



PHYSIOLOGY OF SPEECH

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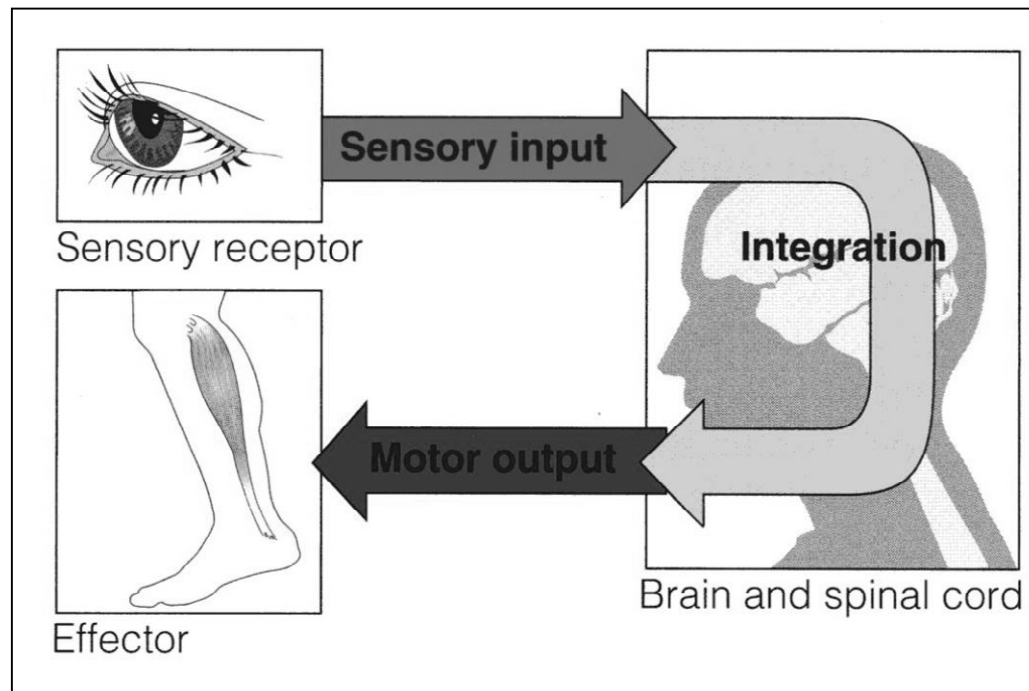
OBJECTIVES

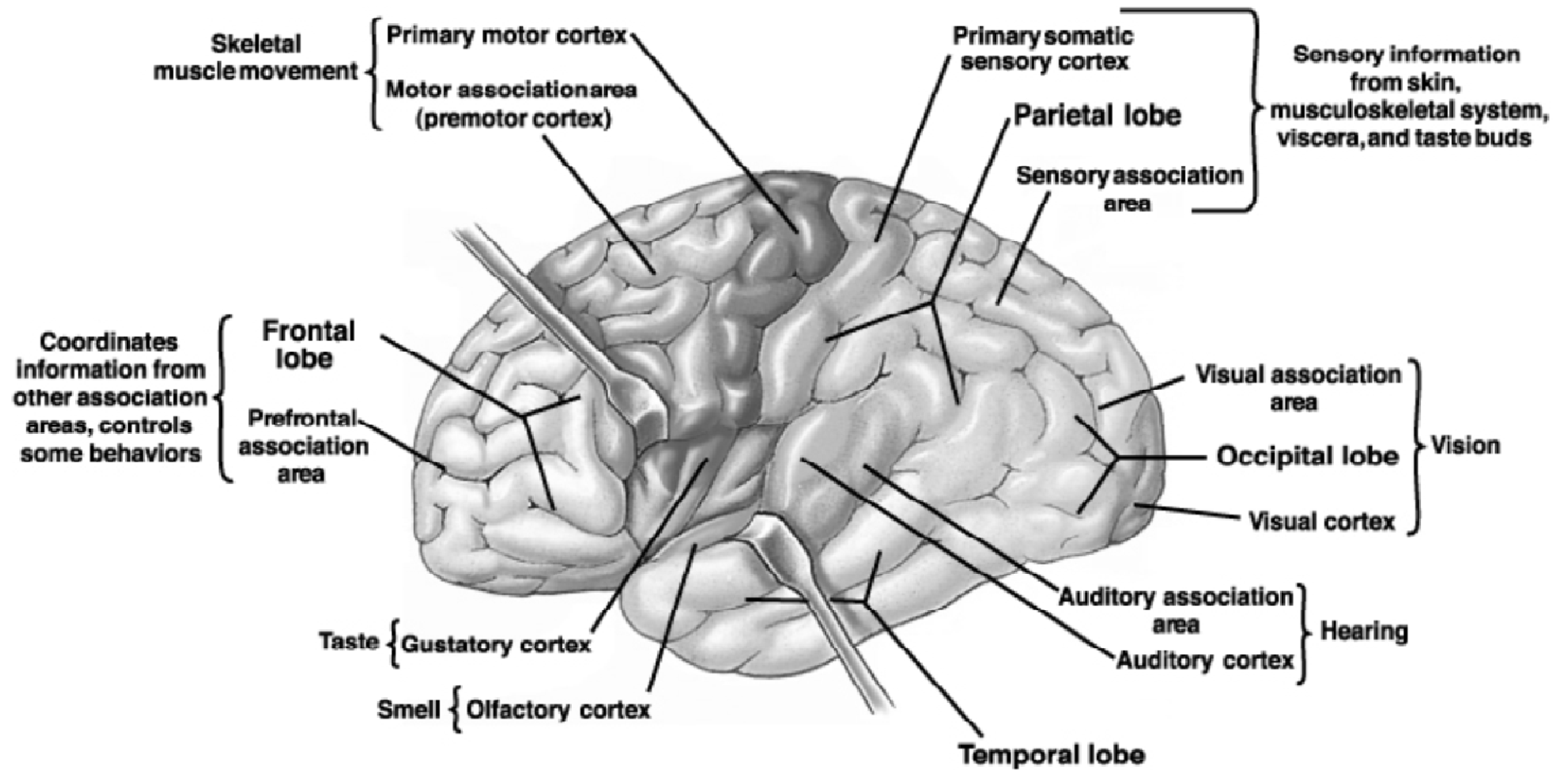
• At the end of this lecture the student should be able to:

