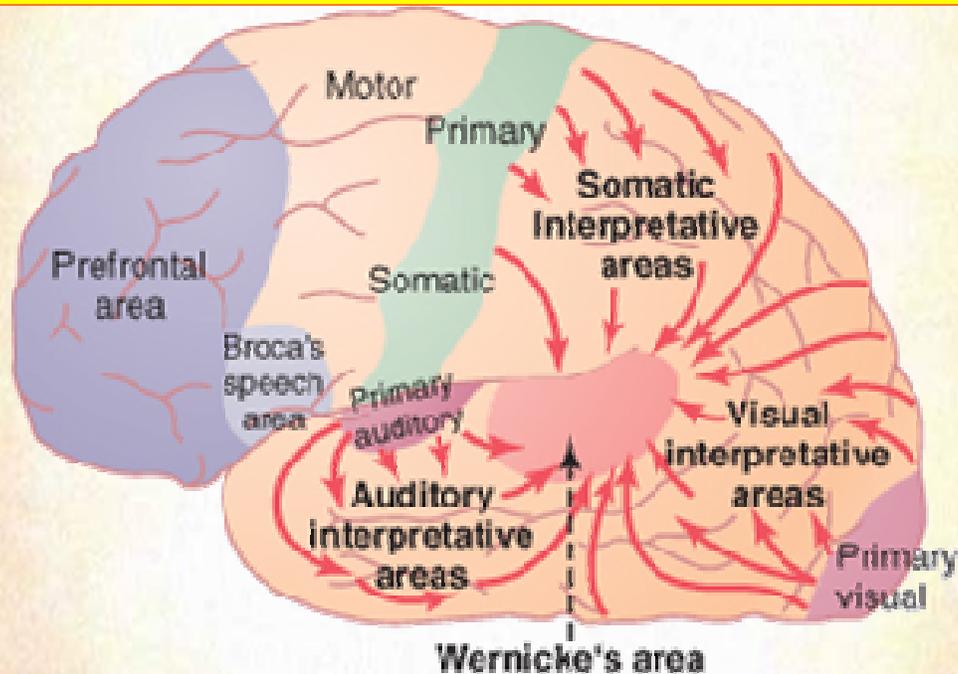
medial undersides of both occipital lobes and along the medioventral surfaces of the temporal lobes

