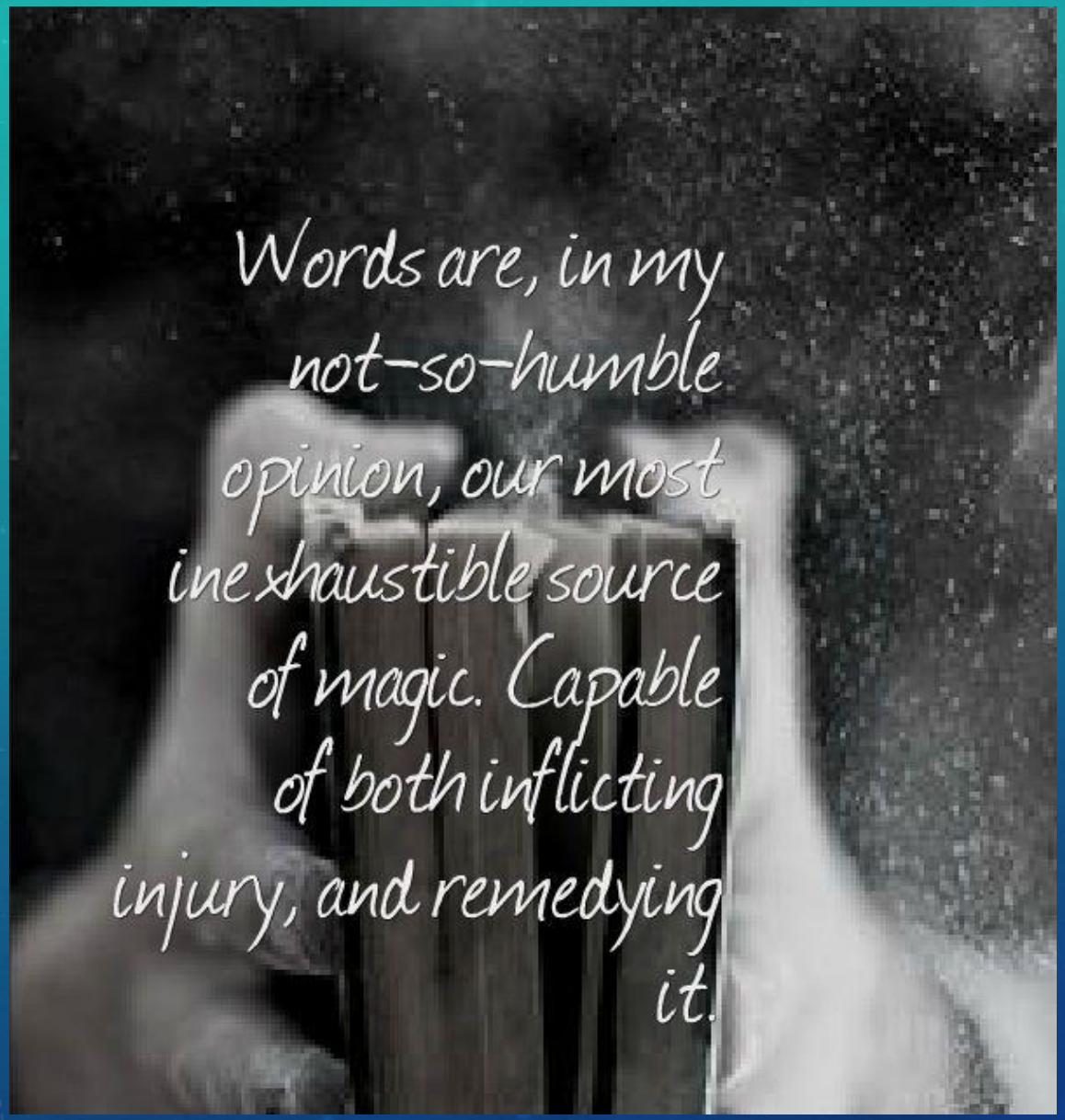
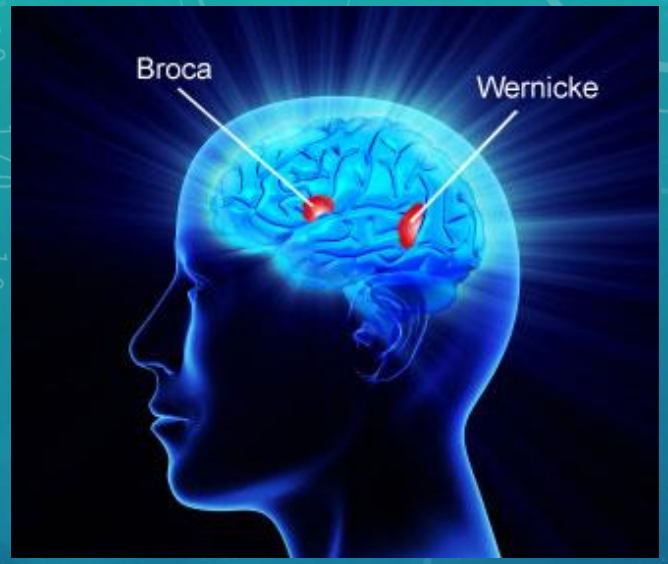

"Speak a good word
or remain silent"
Prophet Muhammad


قَوْلٌ مَّعْرُوفٌ وَمَغْفِرَةٌ خَيْرٌ مِّنْ صَدَقَةٍ
"Kind speech and forgiveness are better than charity followed by injury".
(Quran 2:263)


Words are, in my
not-so-humble
opinion, our most
inexhaustible source
of magic. Capable
of both inflicting
injury, and remedying
it.



LANGUAGE AND SPEECH

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MBBS - FCPS (MEDICINE)

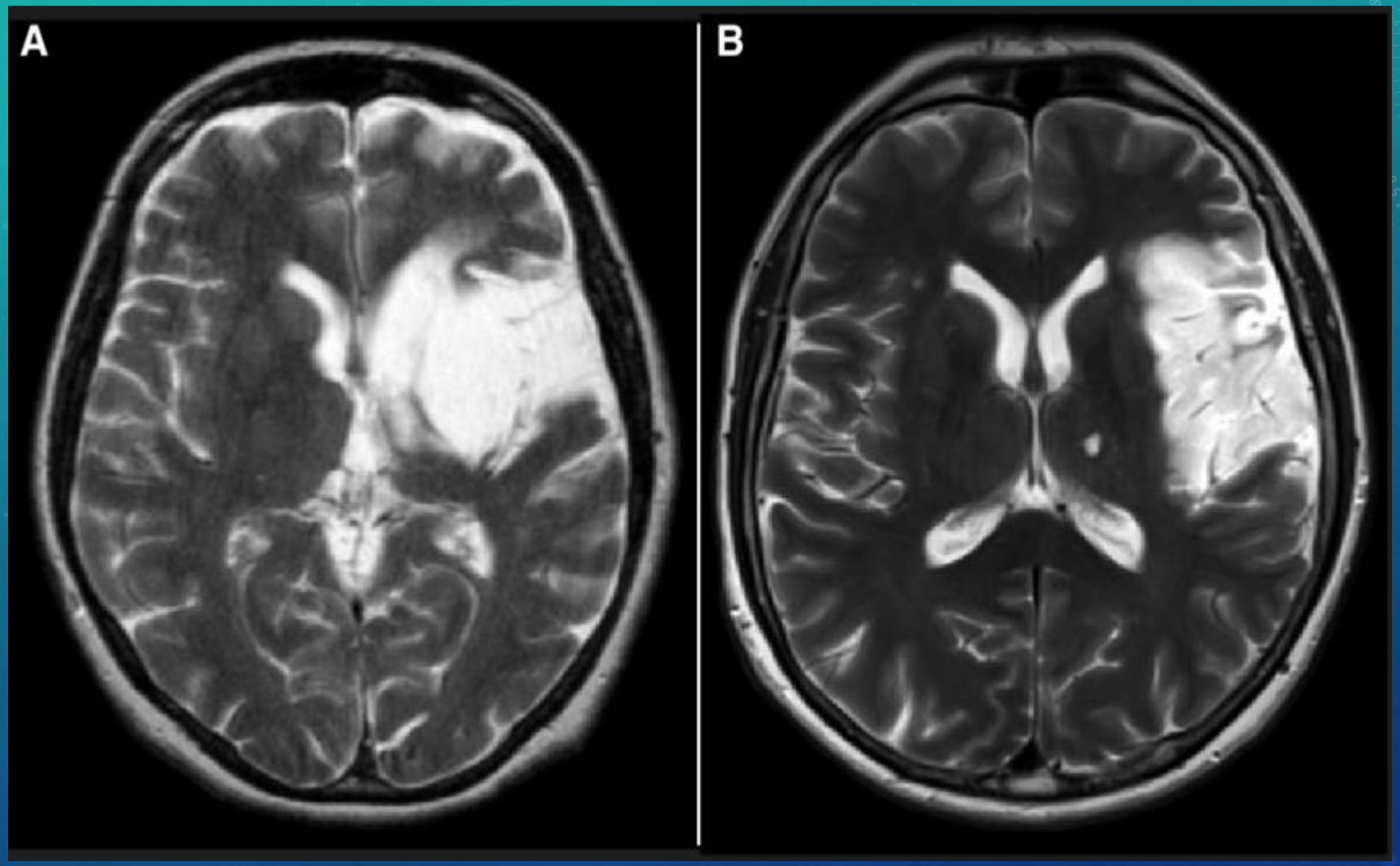
MPHIL (PHYSIOLOGY)

LEARNING OBJECTIVES

- Define and classify speech
- Describe how the brain performs the function of speech
- Describe Broca's area in brain and its function
- Describe Wernicke's area in the brain and its function
- Describe the speech pathways for perceiving a heard word and the speaking the same word & perceiving a written word and repeating it
- Clinical significance of lesions in speech pathways

CASE SCENARIO

- Lets fast forward to a time you are sitting in the medical OPD… and a patient is presented to you. He is a 65 year old retired male with Diabetes and hypertension since last 10 years. Now presenting with decreased movements in right arm and slurred speech since last 12 hours. You examine the patient ….the patient is oriented and can comprehend speech but has non-fluent aphasia and a monoparesis of the right arm. You order a MRI scan.


A
B

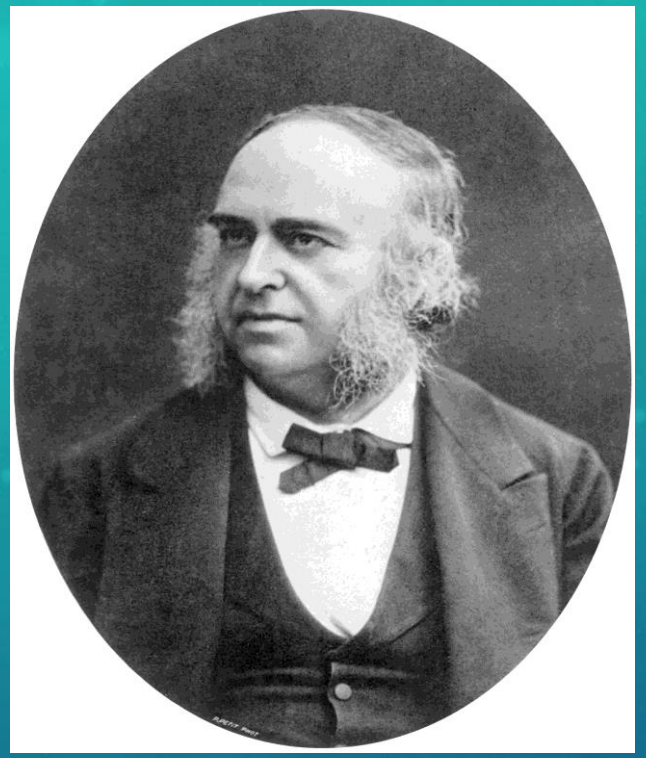
CASE SCENARIO

- Lets fast forward again to a time you are sitting in the medical OPD and a patient is presented to you. He is a 65 year old retired male with Diabetes and hypertension since last 10 years. Now presenting with decreased movements in right arm and slurred speech since last 12 hours. You examine the patient ….the patient is oriented and can comprehend speech but has non-fluent aphasia and a monoparesis on the right arm. You order a MRI scan.
- MRI Report : There is a big infarction on the left fronto parital reigon on the left side.
- WHAT IS THE PATIENT SUFFERING FROM ???