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

FUNCTIONS OF NERVOUS SYSTEM

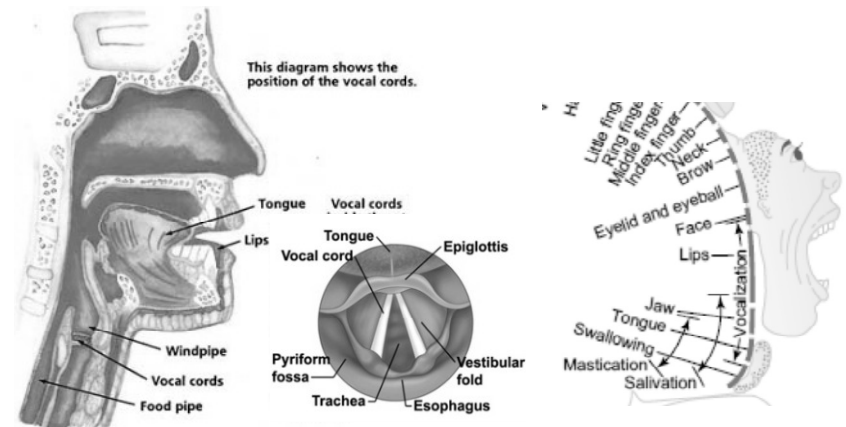
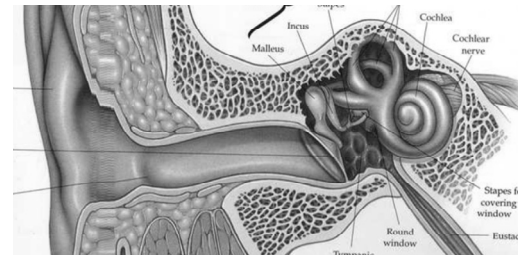
- **Collection of sensory input**
- **Integration**
- **Motor output**



