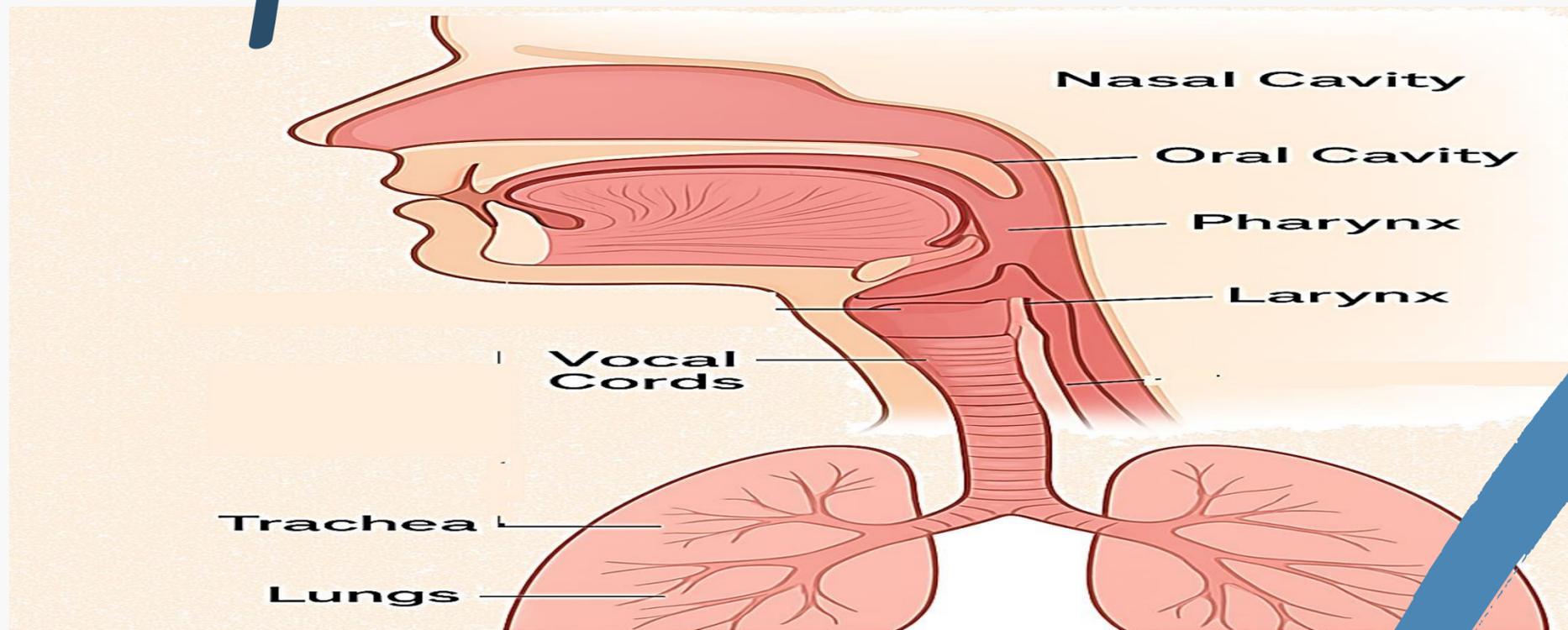


Physiology of Speech



Prof.

Khaled Abdel-Sater M.D



2nd year Dental Students



Study Objectives

Knowledge Objectives

- 1. Identify the primary speech organs** and describe their roles in respiration, phonation, and articulation.
- 2. Explain the phonatory system**, including the function of the larynx and vocal cords in sound production.
- 3. Describe the neural control of speech**, including the major cerebral cortex lobes involved in speech functions.
- 4. Locate Brodmann areas (22, 39, 40, 44, 45)** involved in speech production, comprehension, and coordination.
- 5. Differentiate the major types of aphasia** based on the affected cortical area and clinical features.