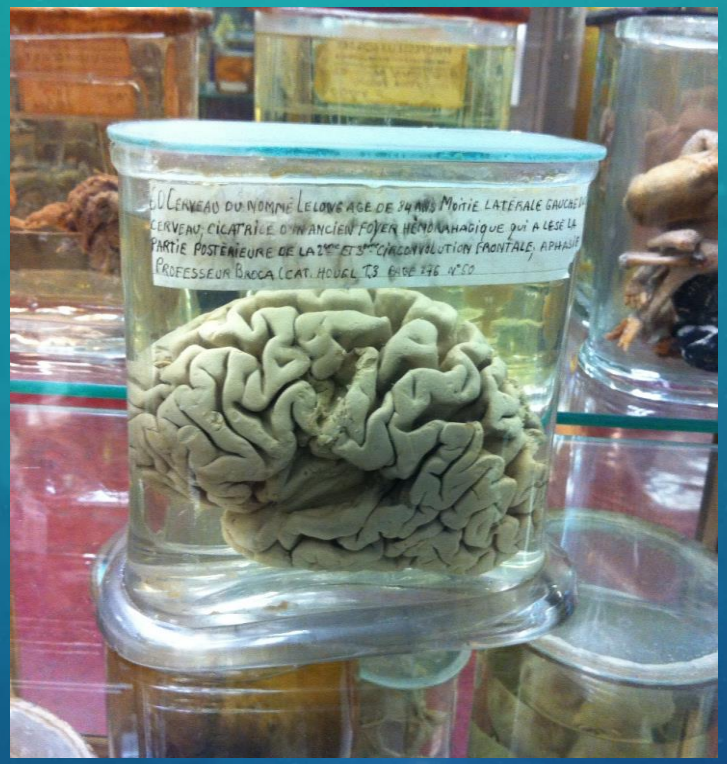
The story of 'Tan'

- In the year 1861, A man named *Victor Leborgne*
- Admitted in a mental hospital with a speech disorder
- Could only speak one word 'tan' , in two successive syllables…tan tan
- Regardless of the question he answered 'tan tan'…
- His intelligence was unaffected
- When he died his doctor autopsied his brain and made a discovery that revolutionized neuroscience of speech and language

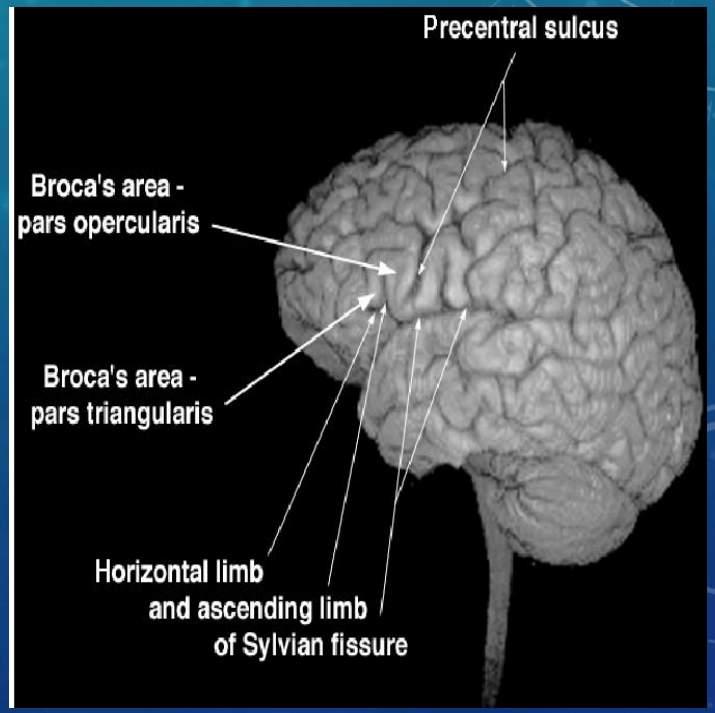
Broca, Paul (1861). Perte de la Parole, ramollissement chronique et destruction partielle du lobe antérieur gauche du cerveau. *Bulletin de la Société Anthropologique, 2*, 235-238



Paul Broca

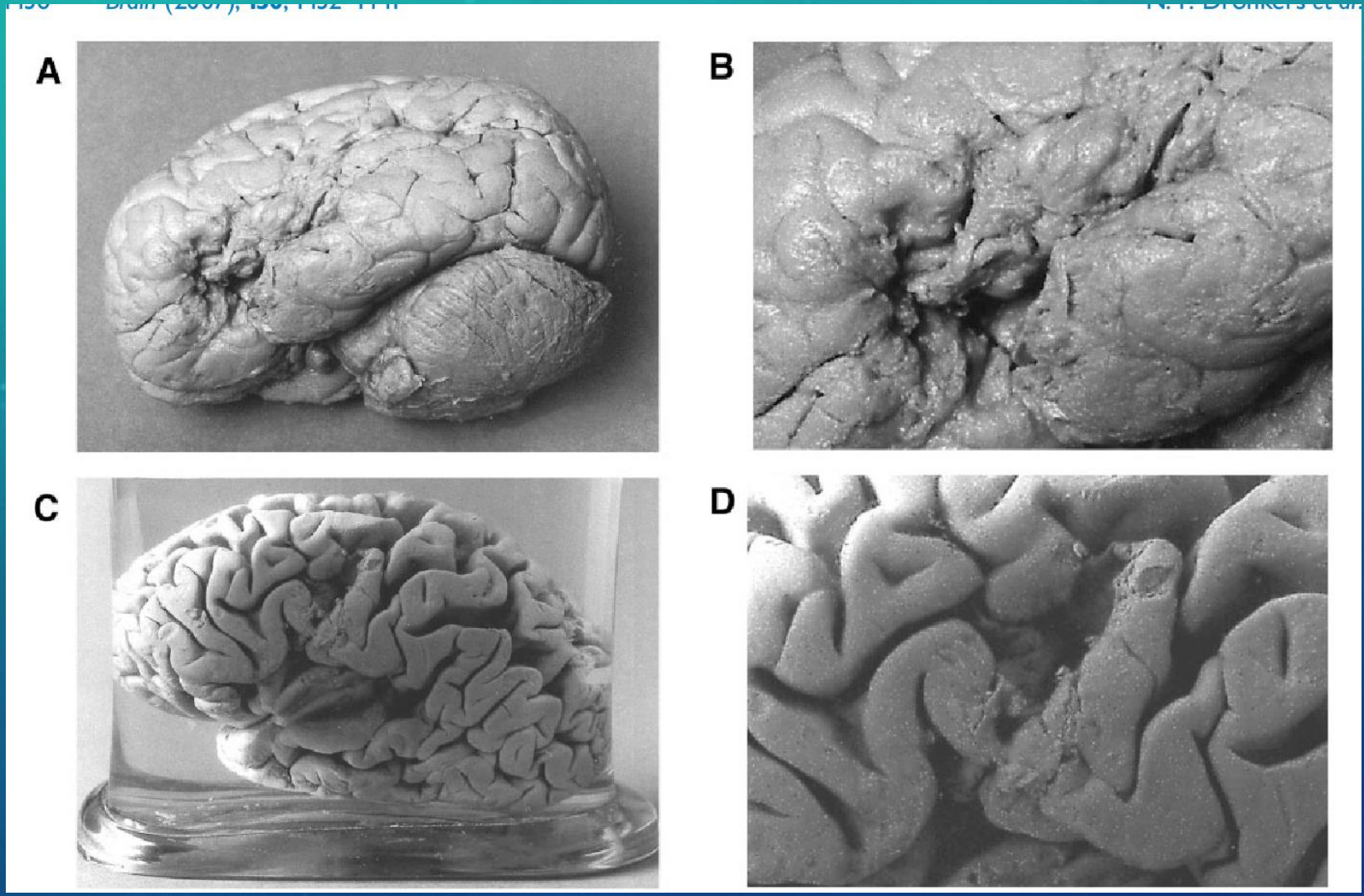


Mr Tan’s brain



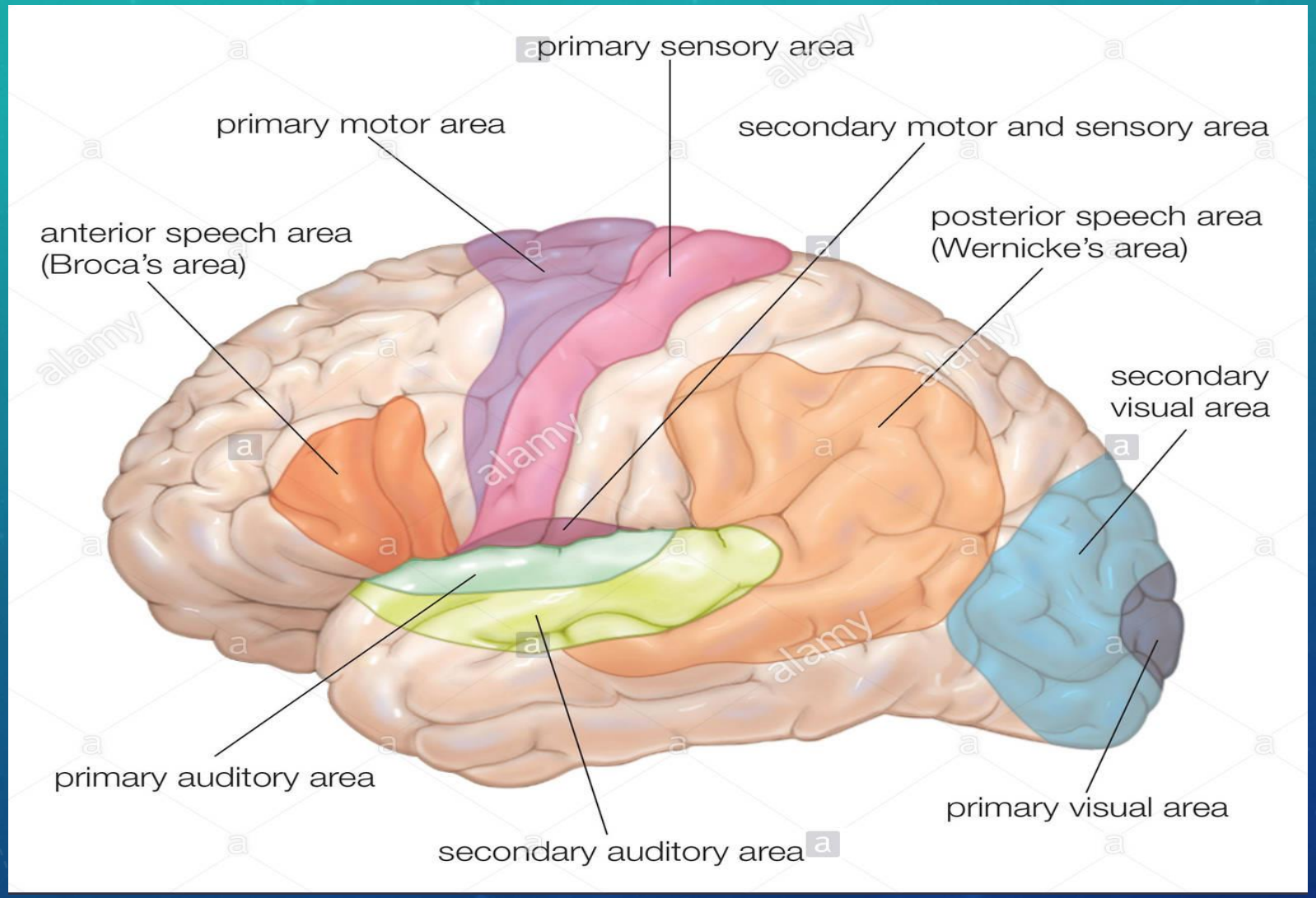
Broca’s area

TAN'S BRAIN



Dronkers NF, Plaisant O, Iba-Zizen MT, & Cabanis EA (2007). Paul Broca's historic cases: high resolution MR imaging of the brains of Leborgne and Lelong. *Brain : a journal of neurology, 130* (Pt 5), 1432-41 PMID: 17405763