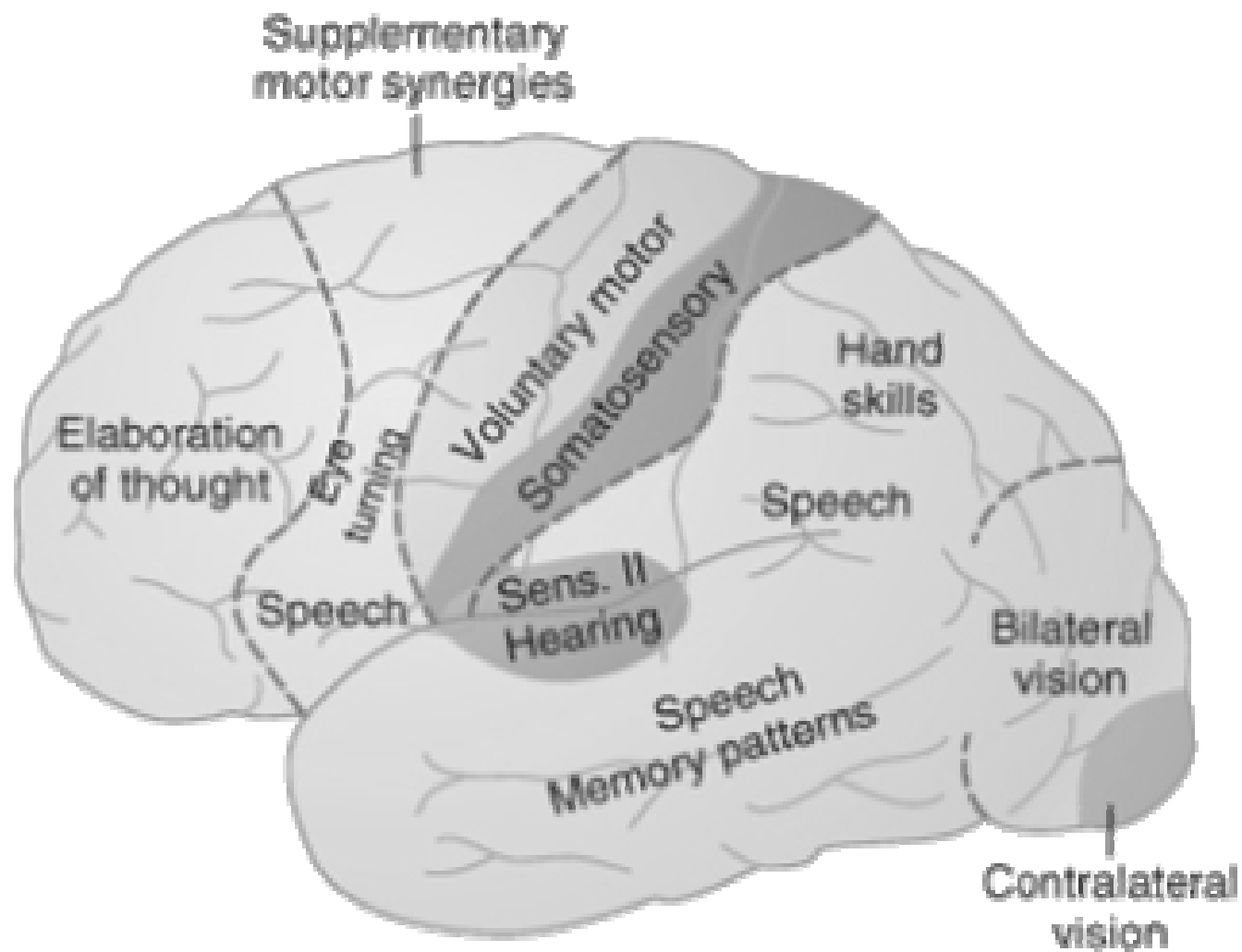


Function of the Brain in Communication- Language Input and Language Output

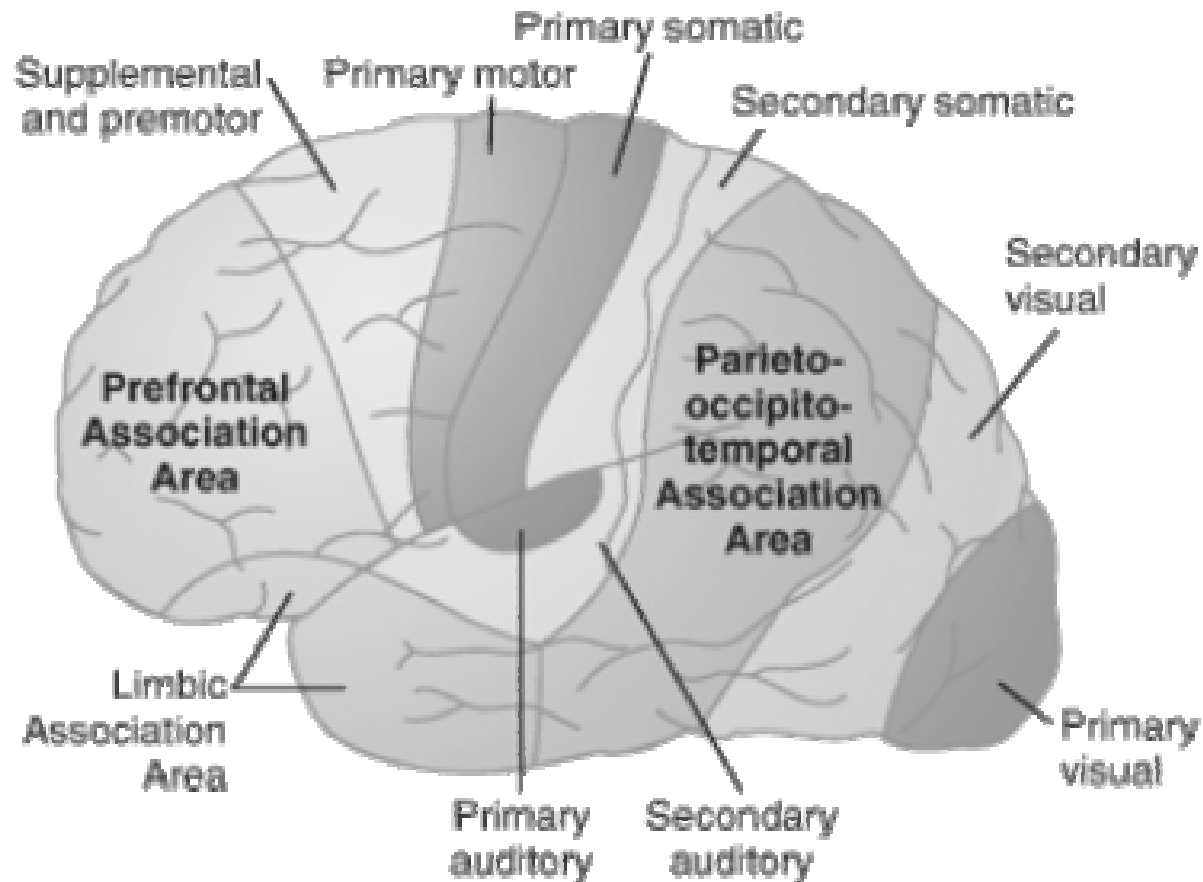
1. Sensory Aspects of Communication.
2. Integration
3. Motor Aspects of Communication.
4. Articulation.



