



PHYSIOLOGY OF SPEECH

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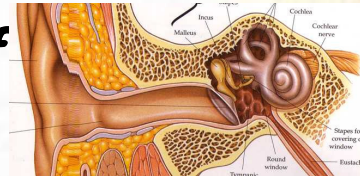
OBJECTIVES

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

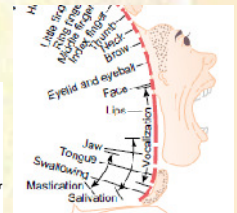
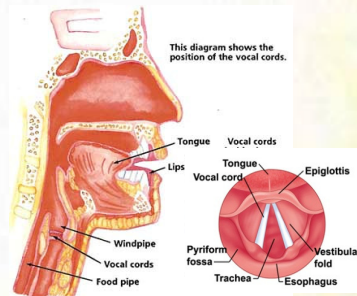
**1. Sensory Aspects of
Communication.**

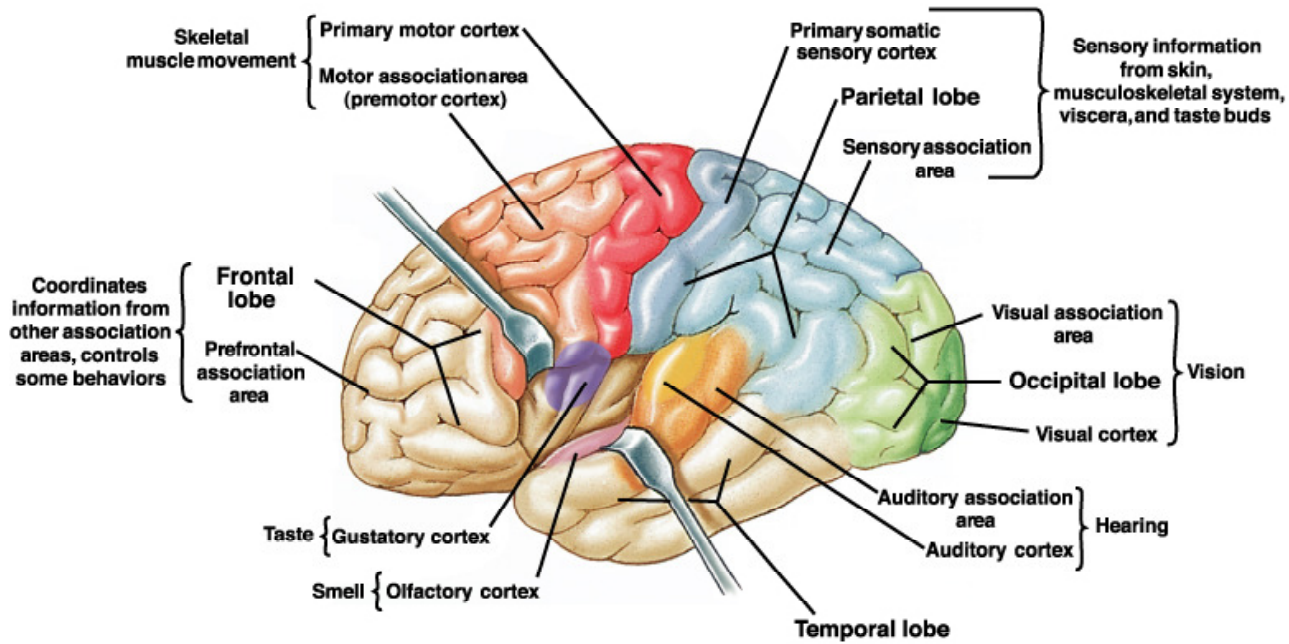


2. Integration