Recall your previous knowledge…



SPEECH

- Speech is defined as expression of thoughts by production of articulate sound, bearing a definite meaning.
- The ability to understand or express oneself by spoken or written words
- One of the higher functions of brain

MECHANISM OF SPEECH

- Coordinated activities between central speech apparatus and peripheral speech apparatus

Central speech apparatus

- Higher centres, cortical and subcortical areas

Peripheral centres:

- Larynx - sound box, pharynx, mouth, nasal cavities, tongue and lips
- All peripheral apparatus functions in coordination with respiratory system

DEVELOPMENT OF SPEECH

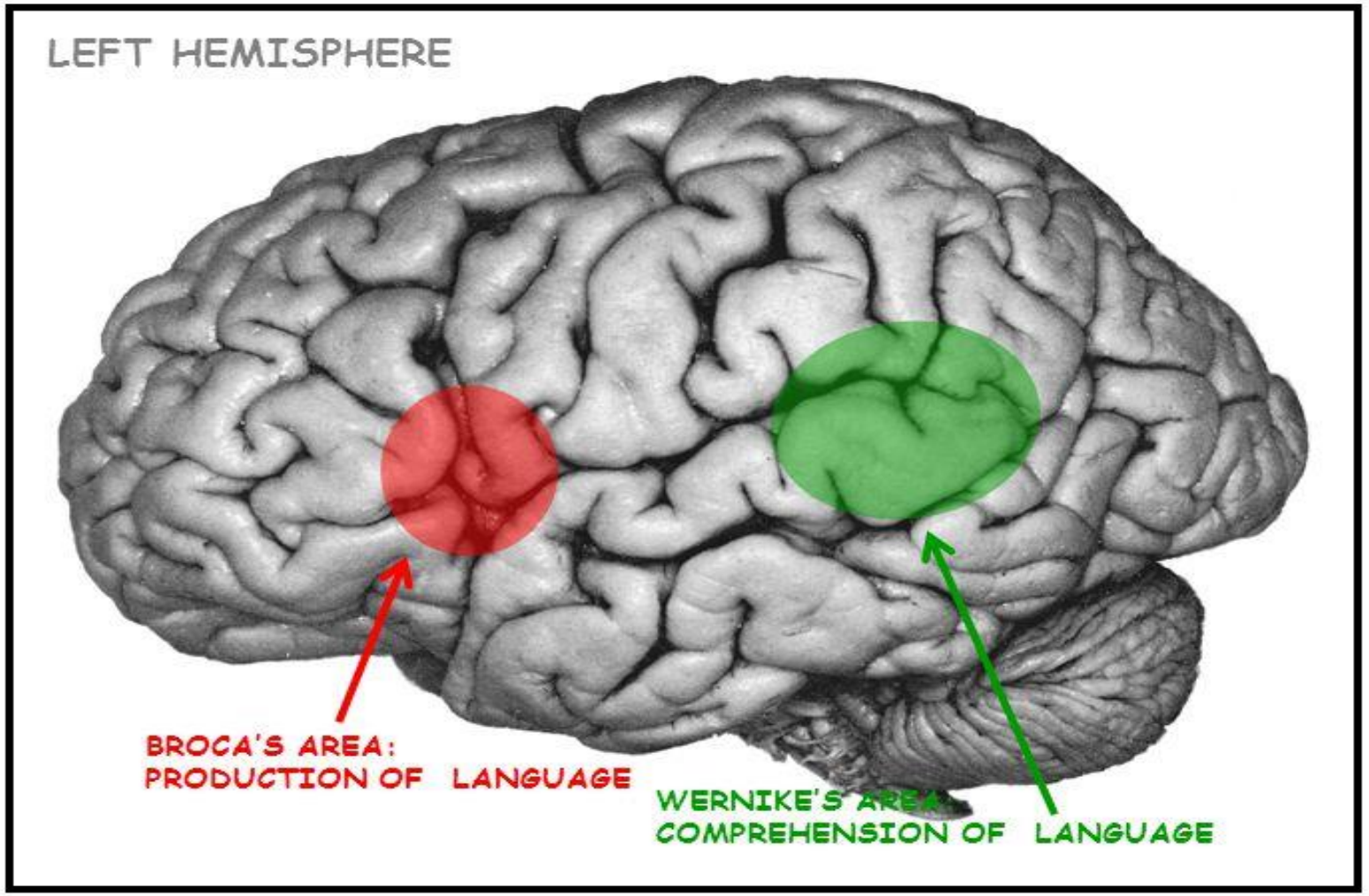
First stage

- Association of words with visual, tactile, auditory and other sensations, aroused by objects in external environment
- Association of words with other sensations is stored as memory

Second stage

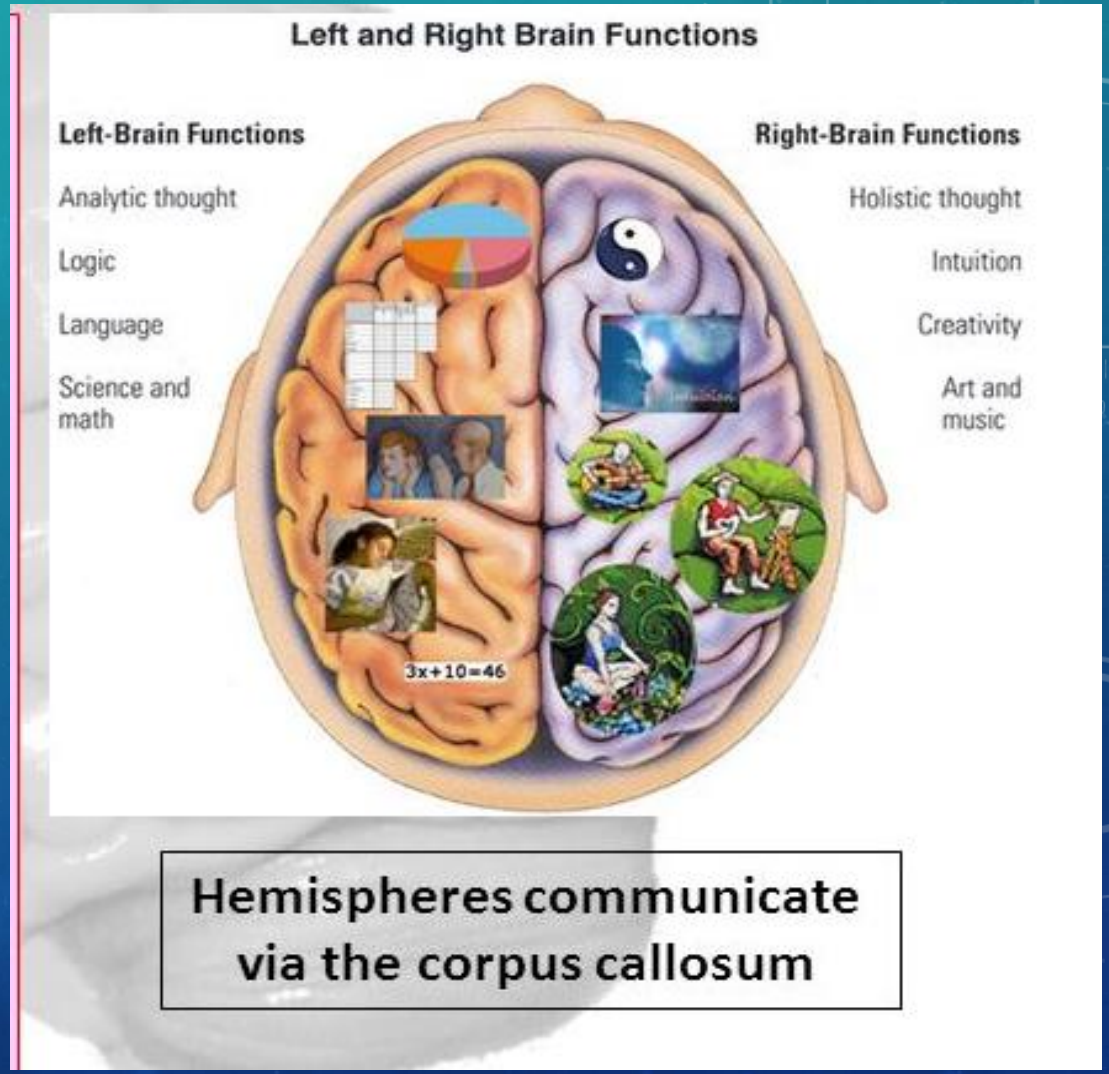
- New neuronal circuits are established during development of speech.
- when a definite meaning has been attached to certain words, pathway between the auditory area and the motor area is established. This pathway helps in speech .the child attempts to formulate words and pronounce the learnt words

PRIMARY LANGUAGE AREAS IN ADULTS ARE IN THE LEFT HEMISPHERE



DOMINANT HEMISPHERE

- **The localization of speech centers & mathematical ability is the criterion for defining the dominant cerebral hemisphere.**
- **In 96% of normal right-handed individuals and 70% of normal left-handed individuals, the left hemisphere contains the language centers. These are left hemisphere dominant.**
- **Cerebral dominance becomes established during the first few years after birth.**



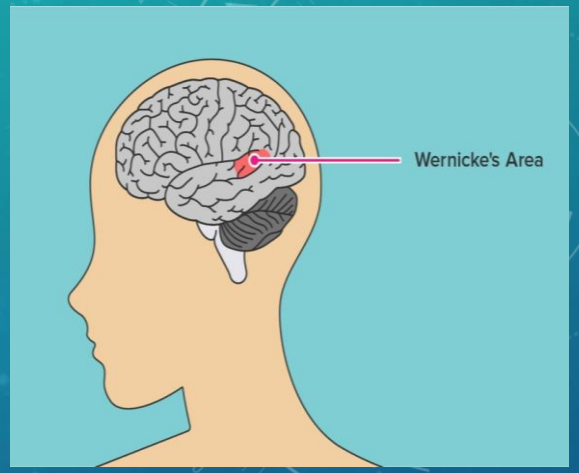

PUGH
FEMALES SPEAK 13,000 MORE WORDS A DAY
'Good grief! Is that all?!'

ROLE OF CORTICAL AREAS IN THE DEVELOPMENT OF SPEECH

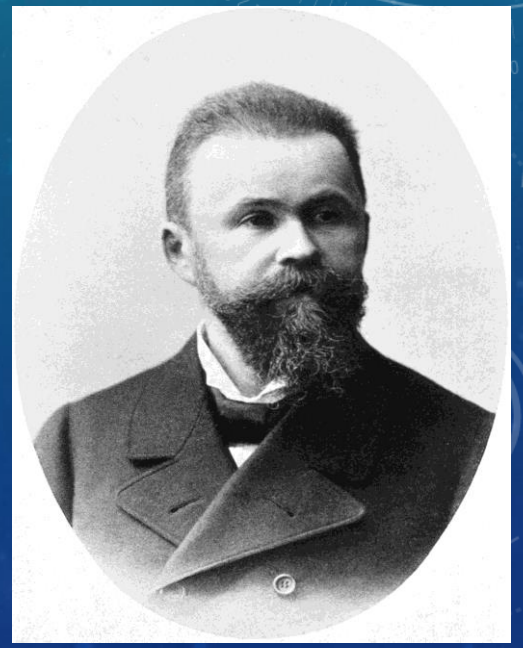
Speech results from Integration of three cortical areas:

- Broca’s area
- Wernicke’s area
- Motor area

WERNICKE'S AREA

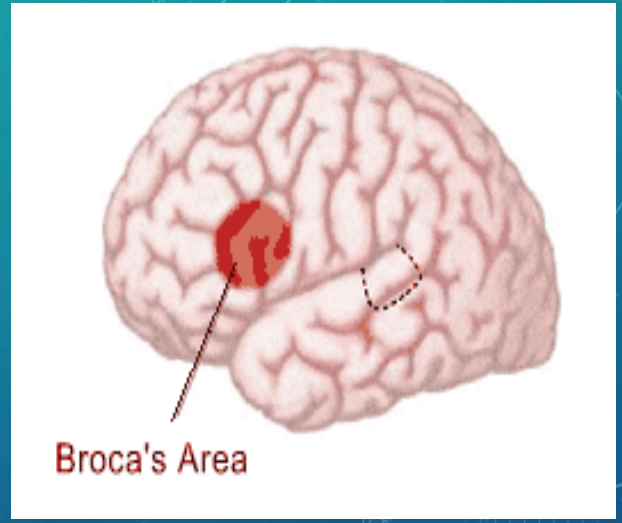


- The auditory comprehension of speech begins at Wernicke's area
- Situated in the superior temporal gyrus in the upper part of temporal lobe on the left hemisphere
- Brodmann area 22
- Sends fibers to Broca's area through the Arcuate fasciculus
- Responsible for understanding the visual and auditory information required for the production of words
- After understanding the words it sends info to the Broca's area



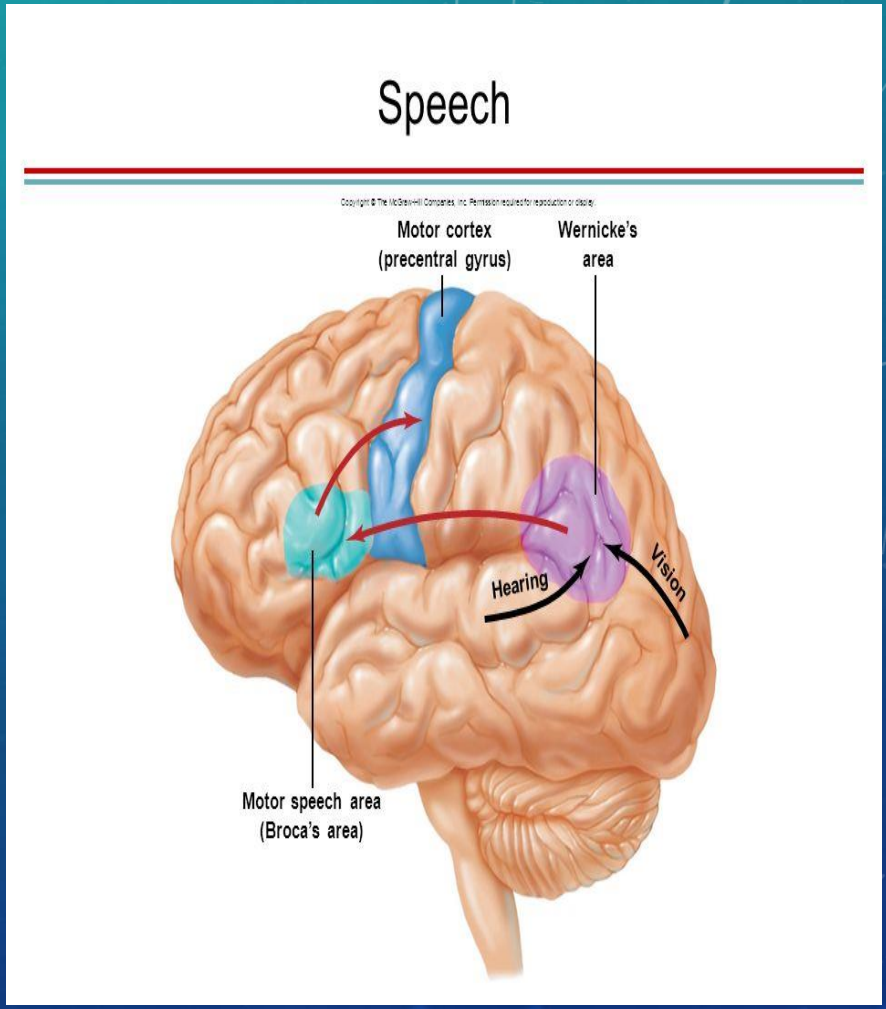
BROCA'S AREA

- Speech is synthesized in the Broca's Area
- Located in the posterior lateral prefrontal cortex and partly in the premotor area
- Brodmann area 44 and 45
- Situated adjacent to motor area, responsible for movement of tongue, lips and larynx which are necessary for speech
- Develops a pattern of motor activities required to verbalize the words
- It receives input from Wernicke's area required for production of words
- Pattern of motor activities is sent to motor area



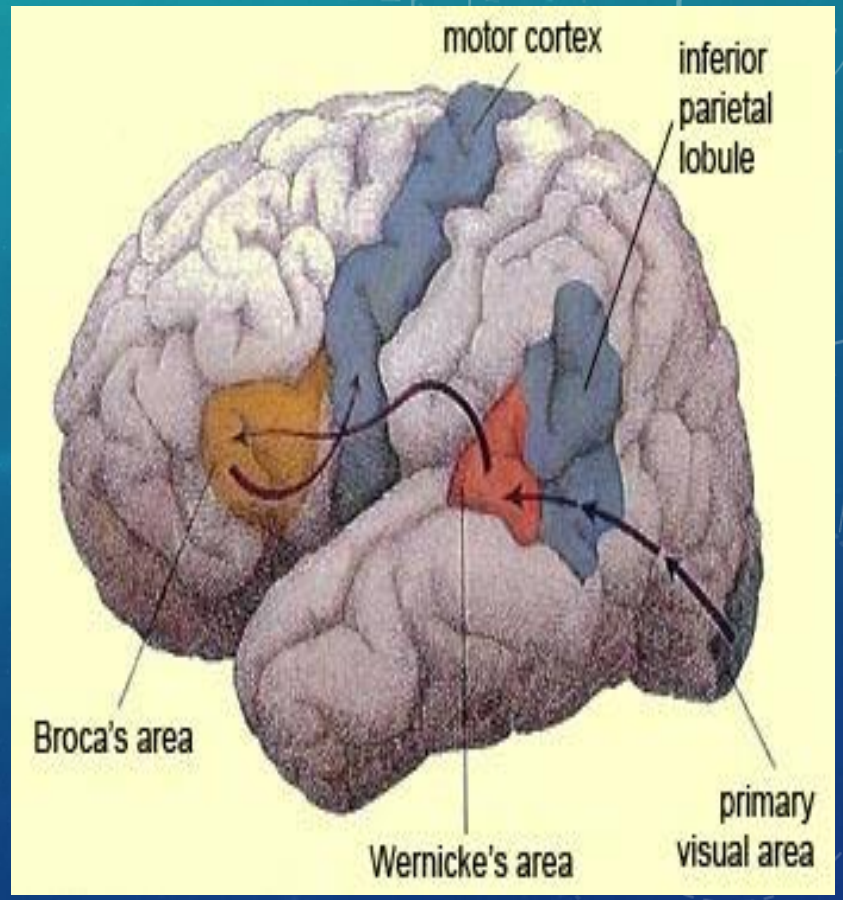
MOTOR AREA

- Receives patterns of activity from Broca's area
- It activates the peripheral speech apparatus
- Results in initiation of movements of tongue, lips and larynx required for speech
- Later when child learns to read, auditory speech is associated with visual symbols (area 18)
- There is association of the auditory and visual areas with the motor areas of the motor areas of muscles of hands
- So child learns to express auditory and visual impressions in the form of written words

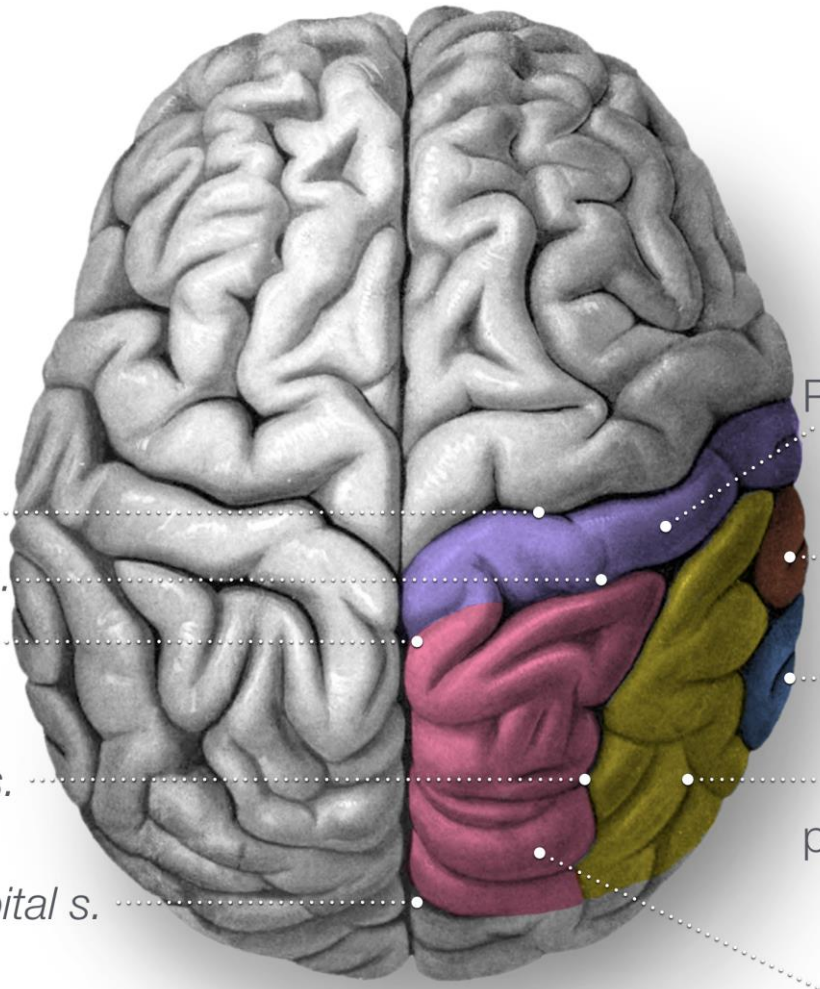


INFERIOR PARIETAL LOBULE

- Also known as “Geschwind’s territory”, in honour of the American neurologist Norman Geschwind
- Brain imaging studies have now shown that the inferior parietal lobule (angular gyrus and supramarginal gyrus) is connected by large bundles of nerve fibres to both Broca’s area and Wernicke’s area.



Parietal lobe



Central s.

Postcentral s.

Marginal s.

Interparietal s.

Parieto-occipital s.

Postcentral g.

Supra-marginal g.

Angular g.

Inferior parietal lobule

Superior parietal lobule

Adapted from illustration from "Sobotta's Textbook and Atlas of Human Anatomy" 1908, now in the public domain.