BRAIN AREAS AND SPEECH



PRIMARY, SECONDARY AND ASSOCIATION AREAS

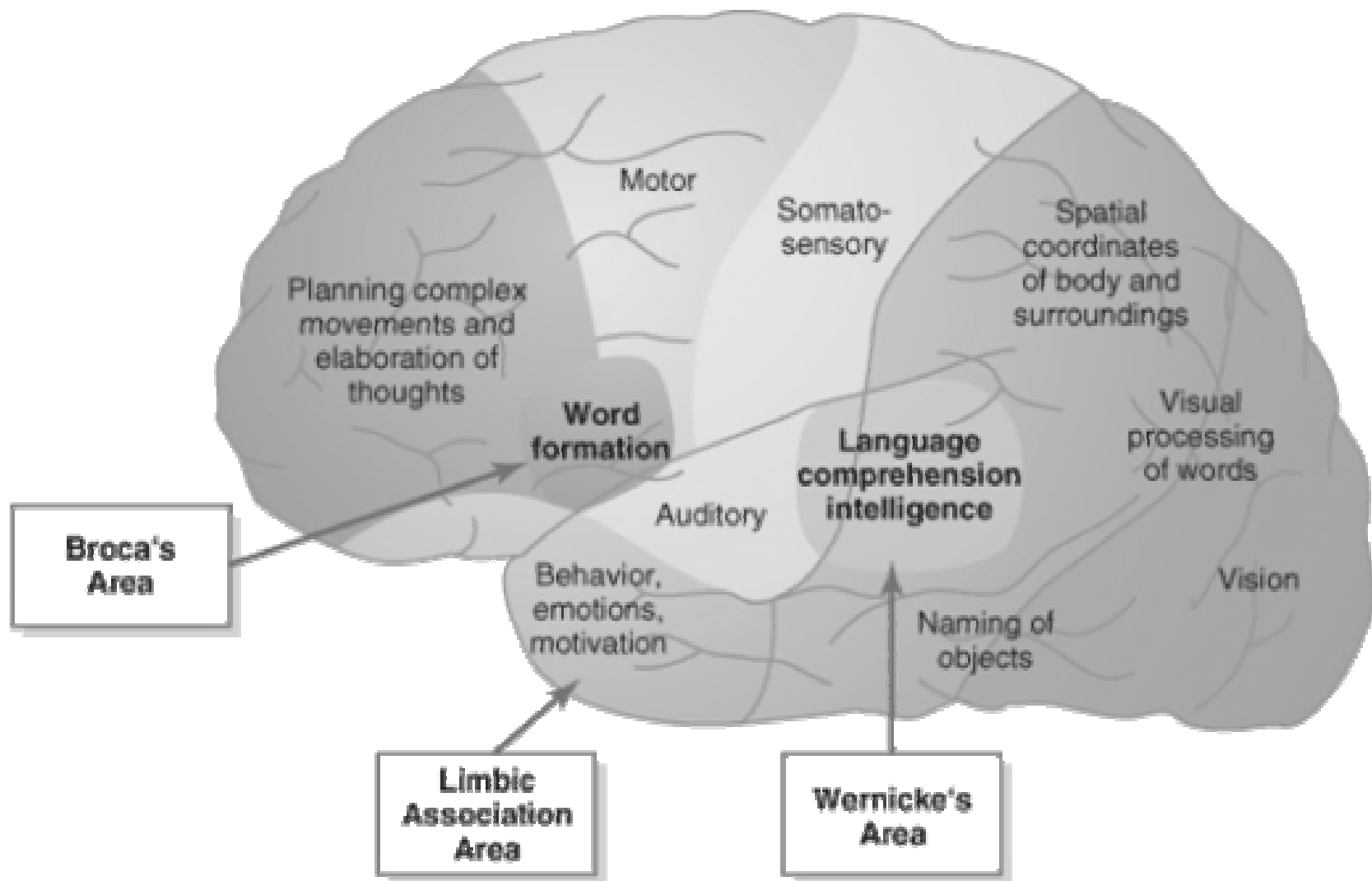


ASSOCIATION AREAS

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

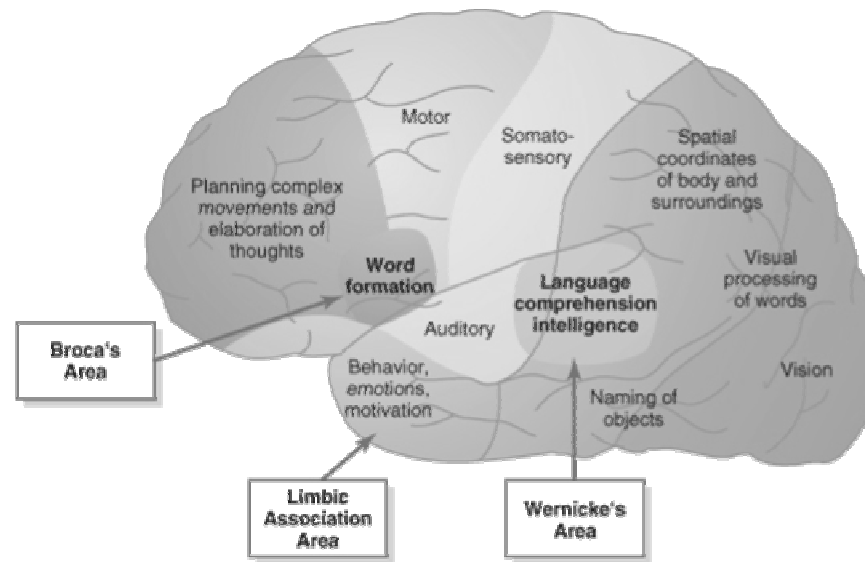
- (1) Parieto-occipitotemporal association area**
- (2) prefrontal association area**
- (3) limbic association area.**



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. This area also works in close association with Wernicke's language comprehension center in the temporal association cortex,

PARIETO-OCCIPITOTEMPORAL ASSOCIATION AREAS

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



PARIETO-OCCIPITOTEMPORAL ASSOCIATION AREAS

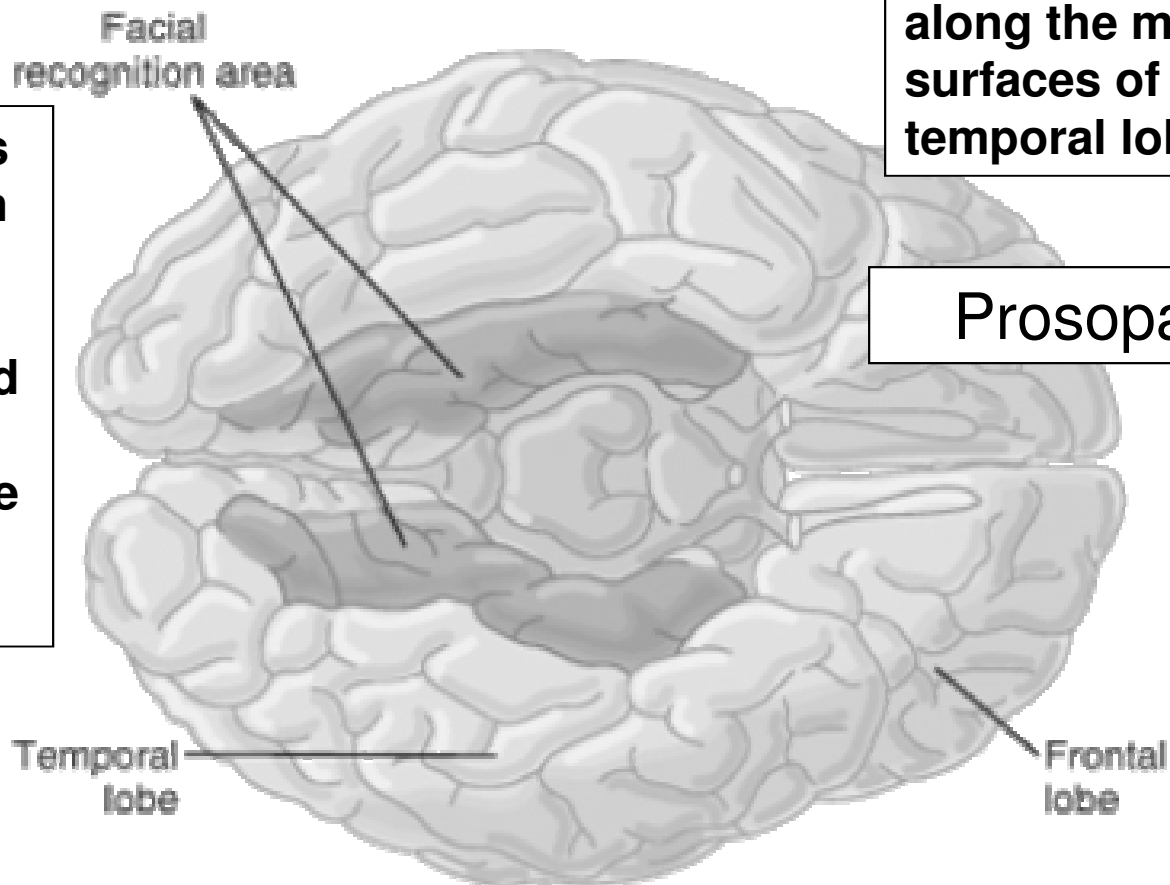
AREA	SITE	FUNCTION
Analysis of the Spatial Coordinates of the Body.	beginning in the posterior parietal cortex and extending into the superior occipital cortex	computes the coordinates of the visual, auditory, and body surroundings.
Area for Language Comprehension	Wernicke's area, lies behind the primary 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.	In the most lateral portions of the anterior occipital lobe and posterior temporal lobe	naming objects.