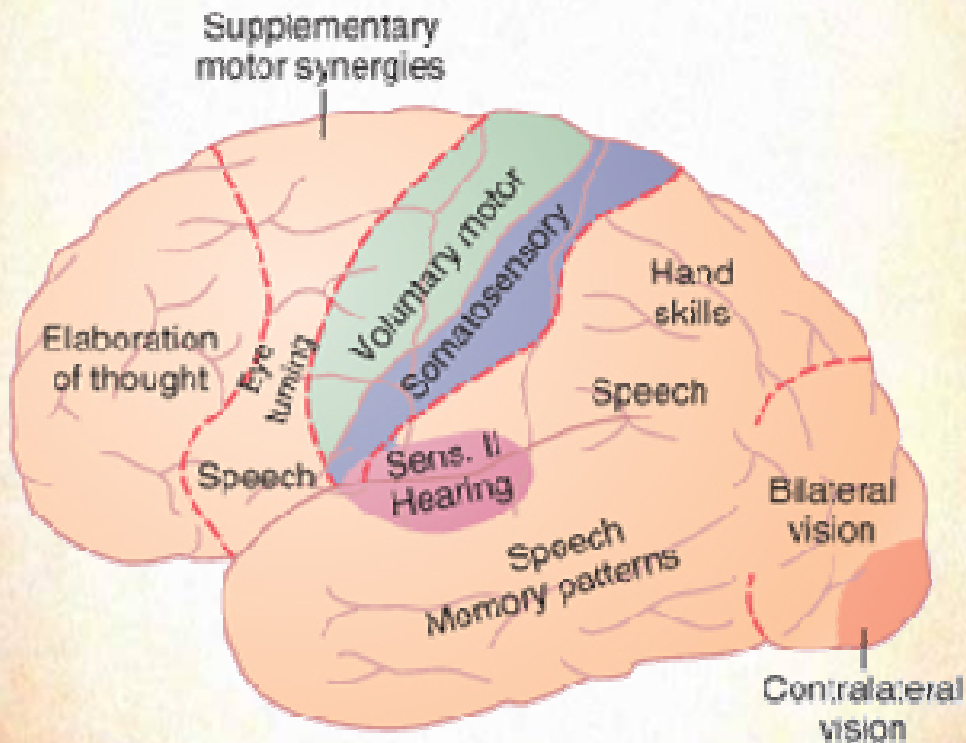
**3. Motor Aspects of
Communication.**

4. Articulation

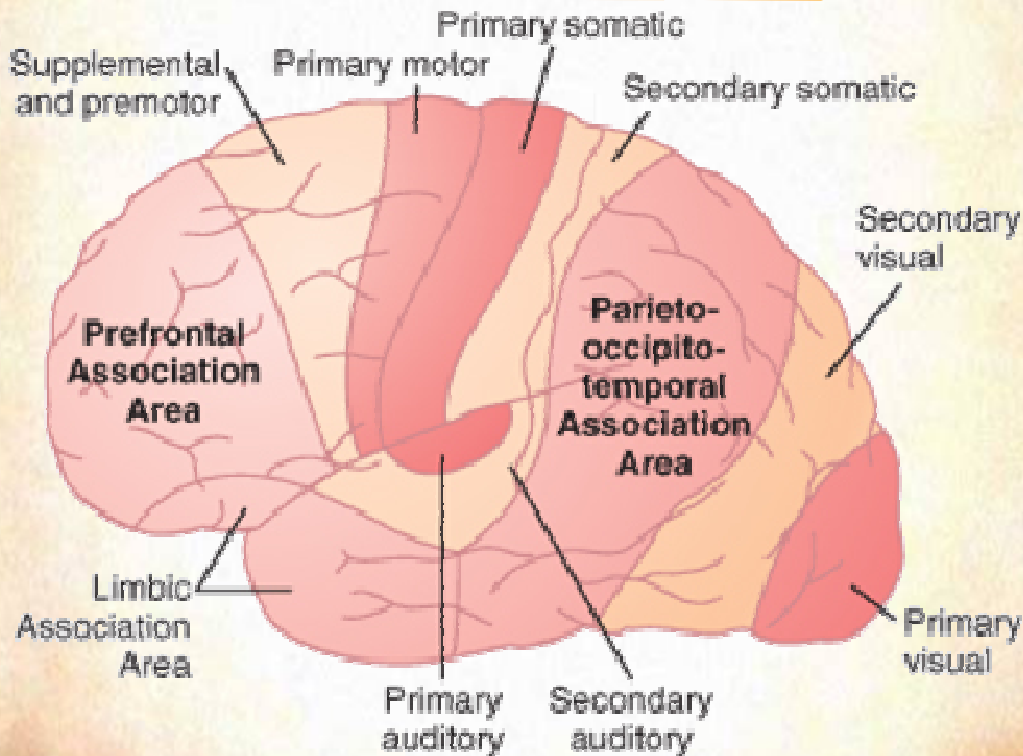




BRAIN AREAS AND SPEECH



PRIMARY, SECONDARY AND ASSOCIATION AREAS

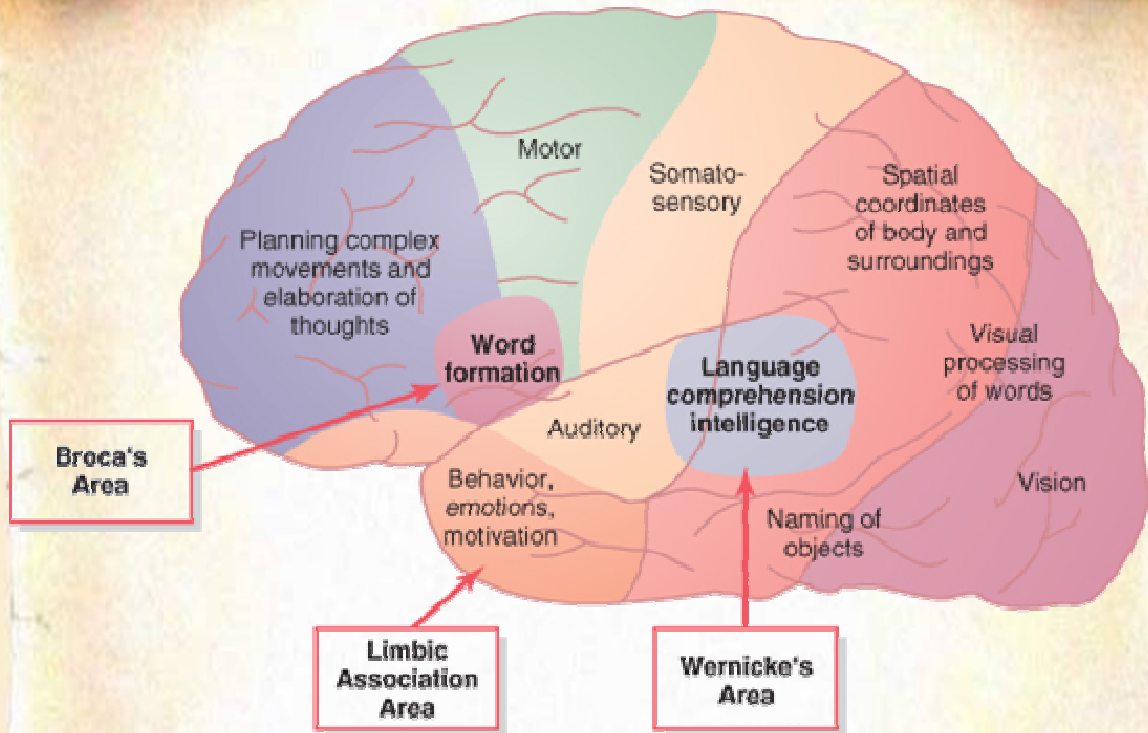


ASSOCIATION AREAS

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.**



Broca's Area. A special region in the frontal cortex, called Broca's area, provides the neural circuitry for word formation. This area, is located partly in the posterior lateral prefrontal cortex and partly in the premotor area. It is here that plans and motor patterns for expressing individual words or even short phrases are initiated and executed.

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.