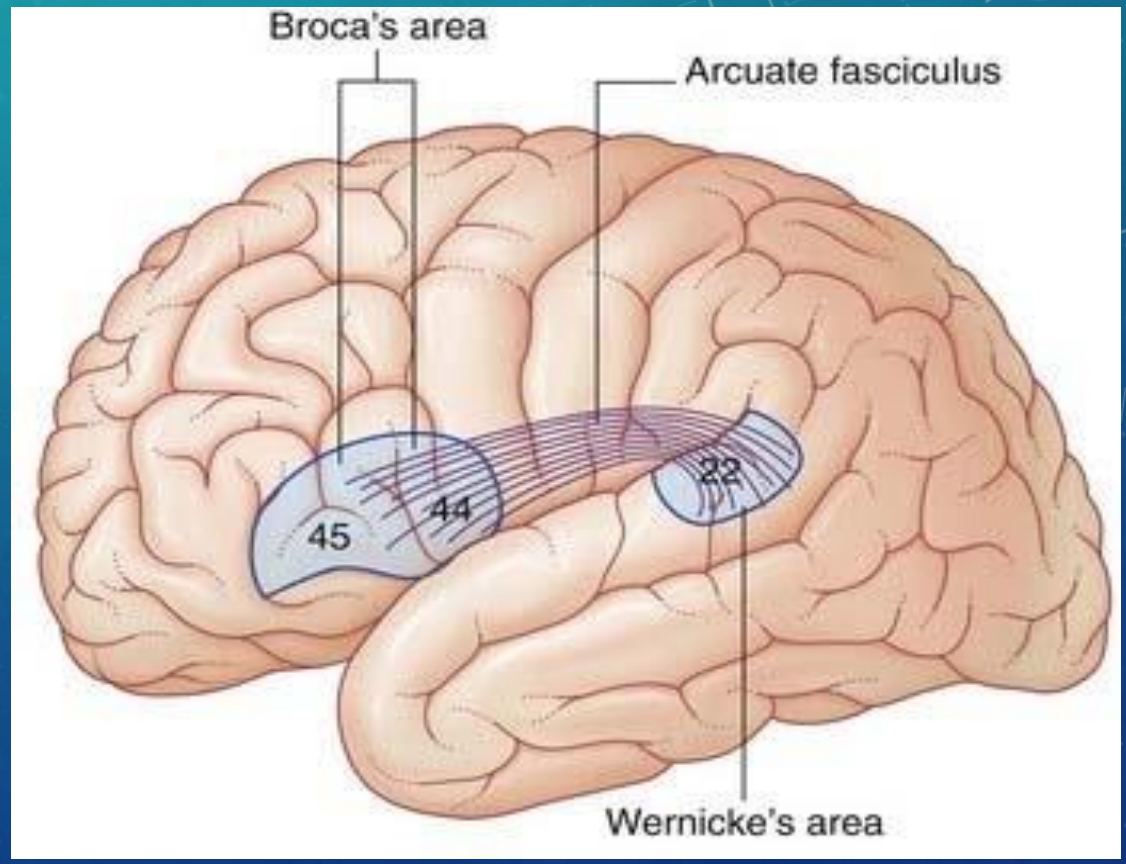
Brain Areas Involved in Language

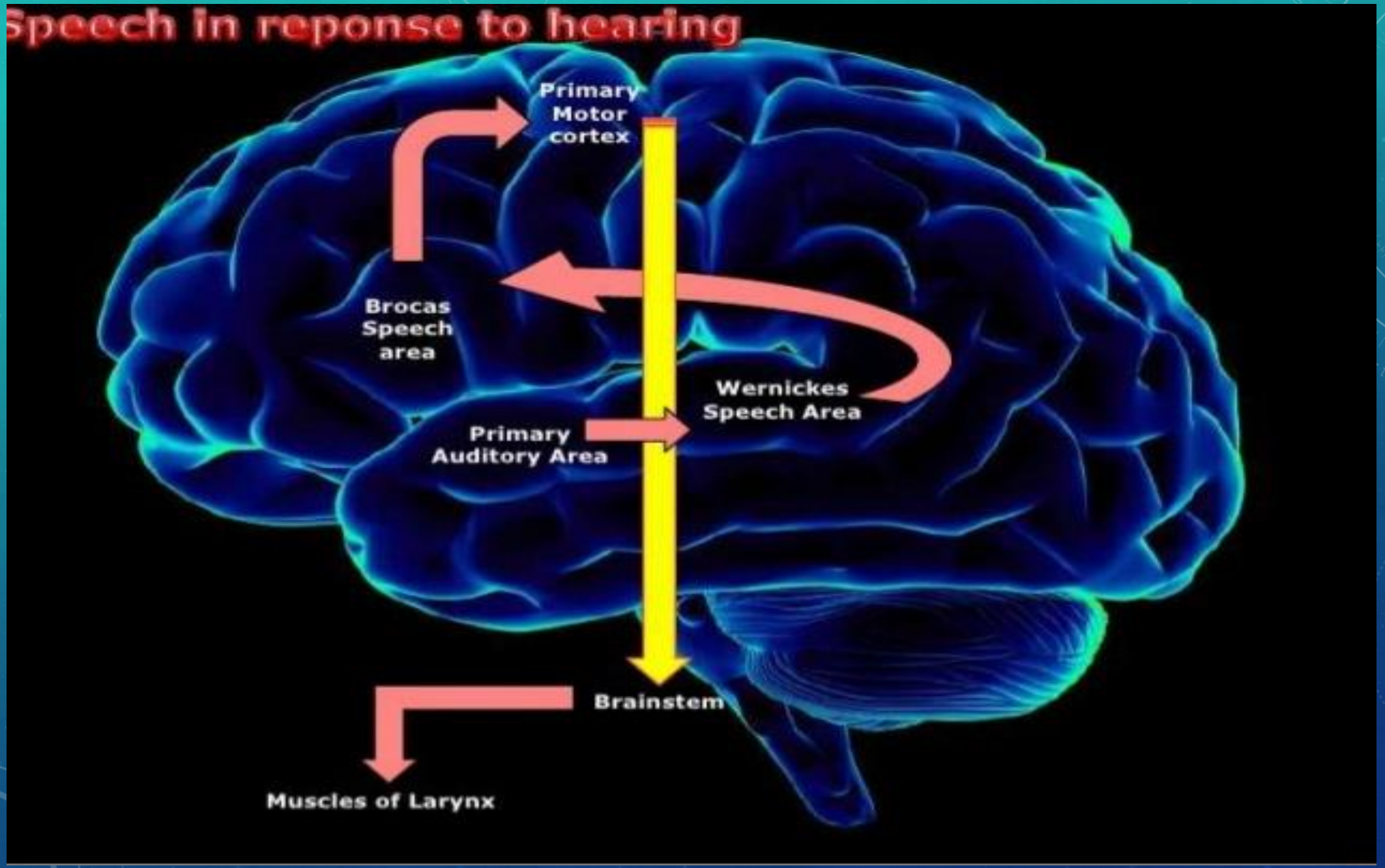
Area	Location	Function
1 **Wernicke's Area** (Brodmann's area 22)	•At the posterior end of the **superior gyrus** of the **temporal lobe** •Closely associated with 1 & 2 auditory areas	•**Comprehension**[1] of auditory & visual information, then project it to Broca's area via Arcuate fasciculus. •Interpretations[2] of **sensory experience.** •Formation of **thought** in response to sensory experience. •**Choice of words** to express thoughts.
2 **Broca's Area** (Brodmann's area 44 & 45)	At the lower end of **premotor area in frontal lobe**	•Process information received from Wernicke's area . area into **detailed & co-ordinated** pattern for vocalization[3]. •Then project it to **motor cortex** to Initiate the appropriate **movement of muscle of speech** in tongue, larynx & lips.
3 **Arcuate fasciculus**	Bundle of axons connecting Wernicke's area with Broca's area	**Conduction** between the two areas.
4 **Angular Gyrus** (Brodmann's area 39)	Leis **behind Wernike's area** fused posteriorly into the visual cortex of occipital lobe	Interpretation of information obtained from **reading from visual cortex.**

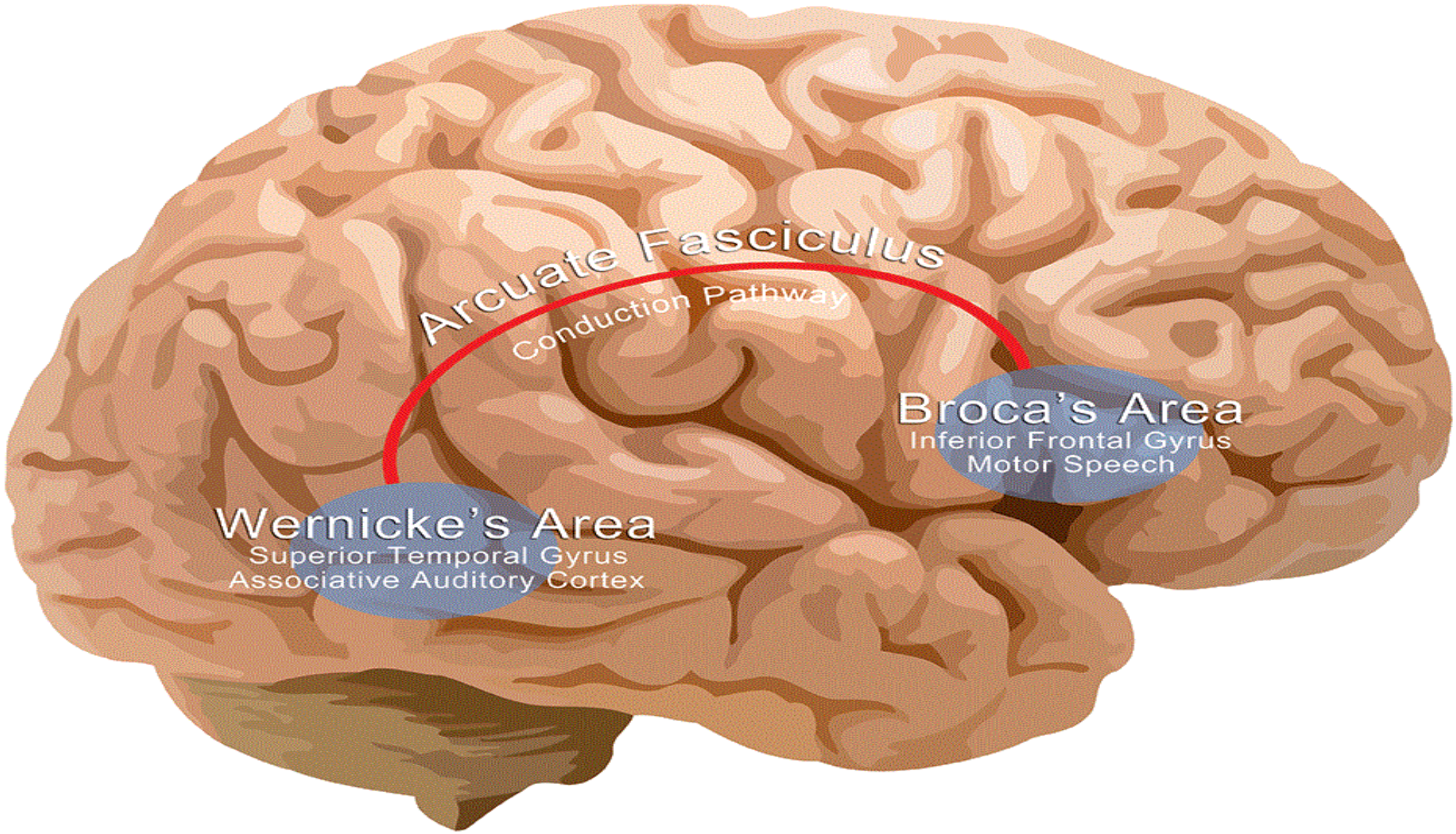
1: ... 2: The action of explaining the meaning of something 3: ...

NERVOUS CONTROL OF SPEECH

- Speech is an integrated and well coordinated motor phenomenon
- Parts of the cortex and sub cortical areas involved in production of speech
- Sub cortical areas concerned with speech are controlled by cortical areas of dominant hemisphere



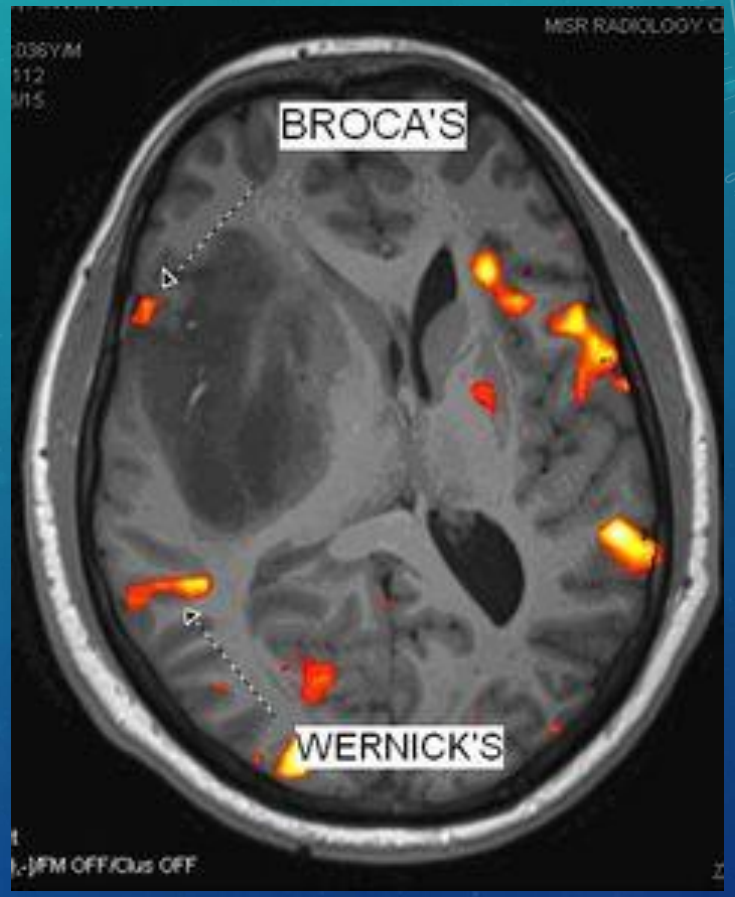

Speech in reponse to hearing
Primary Motor cortex
Brocas Speech area
Wernickes Speech Area
Primary Auditory Area
Brainstem
Muscles of Larynx