FASCIAL RECOGNITION AREAS

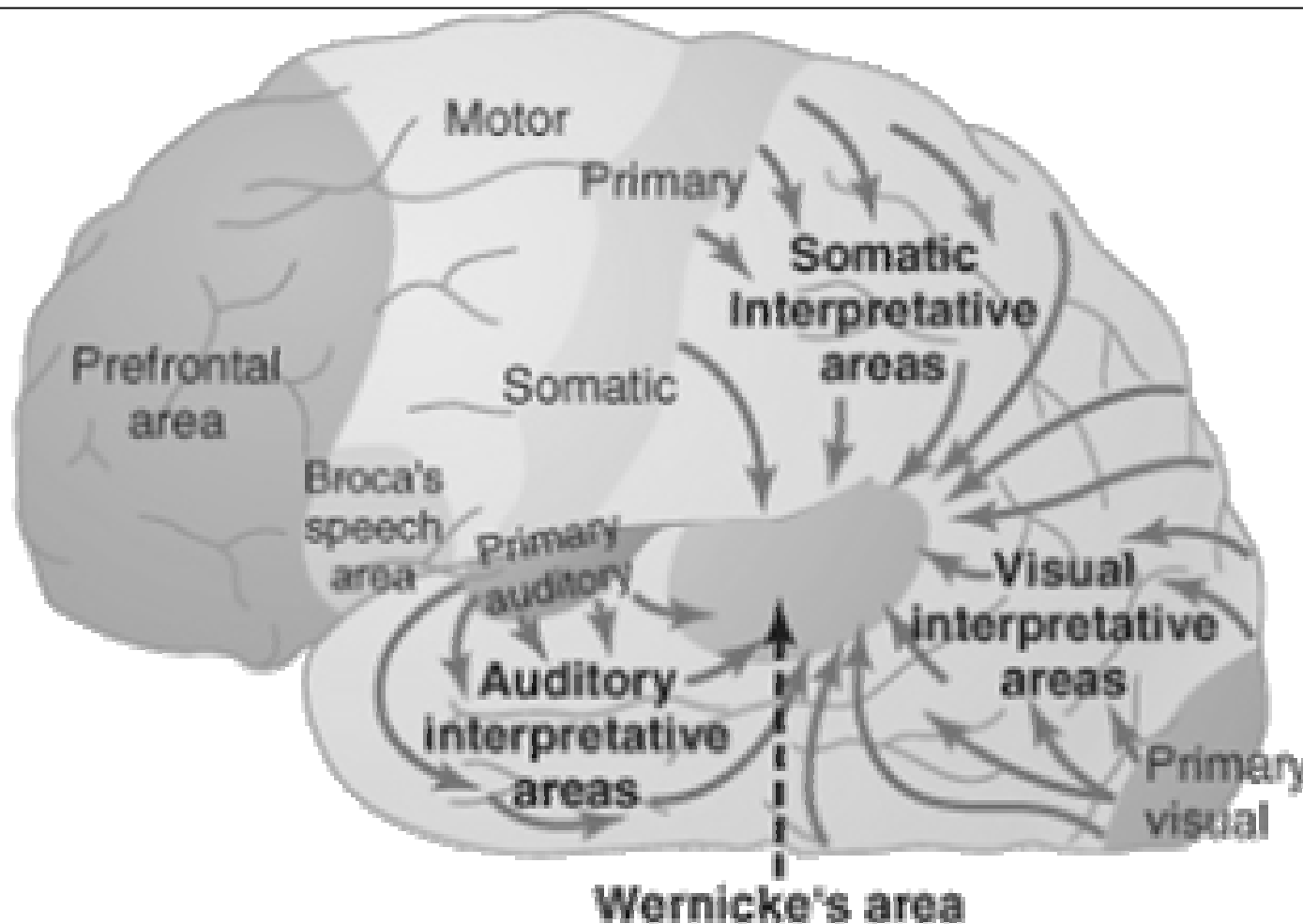
medial undersides of
both occipital lobes and
along the medioventral
surfaces of the
temporal lobes