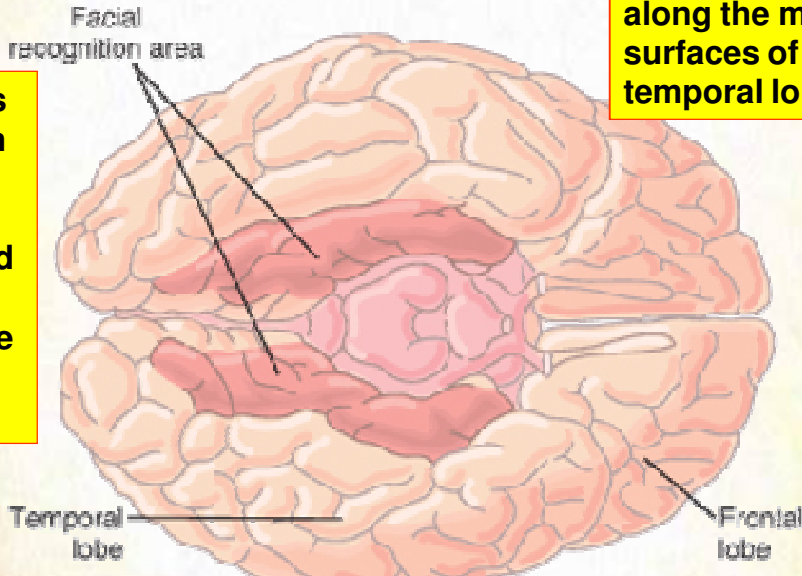
PARIETO-OCCIPITOTEMPORAL ASSOCIATION AREAS

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

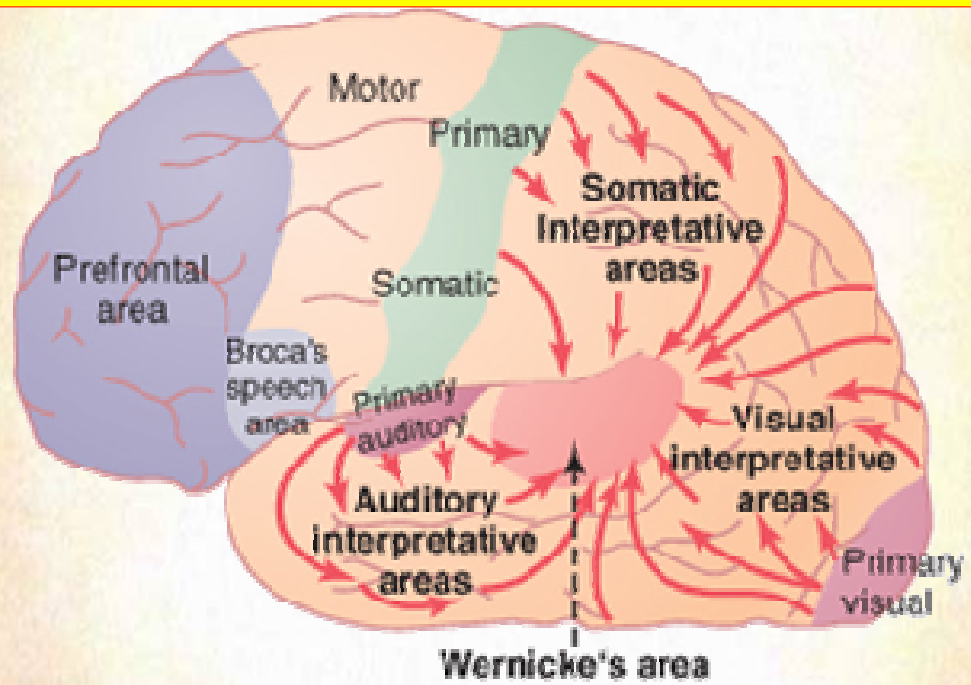
medial undersides of both occipital lobes and along the medioventral surfaces of the temporal lobes

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



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**

Motor areas involved with the control of voluntary muscles

Central sulcus

Sensory areas involved with cutaneous and other senses

Frontal lobe

4. Arcuate Fasciculus

Parietal lobe

5. Broca's Area (44)

(Broca's area)