Temporal lobe

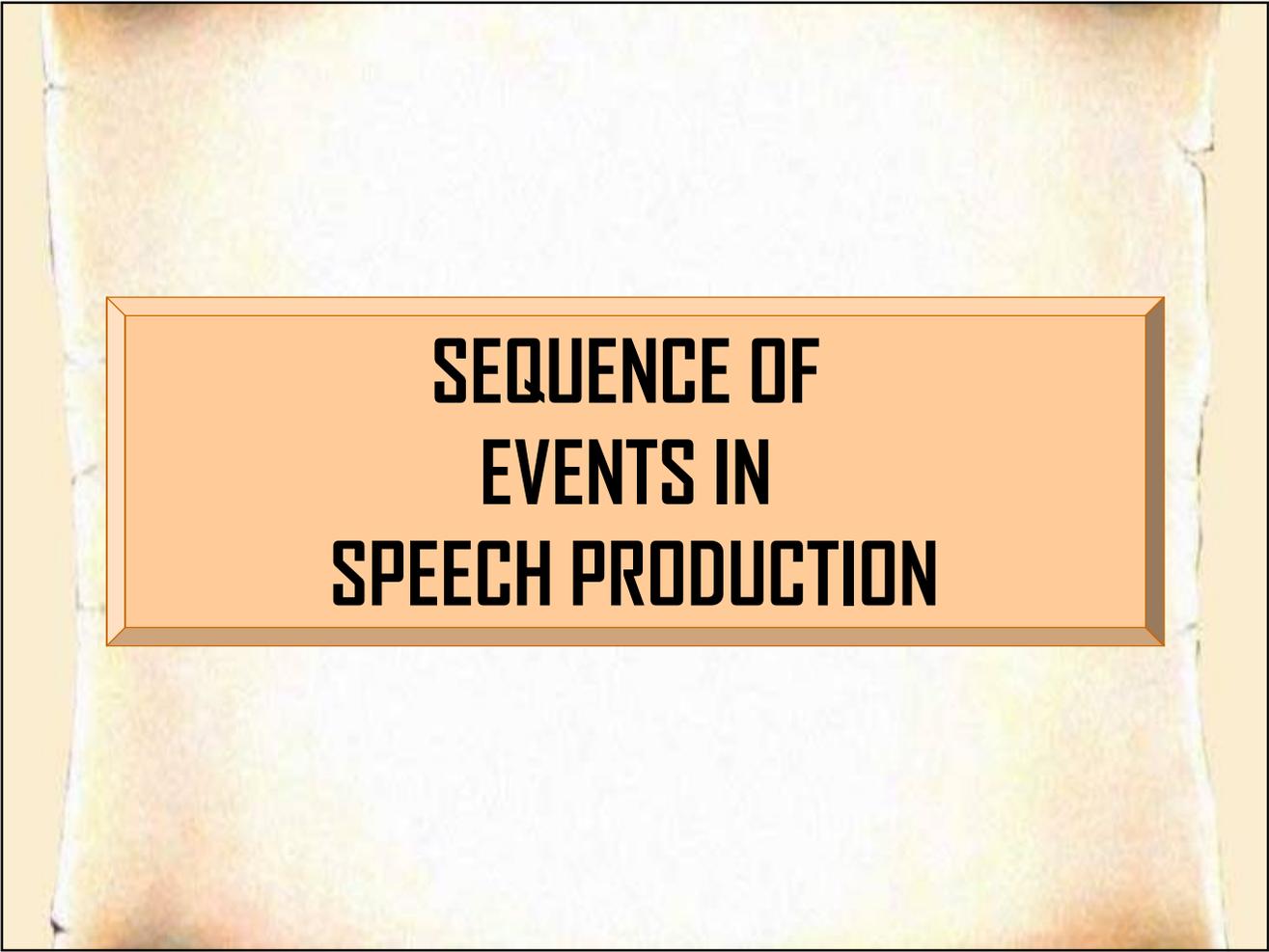
Frontal lobe

***Prosopagnosia***

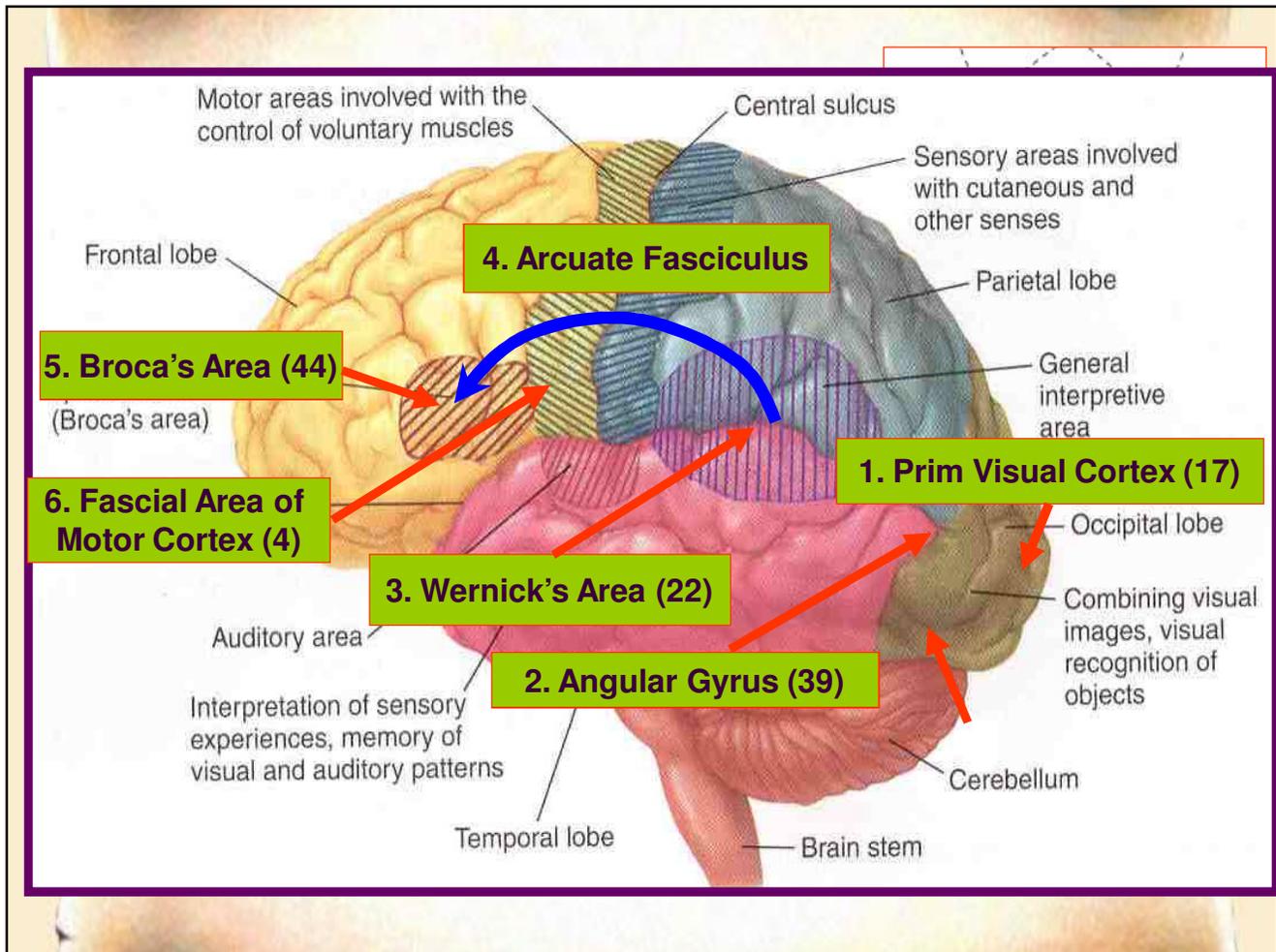
**Comprehensive Interpretative Function of the Posterior Superior Temporal Lobe-"Wernicke's Area" (a General Interpretative Area)  
GNOSTIC AREA, the KNOWING AREA, the TERTIARY ASSOCIATION AREA,**