Arcuate Fasciculus
Conduction Pathway
Broca's Area
Inferior Frontal Gyrus
Motor Speech
Wernicke's Area
Superior Temporal Gyrus
Associative Auditory Cortex

The Wada Procedure

- A simple procedure to study the function of a single cerebral hemisphere
- Fast acting barbiturate is injected into the carotid artery on one side
  - Preferentially carried to the ipsilateral hemisphere
  - Acts as a short-term anesthetic
  - Limbs on the contralateral side become paralyzed
- Can then assess patients' ability to speak
  - If the injection is on the side dominant for speech, patient is completely unable to talk
  - Opposite side retains complete speech ability

SPEECH PATHWAYS

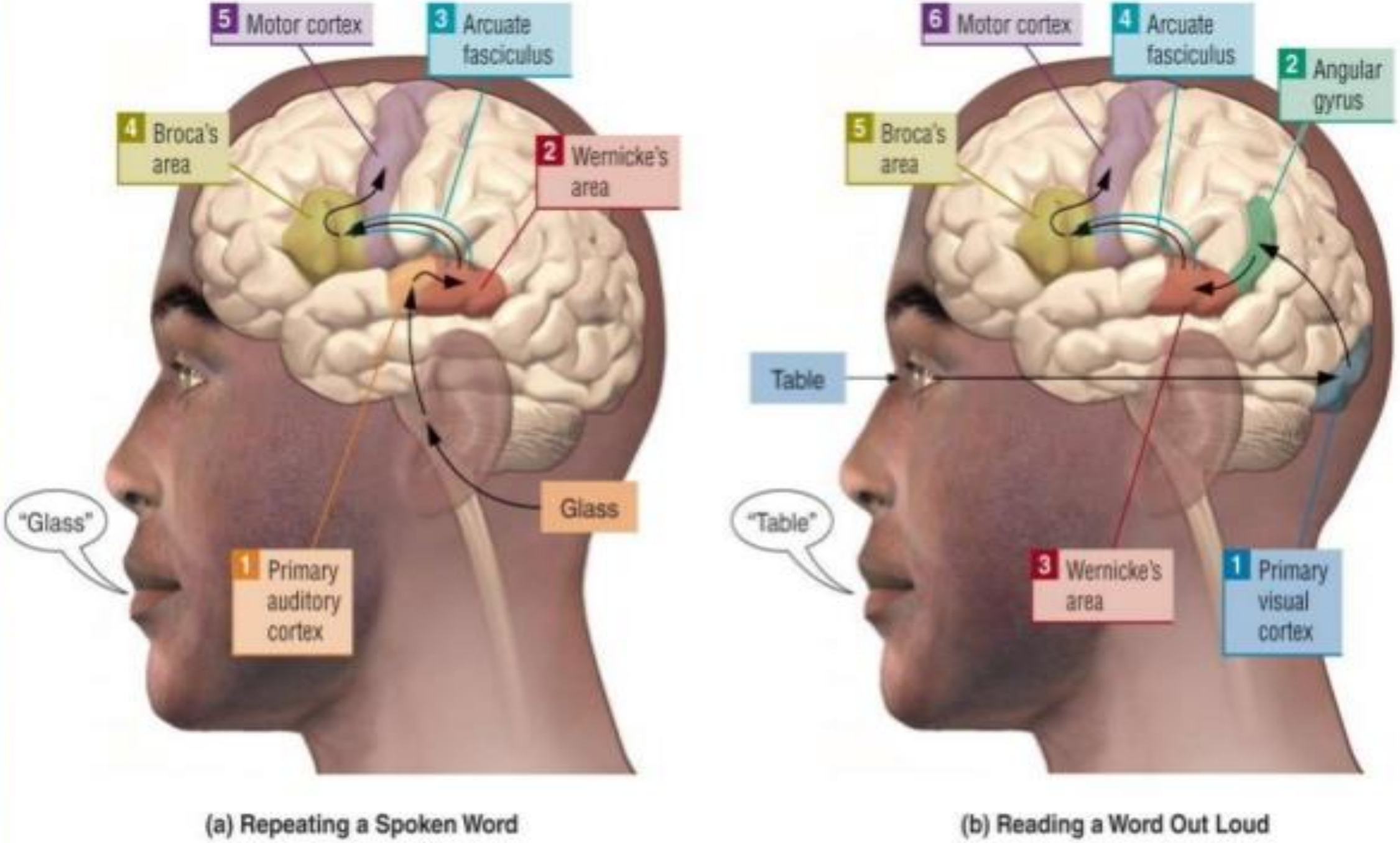


TO REPEAT A WORD THAT YOU *HEAR* INVOLVES THE FOLLOWING PATHWAY:

- Action potentials from the ear reach the primary auditory cortex, where the word is perceived
- the word is recognized in the auditory association area and comprehended in portions of the sensory speech area.
- Action potentials representing the word are then conducted through nerve tracts that connect the sensory and motor speech areas.
- In the motor speech area, the muscle activity needed to repeat the word is determined.
- Action potentials then go to the premotor area, where the movements are programmed,
- and finally to the primary motor cortex, where specific movements are triggered.

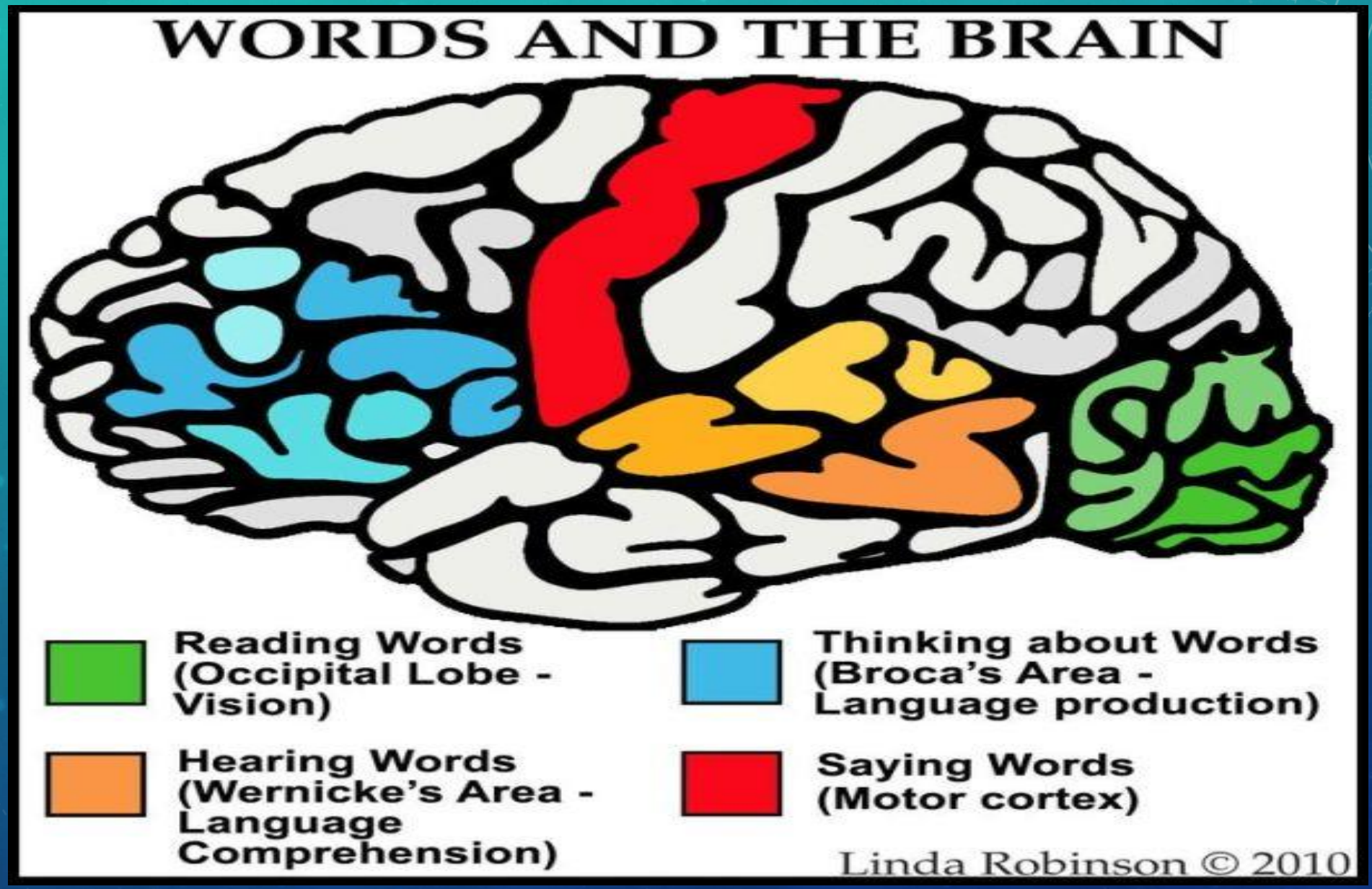
SPEAKING A *WRITTEN* WORD INVOLVES A SLIGHTLY DIFFERENT PATH-WAY:

- The information enters the visual cortex, then passes to the visual association area, where it is recognized.
- The information continues to the angular gyrus and then to the sensory speech area, where it is understood and formulated as it is to be spoken.
- From the sensory speech area, it follows the same route for repeating words that you hear: through nerve tracts to the motor speech area, to the premotor area, and then to the primary motor cortex.



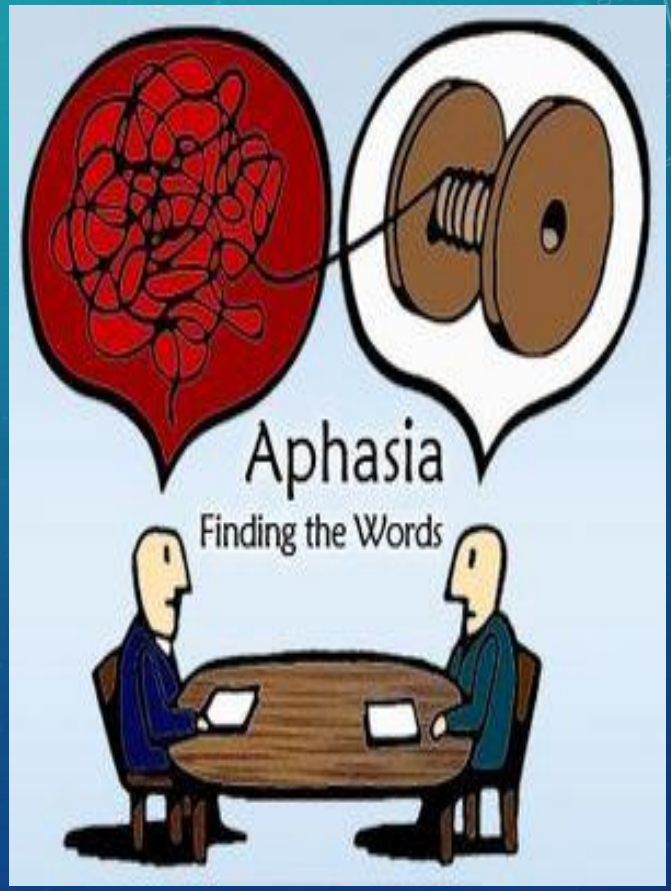
(a) Repeating a Spoken Word

(b) Reading a Word Out Loud


WORDS AND THE BRAIN
Reading Words (Occipital Lobe - Vision)
Thinking about Words (Broca's Area - Language production)
Hearing Words (Wernicke's Area - Language Comprehension)
Saying Words (Motor cortex)
Linda Robinson © 2010