General interpretive area

1. Prim Visual Cortex (17)

6. Fascial Area of Motor Cortex (4)

Occipital lobe

3. Wernick's Area (22)

Combining visual images, visual recognition of objects

Auditory area

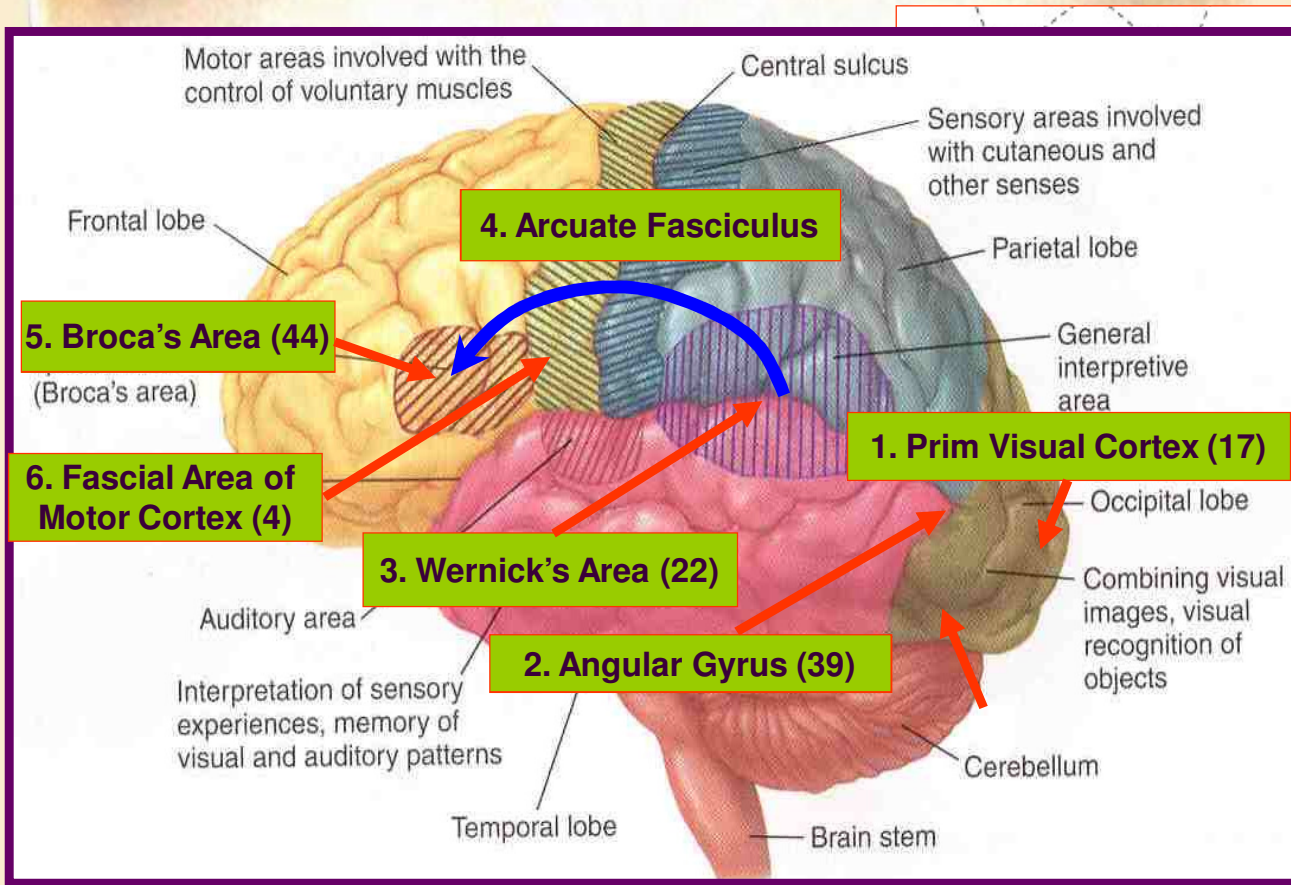
2. Angular Gyrus (39)