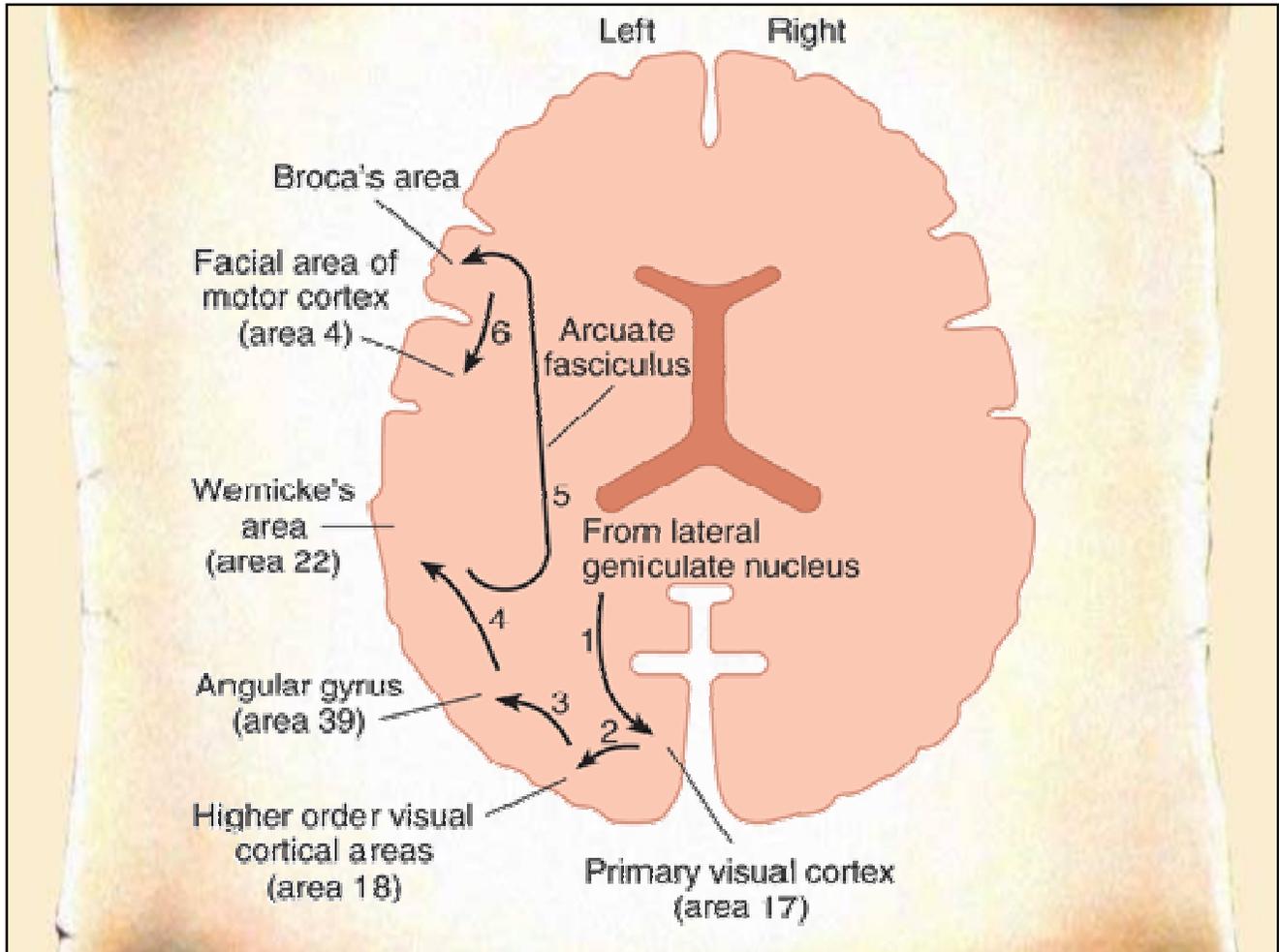


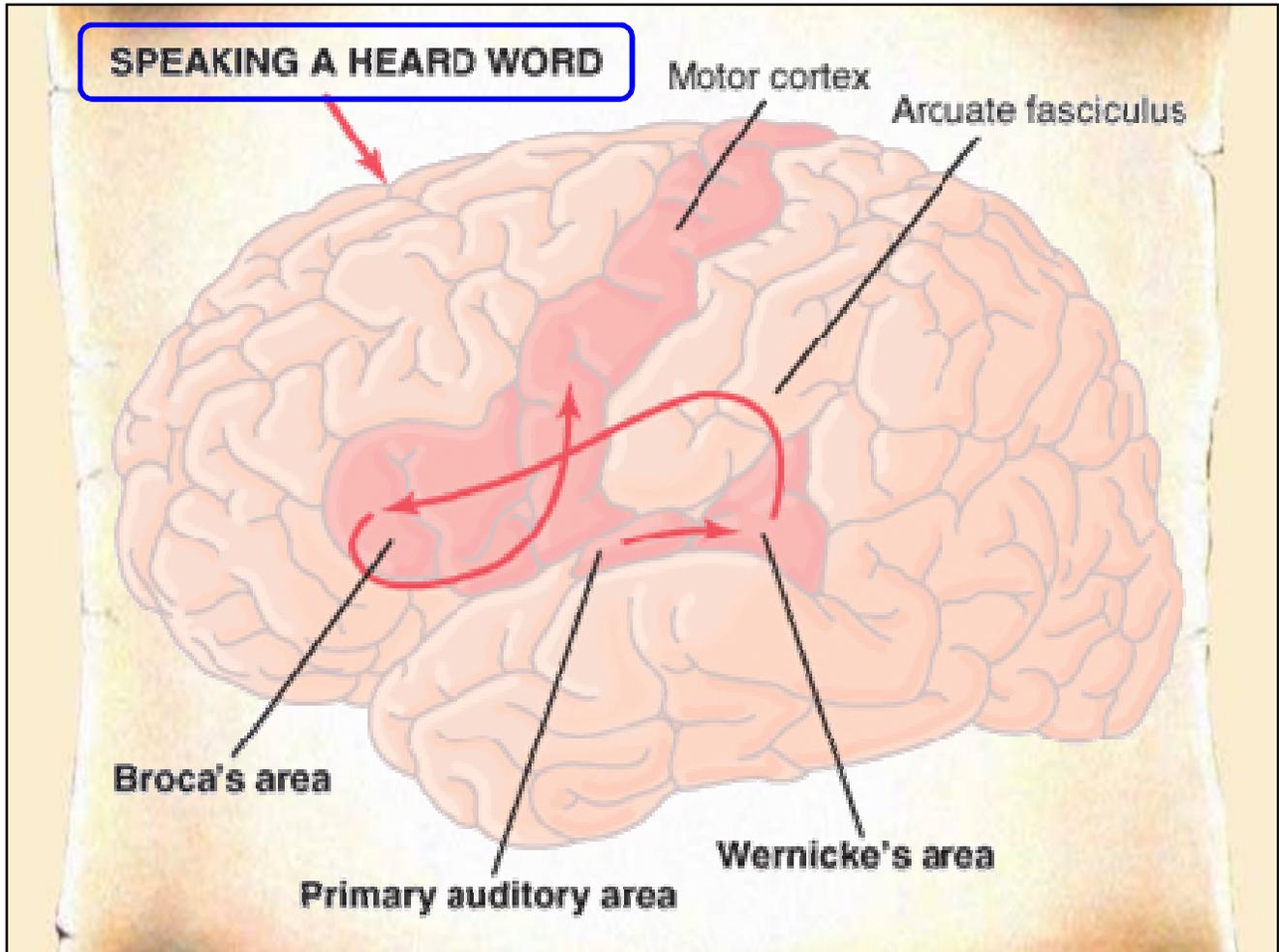
**After severe damage in Wernicke's area, a person might hear perfectly well and even recognize different words but still be unable to arrange these words into a coherent thought.**