Prosopagnosia

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



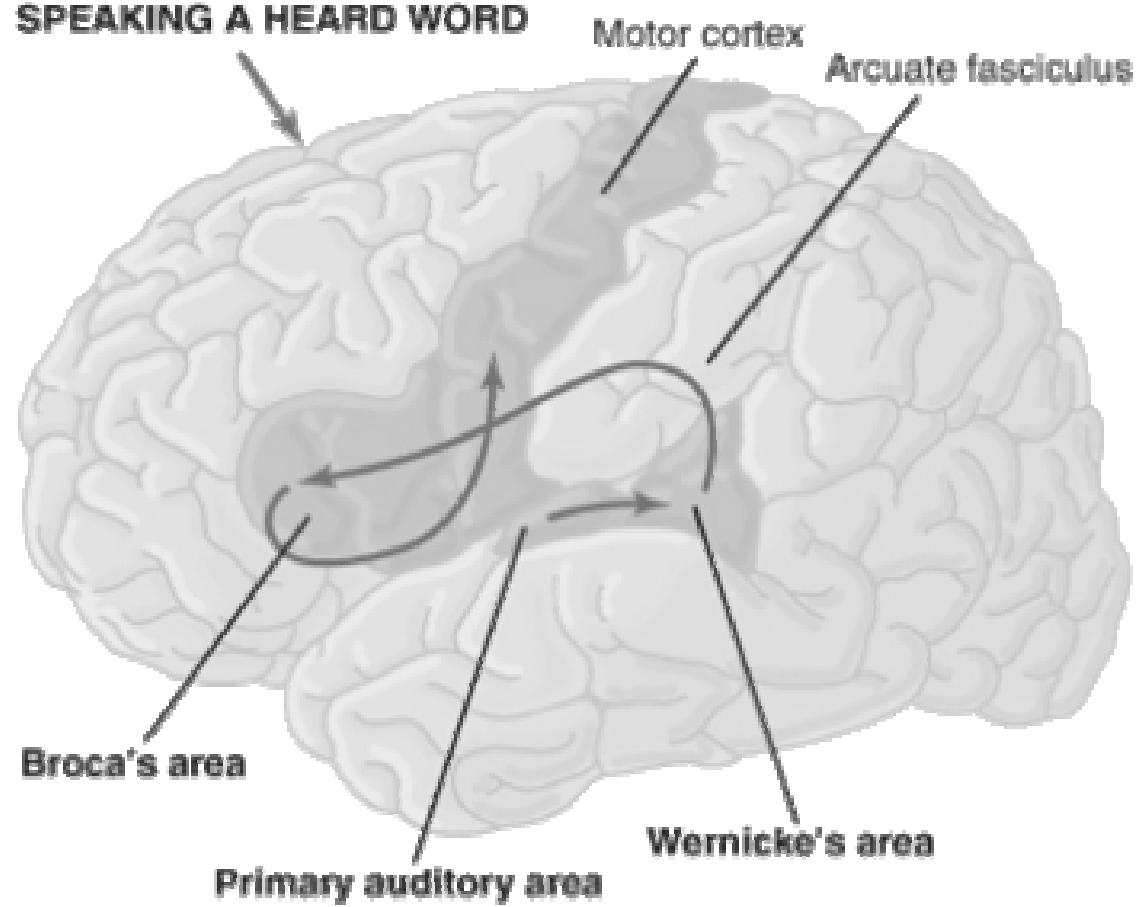
**Comprehensive Interpretative Function of the Posterior Superior Temporal Lobe-"Wernicke's Area" (a General Interpretative Area)
GNOSTIC AREA, the KNOWING AREA, the TERTIARY ASSOCIATION AREA,**

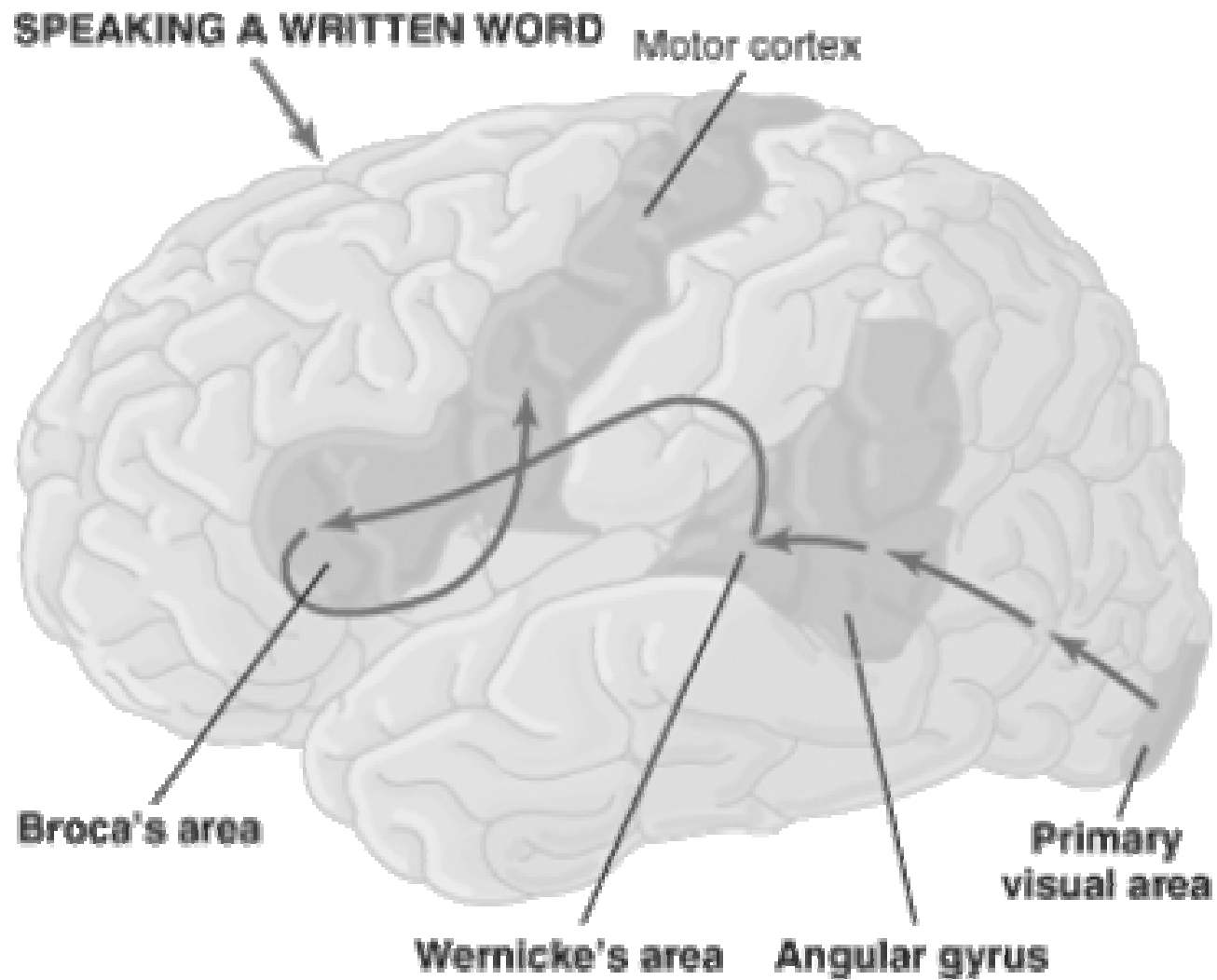


After severe damage in Wernicke's area, a person might hear perfectly well and even recognize different words but still be unable to arrange these words into a coherent thought.