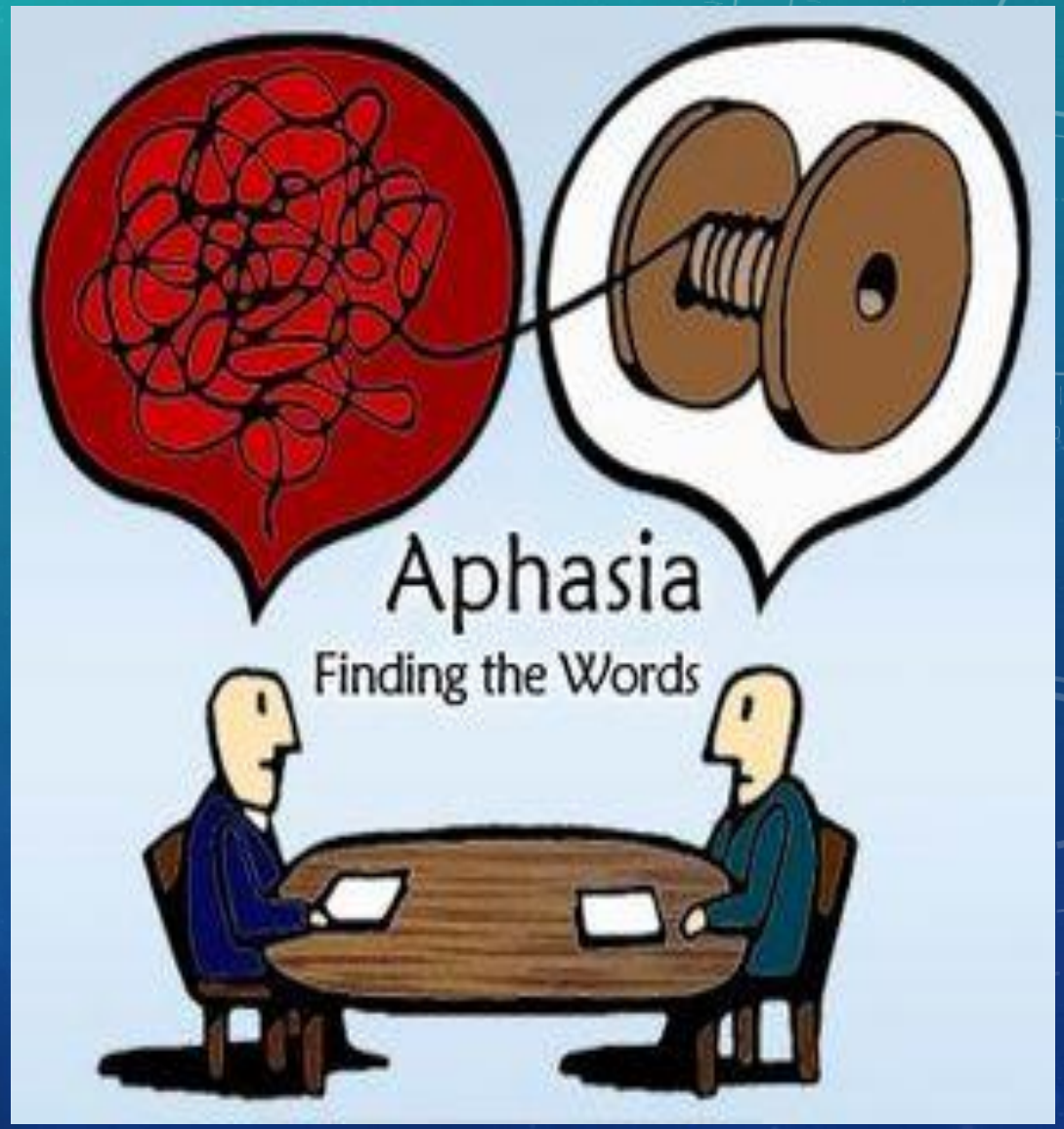

THE MIND IS A WONDERFUL THING, IT STARTS WORKING THE MINUTE YOU'RE BORN, AND NEVER STOPS UNTIL YOU GET UP TO SPEAK!
ABC
CREATIVE SERVICES

DISORDERS OF SPEECH



DISORDERS OF SPEECH

- Aphasia
- Dysarthria
- Dysphonia
- Stammering



APHASIA

- Loss of or impairment of speech due to damage to the higher centres of brain
- Different types depending on the site of the lesion
- Cause is usually stroke, ischemic or hemorrhagic
- Other causes; brain trauma, demyelinating disorders etc

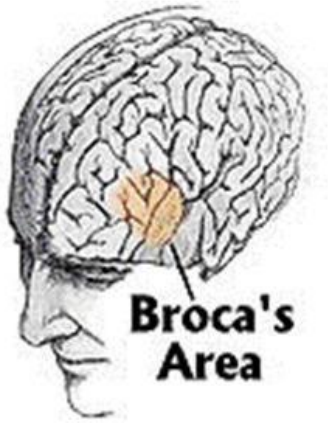
TYPES OF APHASIA

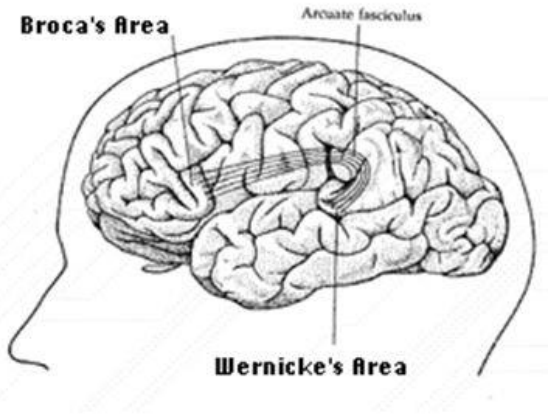
Broca's aphasia	Wernicke's aphasia	Global aphasia	Conduction aphasia
• Damage to more anterior parts of the brain resulting in problems with spoken language. • People feel foolish for not being able to make their point.	• Damage to more posterior areas resulting in language that is well articulated but meaningless. • People may be unaware that they are not making sense and become angry with those who do not understand them.	• Combination of Broca's and Wernicke's aphasia. • People will have severely impaired comprehension and limited speech, although they may have a single word or phrase that they use repeatedly.	• Speech is relatively accurate and fluent but some words are replaced by similar-sounding nonsense words.

Broca's aphasia

Damage to Broca's area results in:

- **slow labored speech**
- **little grammatical fluency**
  - **omission of function words**
  - **omission of inflections**
- **word finding difficulty**
- **comprehension may be impaired**



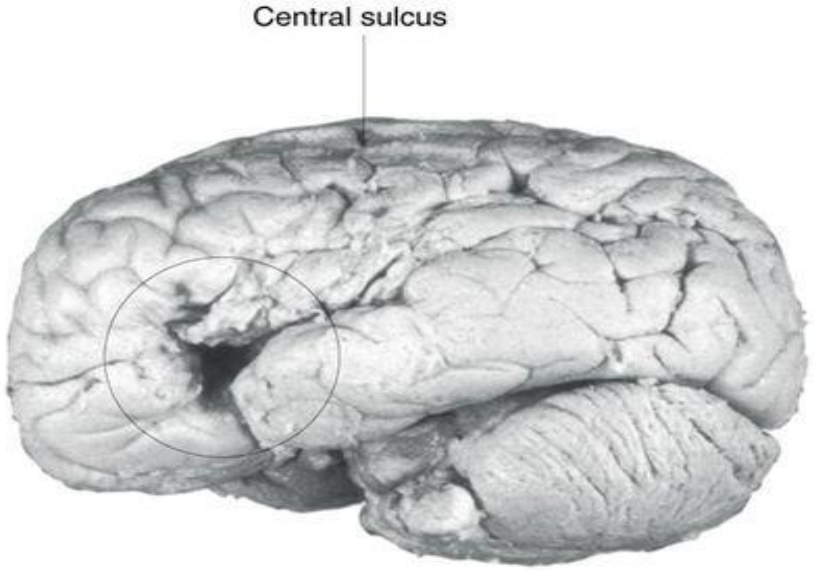


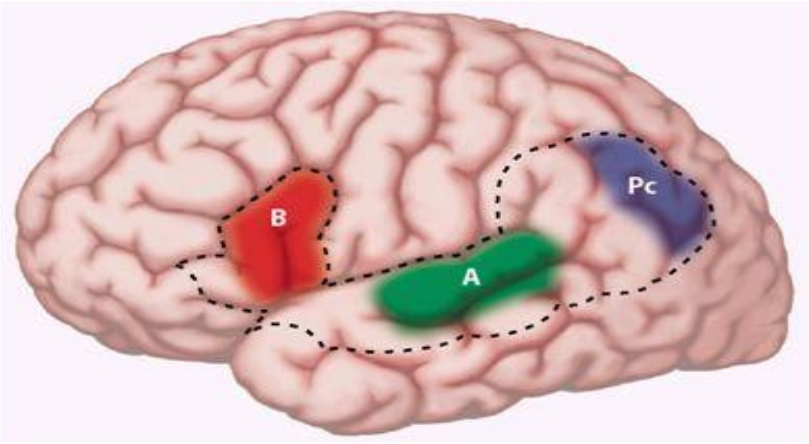
[Brocas aphasia - YouTube]

Broca's Brain

Pierre Paul Broca
(1824-1880)

Patient Tan's brain





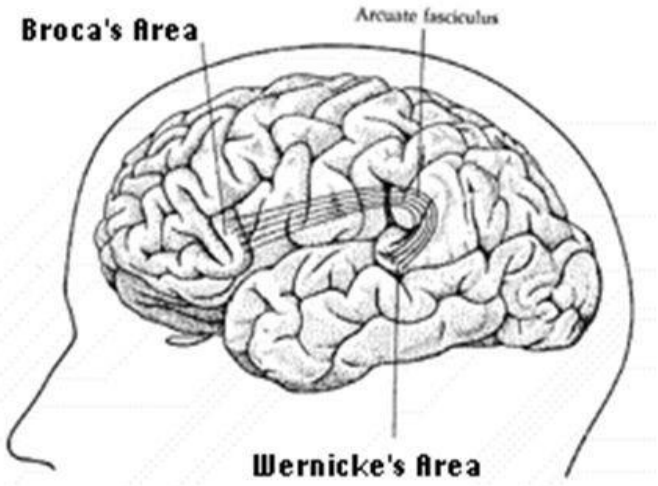
B = Broca's area of motor speech; A = sensory speech center of Wernicke;
Pc = area concerned with language (after Wernicke)

WERNICKE'S APHASIA

Wernicke's aphasia

Damage to Wernicke's area results in:

- **Loss of meaningful messages**
  - **But fluent and grammatical**
  - **paraphasias or inappropriate words**
  - **neologisms - invented words**
- **language comprehension difficulty, especially with complex sentences**



[Fluent Aphasia (Wernicke's Aphasia) - YouTube]

GLOBAL APHASIA

- **Global aphasia** is a severe form of nonfluent **aphasia**
- caused by damage to the left side of the brain, that affects receptive and expressive language skills (needed for both written and oral language)
- as well as auditory and visual comprehension.
- Usually due to a middle cerebral artery leison

Wernicke's Aphasia Example

- **Examiner**: What kind of work have you done?
- **Patient**: We, the kids, all of us, and I, we were working for a long time in the ... you know ... it's the kind of space, I mean place rear to the spedawn ...
- **Examiner**: Excuse me, but I wanted to know what work you have been doing.
- **Patient**: If you had said that, we had said that, poomer, near the fortunate, porpunate, tamppoo, all around the fourth of martz. Oh, I get all confused.