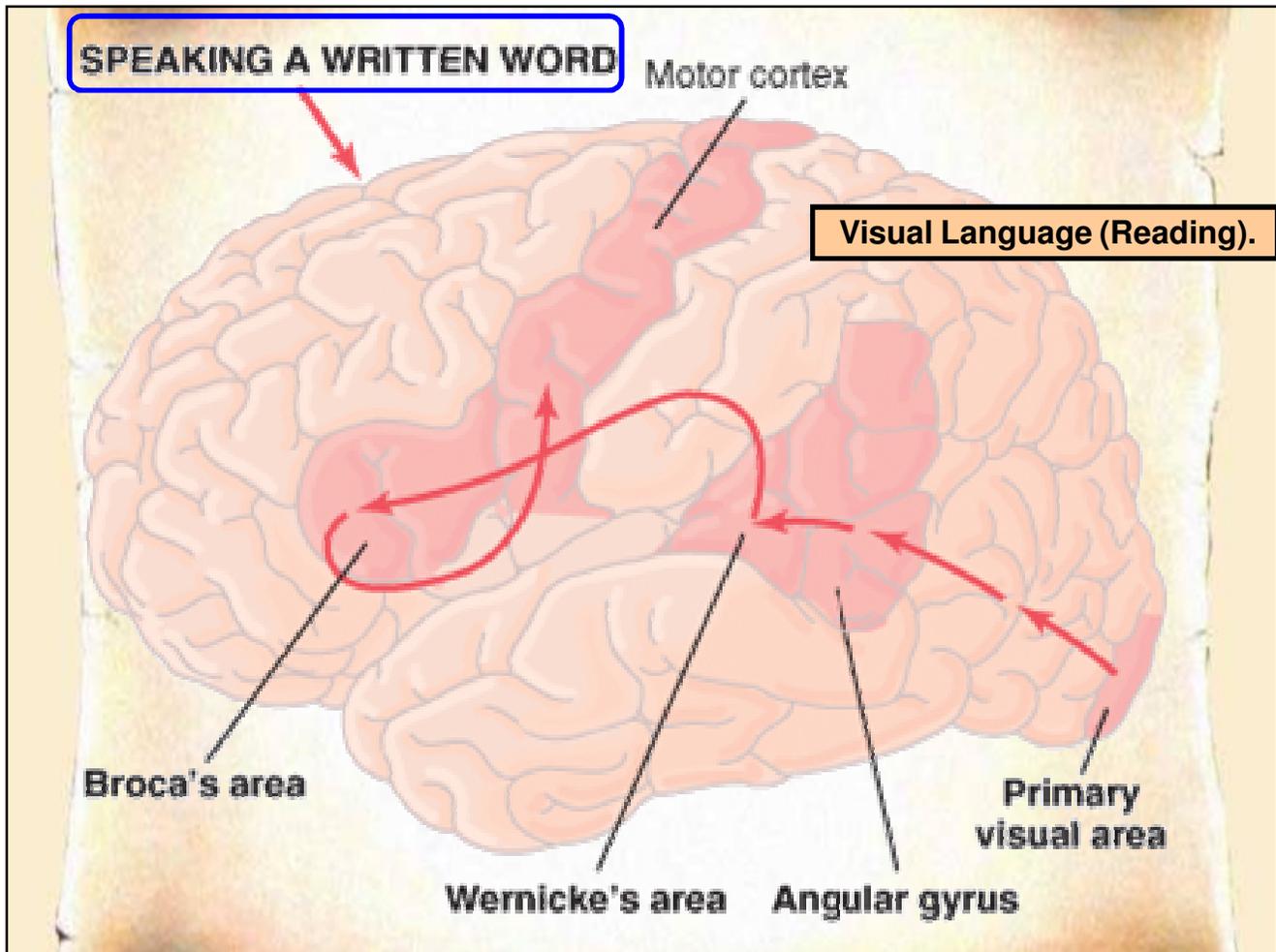


**SEQUENCE OF  
EVENTS IN  
SPEECH PRODUCTION**







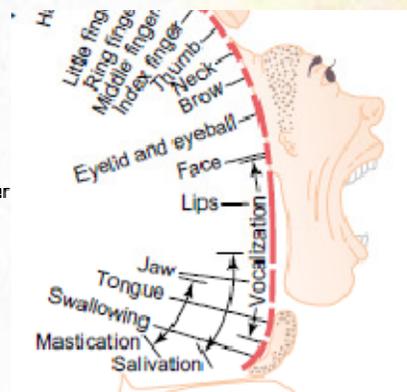
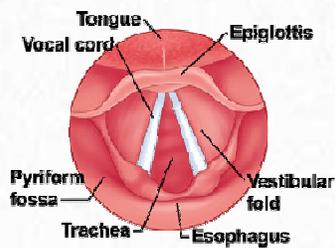
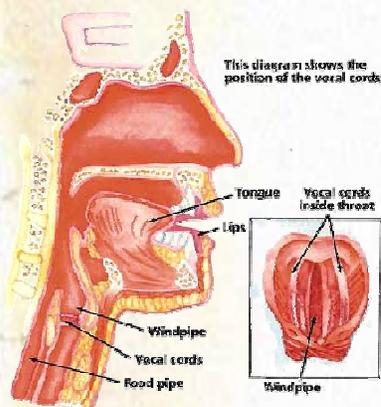


AREA/LESION	LESION FAETURES
Auditory association areas	Word deafness
Visual association areas	Word blindness called dyslexia
Wernicke's Aphasia	Unable to interpret the thought
Broca's Aphasia	Motor Aphasia
Global Aphasia	Unable to interpret the thought Motor Aphasia
Conduction Aphasia	Fluent speech but conveys information imperfectly Repetition Affected

## **ARTICULATION**

- **Means the muscular movements of the mouth, tongue, larynx, vocal cords**
- **Responsible for the intonations, timing, and rapid changes in intensities of the sequential sounds.**
- **The facial and laryngeal regions of the motor cortex activate these muscles, and the cerebellum, basal ganglia, and sensory cortex all help to control the sequences and intensities of muscle contractions**