AREA	LESION FAETURES
Auditory association areas	Word deafness
Visual association areas	Word blindness called dyslexia
Wernicke's Aphasia	Unable to interpret the thought
Broca's Area Causes	Motor Aphasia
Global Aphasia	Unable to interpret the thought Motor Aphasia

SPEAKING A HEARD WORD



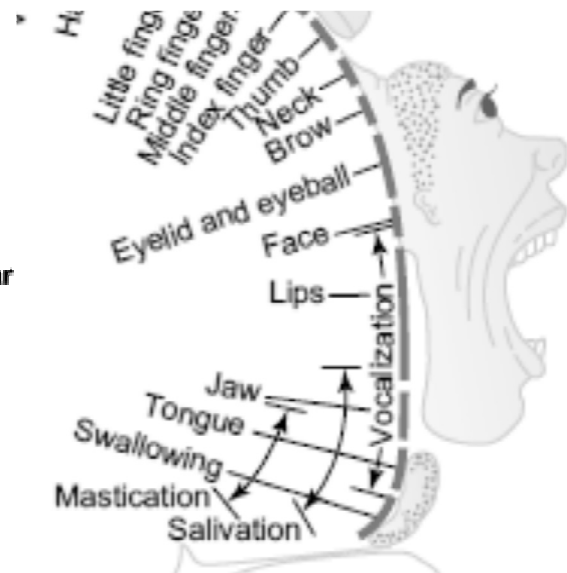
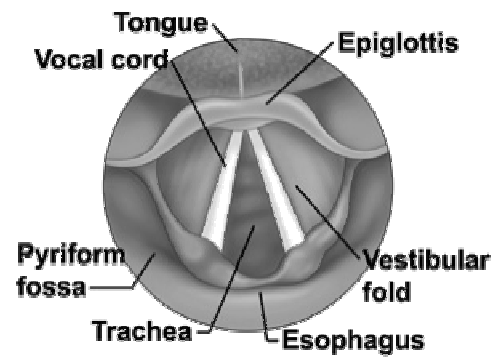
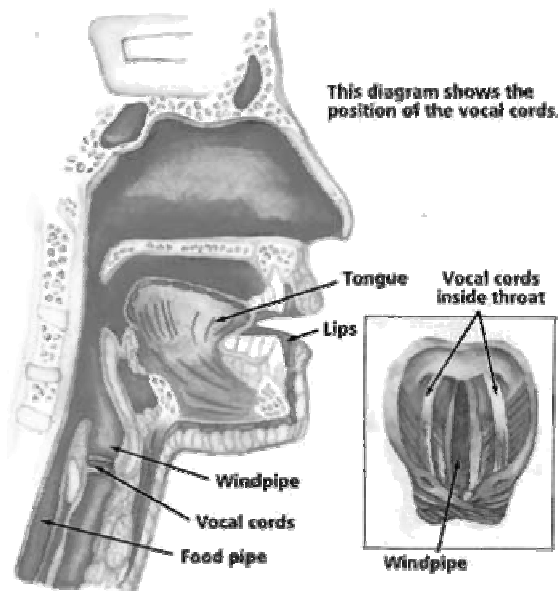


Visual Language (Reading).