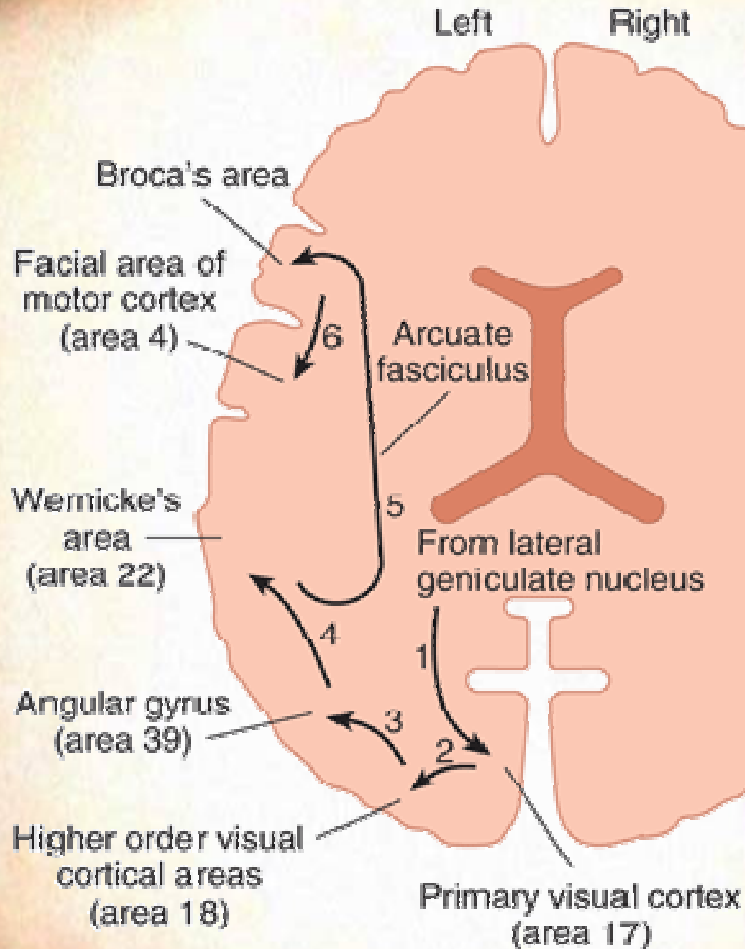
Interpretation of sensory experiences, memory of visual and auditory patterns