- **Broca's Aphasia**
  - "Yes . . . Monday . . . Dad and Dick . . . Wednesday nine o'clock . . .ten o'clock doctors . . . and . . .teeth." (Geschwind, 1980)
- **Wernicke's Aphasia**
  - "Mother is away here working her work to get her better, but when she's looking the two boys looking in the other part. She's working another time." (Geschwind, 1980)

DYSARTHRIA

DISORDERED ARTICULATION

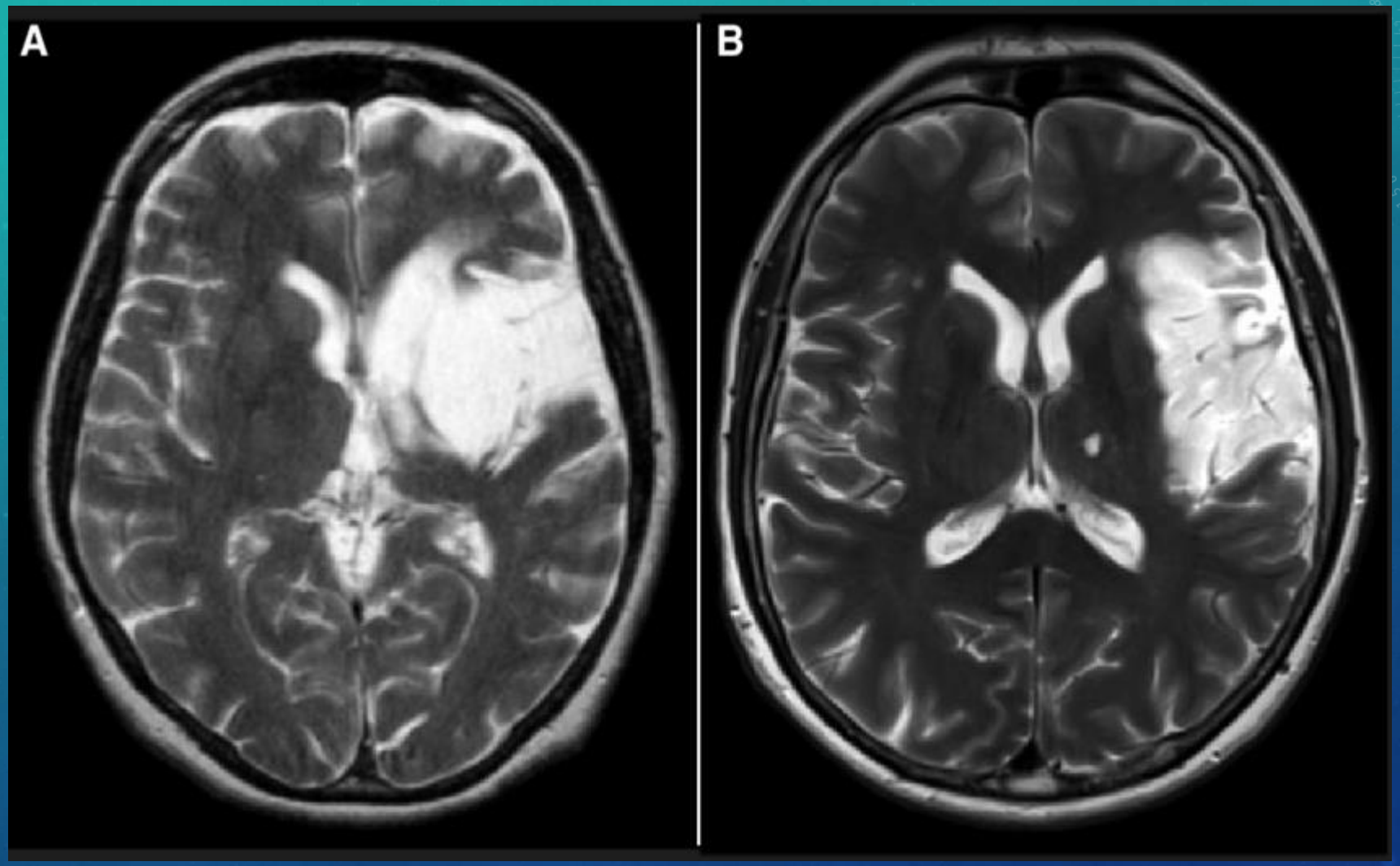
Slurred speech.
Language is intact
Paralysis, slowing or incoordination of muscles of articulation or local discomfort causes various different patterns of dysarthria.

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.

CASE SCENARIO

- Lets fast forward again to a time you are sitting in the medical OPD and a patient is presented to you. He is a 65 year old retired male with Diabetes and hypertension since last 10 years. Now presenting with decreased movements in right arm and slurred speech since last 12 hours. You examine the patient ….the patient is oriented and can comprehend speech but has non-fluent aphasia and a monoparesis on the right arm. You order a MRI scan.
- MRI Report : There is a big infarction on the left fronto parital reigon on the left side.
- WHAT IS THE PATIENT SUFFERING FROM ???
- **Left sided brain infarction or stroke with Broca's aphasia**


A
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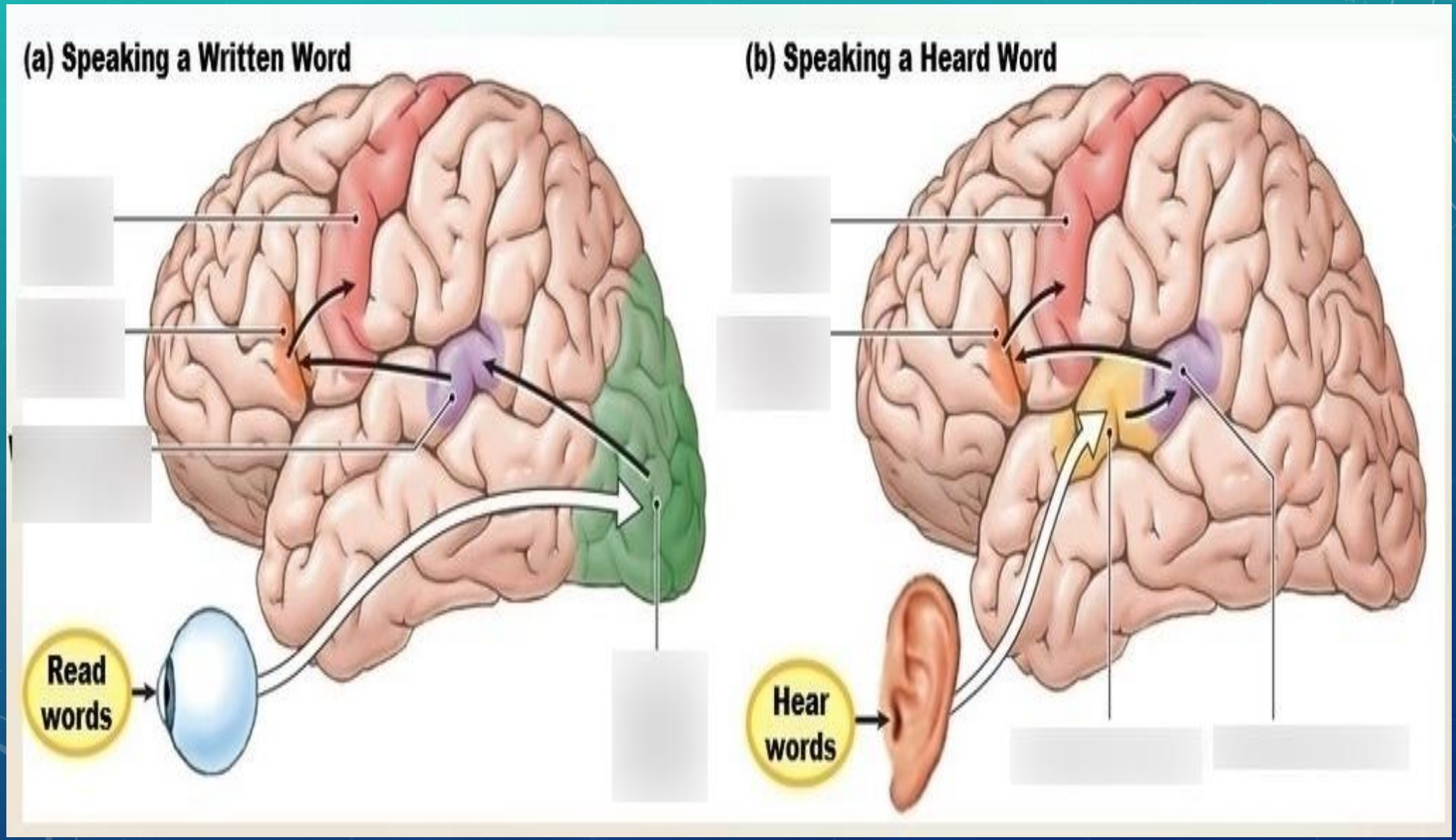
Quiz time


(a) Speaking a Written Word
Read words
(b) Speaking a Heard Word
Hear words

STROKE SYMPTOMS

Remember, recognize and act fast

F **Face** drooping

A **Arm** weakness

S **Speech** difficulties

T **Time** to call

"Dad, guess what? I've got my first part in a play," said the budding young actor. "I play the part of a man who has been married for 25 years."

"That's a good start, son," replied the father. "Just keep at it and one of these days you'll get a speaking part."

The Prophet (s.a.w.) said,

“The most beloved of speech
according to Allah (s.w.t.)
is when the servant says,

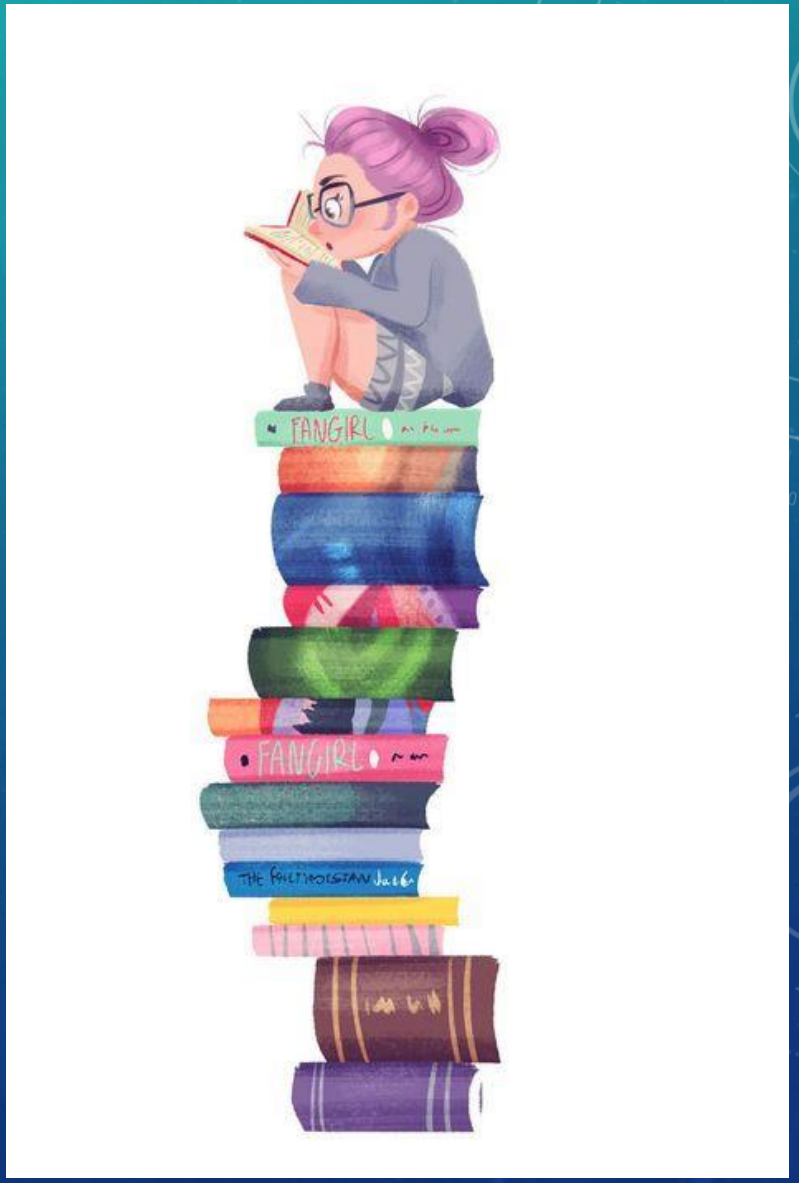
‘Subhanallahi wa bihamdihi’

(How Transcendent is Allah
and we praise him!).”

(Muslim)

RECOMMENDED BOOKS

- Guyton and Hall
- Sherwood
- Sembalingum




That's all Folks!
SUPERB wallpapers