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



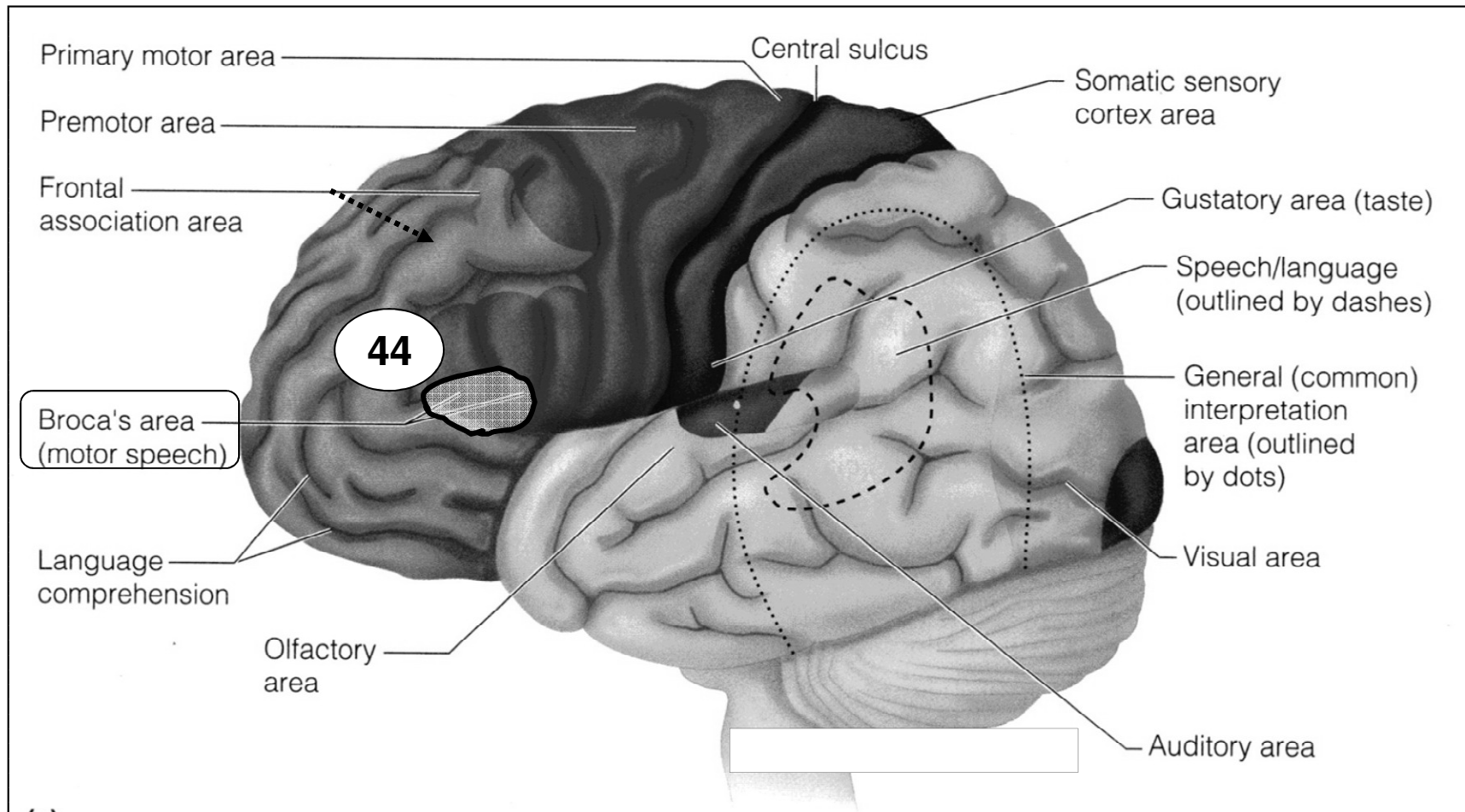
Brain Areas Concerned with Language

- **Wernick's Area**
- **Broca's Area**
- **Speech articulation Area in Insula**
- **Motor Cortex**
- **Angular Gyrus**
- **Aud Assoc Areas**

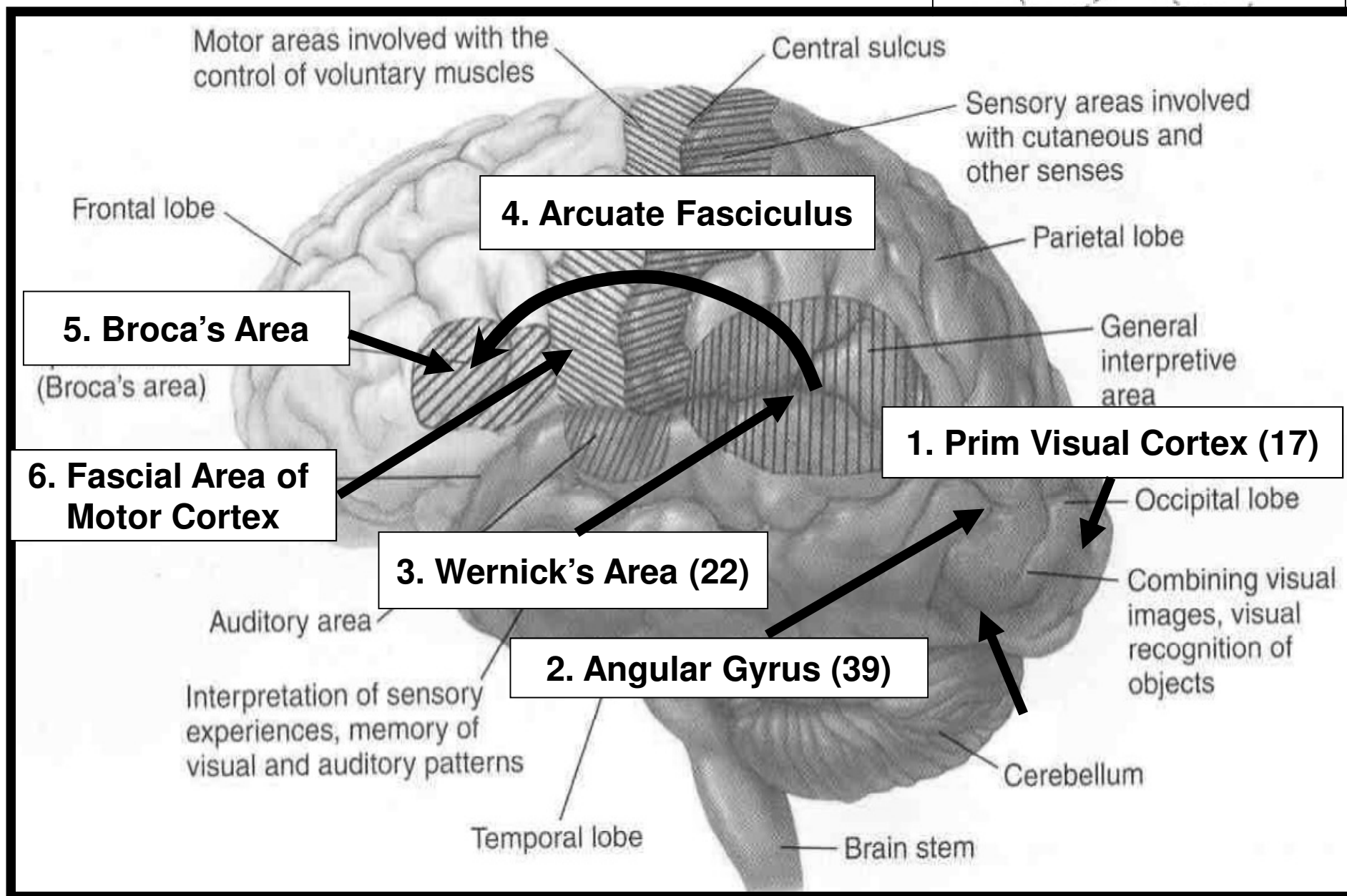
BROCA'S AREA

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

DAMAGE TO THIS AREA CAUSES INABILITY TO SAY WORDS PROPERLY



SEQUENCE OF EVENTS IN SPEECH PRODUCTION



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

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;**
dressing or constructional apraxia

Terms to Remember

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