Cerebellum

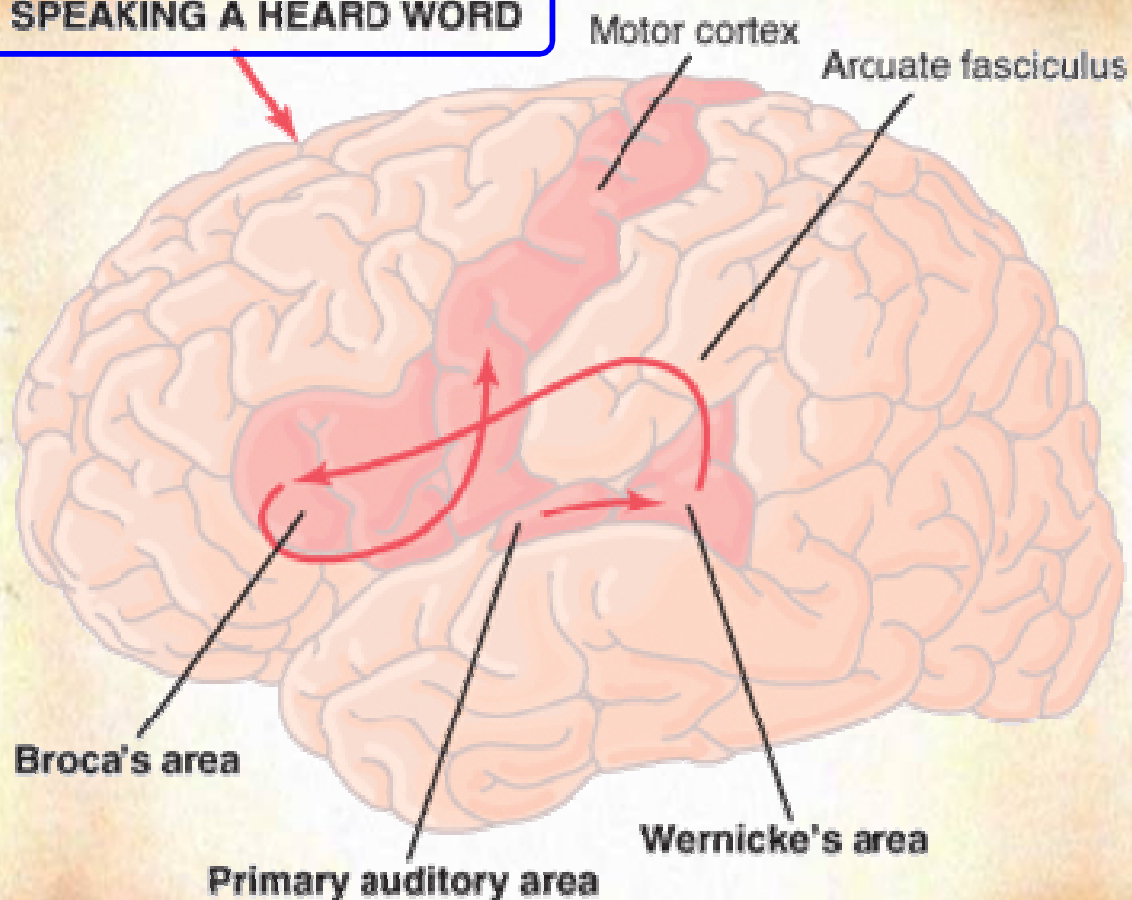
Temporal lobe

Brain stem

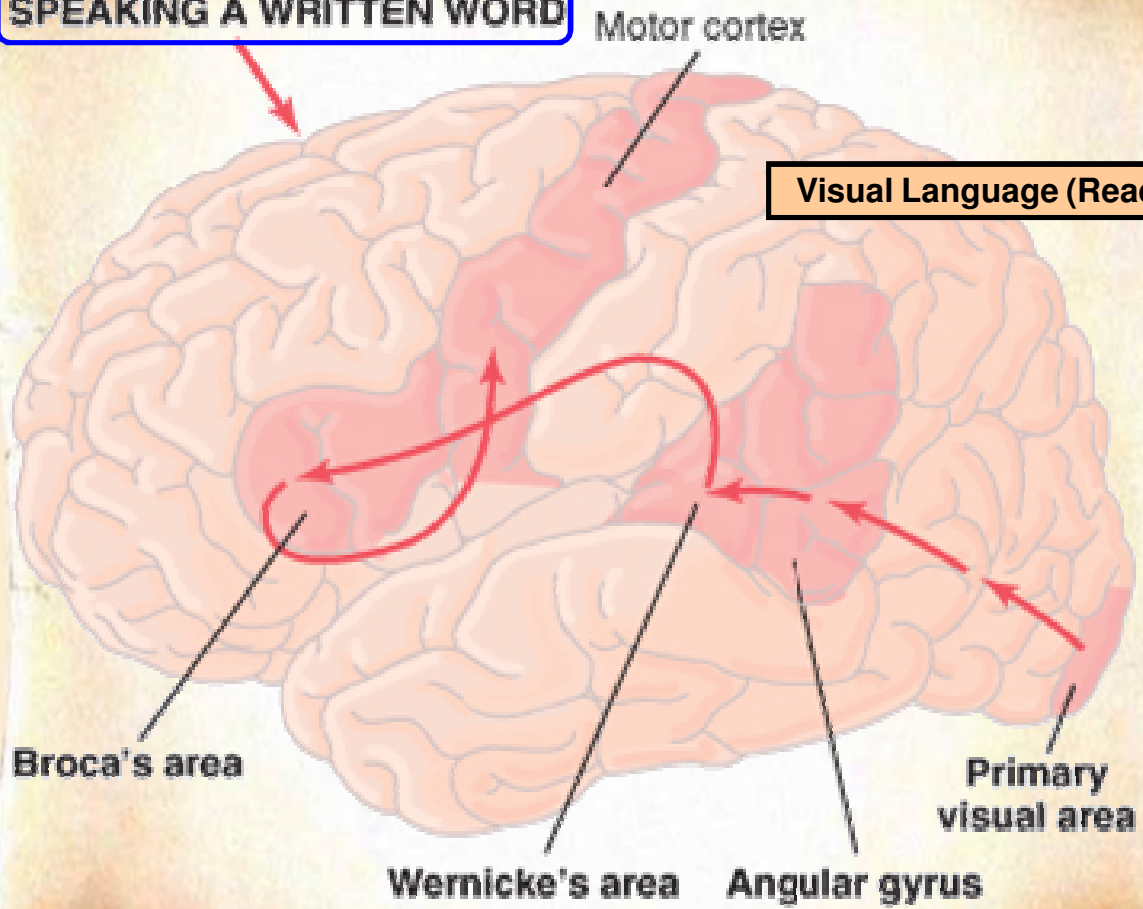




SPEAKING A HEARD WORD



SPEAKING A WRITTEN WORD



Motor cortex

Visual Language (Reading).