# ARTICULATION



## **Brain Areas Concerned with Language**

- **Wernick's Area**
- **Broca's Area**
- **Angular Gyrus**
- **Arcuate Fasciculus**
- **Visual Processing Areas**
- **Auditory Processing Areas**
- **Motor Cortex (Articulation)**
- **Insula (Articulation)**

# Motor Homonculus





**SPEECH DISORDERS**

# **APHASIA**

## **CATEGORICAL HEMISPHERE**

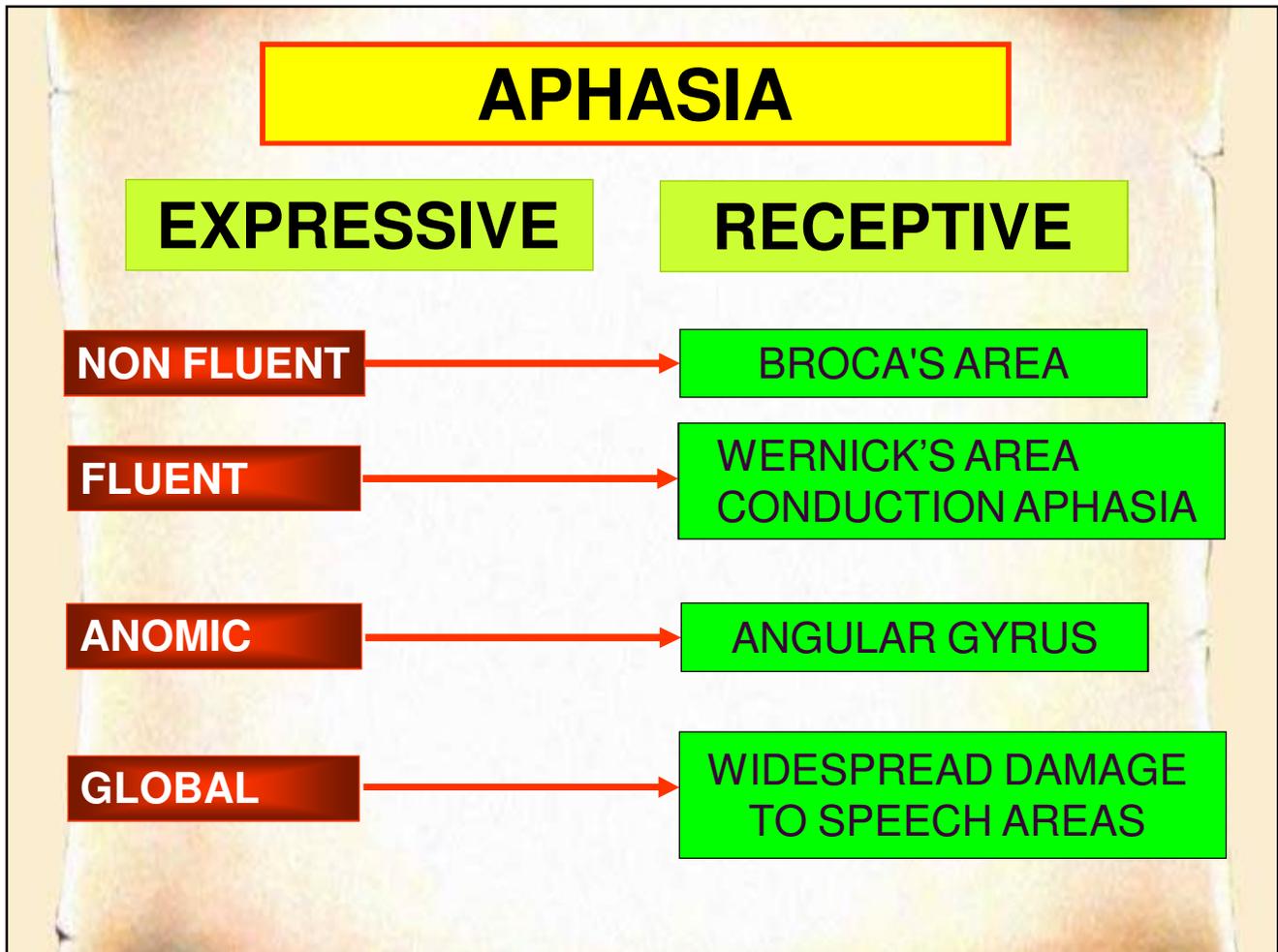
**APHASIA IS LOSS OF OR DEFECTIVE LANGUAGE FROM DAMAGE TO THE SPEECH CENTRES WITHIN THE LEFT HEMISPHERE.**