Broca's area

Wernicke's area

Angular gyrus

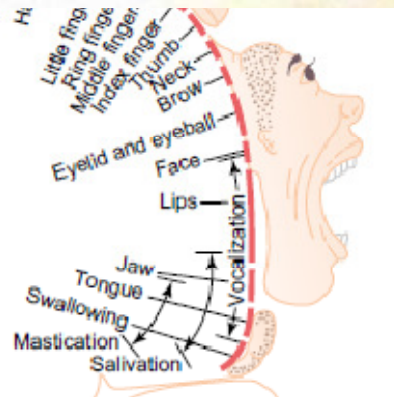
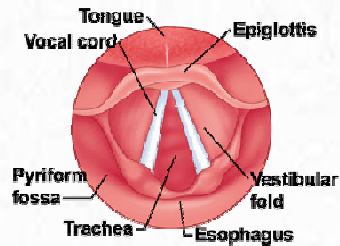
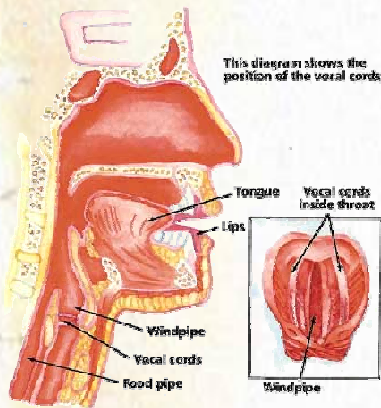
Primary visual area

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**

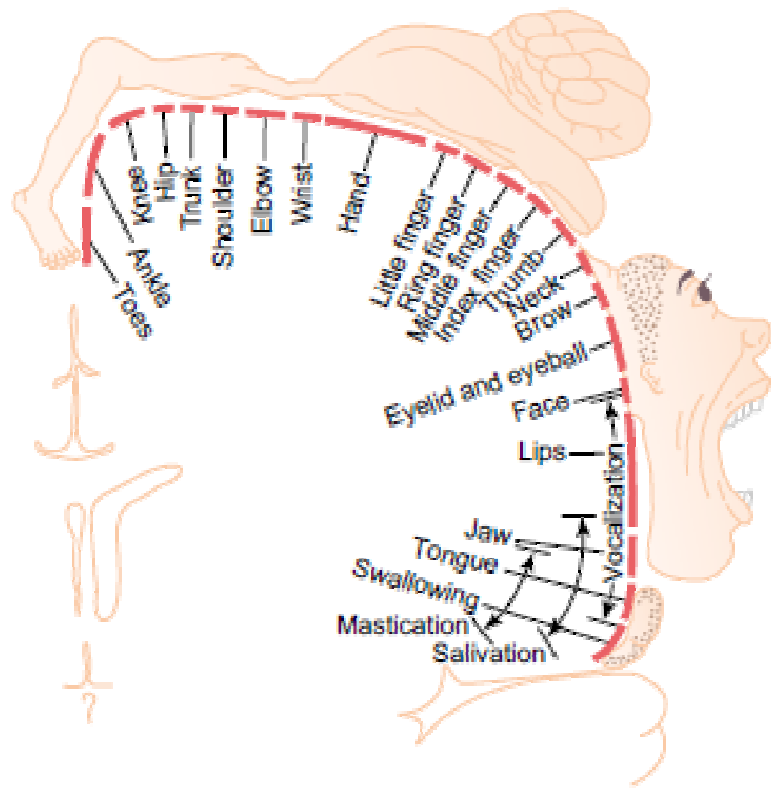
ARTICULATION



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



The background is a light, textured surface, possibly aged paper or parchment, with a warm, yellowish-beige tone. A central horizontal banner in a solid orange color contains the text. The banner has slightly irregular, hand-drawn edges. The text is centered within the banner and is written in a bold, black, sans-serif font.

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

APHASIA

EXPRESSIVE

RECEPTIVE

NON FLUENT

BROCA'S AREA

FLUENT

**WERNICK'S AREA
CONDUCTION APHASIA**

ANOMIC

ANGULAR GYRUS

GLOBAL

**WIDESPREAD DAMAGE
TO SPEECH AREAS**

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