# **DYSARTHRIA**

**DYSARTHRIA SIMPLY MEANS DISORDERED ARTICULATION - SLURRED SPEECH. LANGUAGE IS INTACT, CF. APHASIA.**

## **REMEMBER THAT**

**IN APHASIA THERE IS NO DAMAGE TO VISION, HEARING OR MOTOR PARALYSIS. THE DAMAGE IS IN SPEECH CENTERS IN CATEGORICAL HEMISPHERES**



## **BROCA'S APHASIA**

**(EXPRESSIVE APHASIA, ANTERIOR APHASIA)**

**Damage in the left frontal lobe causes reduced speech fluency with comprehension preserved.**

**The patient makes great efforts to initiate language, which becomes reduced to a few disjointed words. There is failure to construct sentences.**

**Patients who recover from this form of aphasia say they knew what they wanted to say, but 'could not get the words out'.**

## WERNICKE'S APHASIA (RECEPTIVE APHASIA, POSTERIOR APHASIA)

**Left temporo-parietal damage** leaves language that is fluent but the words themselves are incorrect. This varies from insertion of a few incorrect or nonexistent words into **fluent speech to a profuse outpouring of jargon** (that is, rubbish with wholly nonexistent words). Severe jargon aphasia may be bizarre - and confused with psychotic behaviour.

Patients who have recovered from Wernicke's aphasia say that when aphasic they found speech, both their own and others', like a wholly unintelligible foreign language. They could neither stop themselves, nor understand themselves and others.

## **GLOBAL APHASIA (CENTRAL APHASIA)**

This means the **combination** of the expressive problems of Broca's aphasia and the loss of comprehension of Wernicke's. The patient can **neither speak nor understand** language. It is due to widespread damage to speech areas and is the commonest aphasia after a severe left hemisphere infarct. Writing and reading are also affected.

# DYSARTHRIA

## DISORDERED ARTICULATION

Slurred speech.

Language is intact, cf. aphasia.

Paralysis, slowing or incoordination of muscles of articulation or local discomfort causes various different patterns of dysarthria.

### Examples

- 'gravelly' speech of upper motor neurone lesions of lower cranial nerves,
- jerky, ataxic speech of cerebellar lesions (Scanning Speech),
- the monotone of Parkinson's disease (Slurred),
- speech in myasthenia that fatigues and dies away.

**Many aphasic patients are also somewhat dysarthric.**

## **STUTTERING** التأتأة

- **Have right cerebral dominance and widespread overactivity in the cerebral cortex and cerebellum. This includes increased activity of the supplementary motor area.**

## THE NON-DOMINANT HEMISPHERE

## REPRESENTATIONAL HEMISPHERE

- Understanding and interpreting music,
- Nonverbal visual experiences (especially visual patterns),
- Spatial relations between the person and their surroundings,
- The significance of "body language"
- Intonations of people's voices, and probably
- Many somatic experiences related to use of the limbs and hands eg;

*dresssing or constructional apraxia*

## ***Terms to Remember***

- **Dysarthria**
- **Broca's aphasia**
- **Wernicke's aphasia**
- **Conduction aphasia**
- **Anomic aphasia**
- **Global aphasia**
- **Dyslexia**
- **Acalculia**
- **Prosopagnosia**
- **Achromatopsia**
- **Stuttering**



# BROCA'S AREA

LOCATED AT THE BASE OF THE PRECENTRAL GYRUS, IN THE LEFT HEMISPHERE

DAMAGE TO THIS AREA CAUSES INABILITY TO SAY WORDS PROPERLY