Skills Objectives

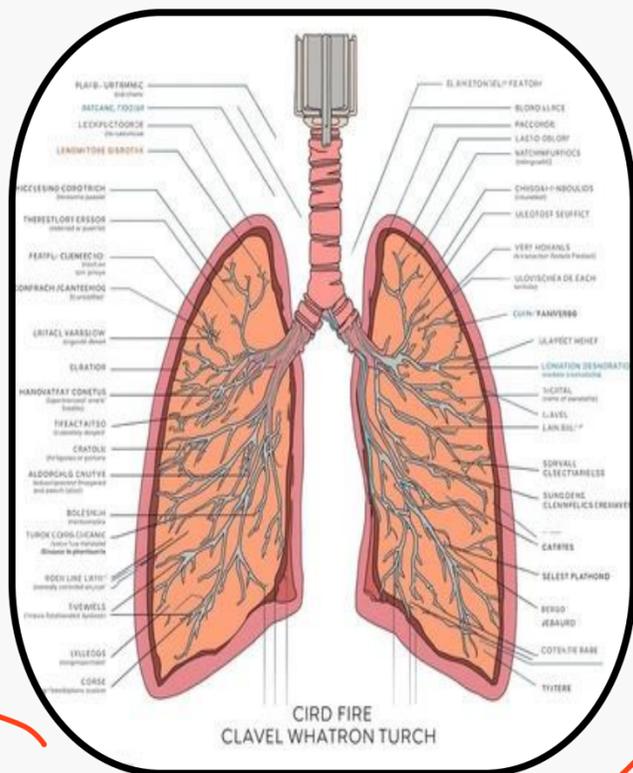
- 6. Analyze how respiratory, phonatory, and articulatory systems interact** to produce intelligible speech.
- 7. Interpret clinical cases of speech deficits** and link them to dysfunction in specific cortical regions.

Attitude/Objectives

- 8. Appreciate the complexity and integration of neural and muscular control** required for normal verbal communication.

We use more than 100 muscles just to say a simple word e.g. Hi

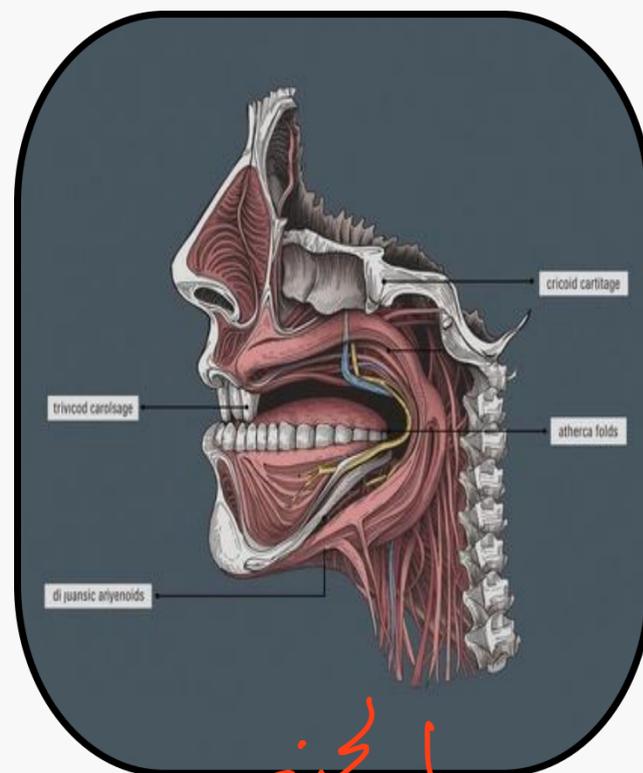
Primary Speech Organs



Respiratory system

Provide the power for speech by pushing air out of the body.

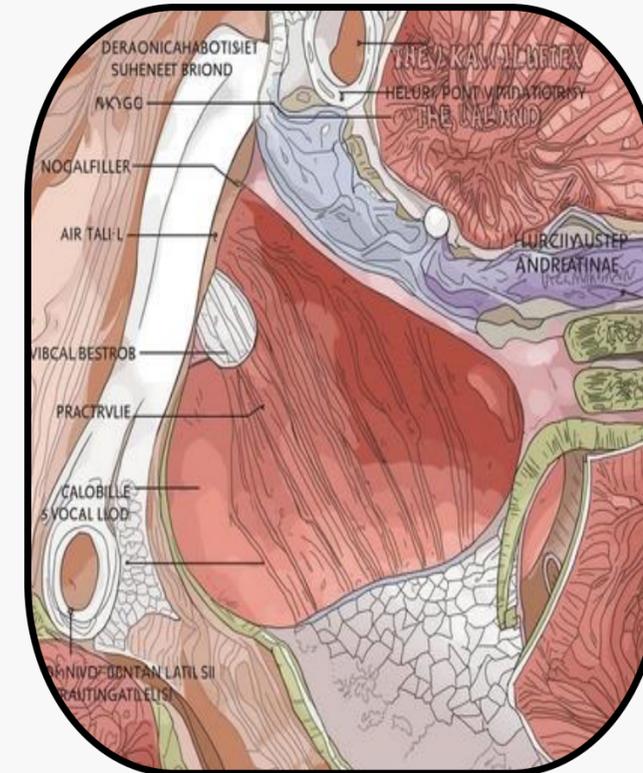
بجهد اهتزاز للأجبال الصوتية



Larynx

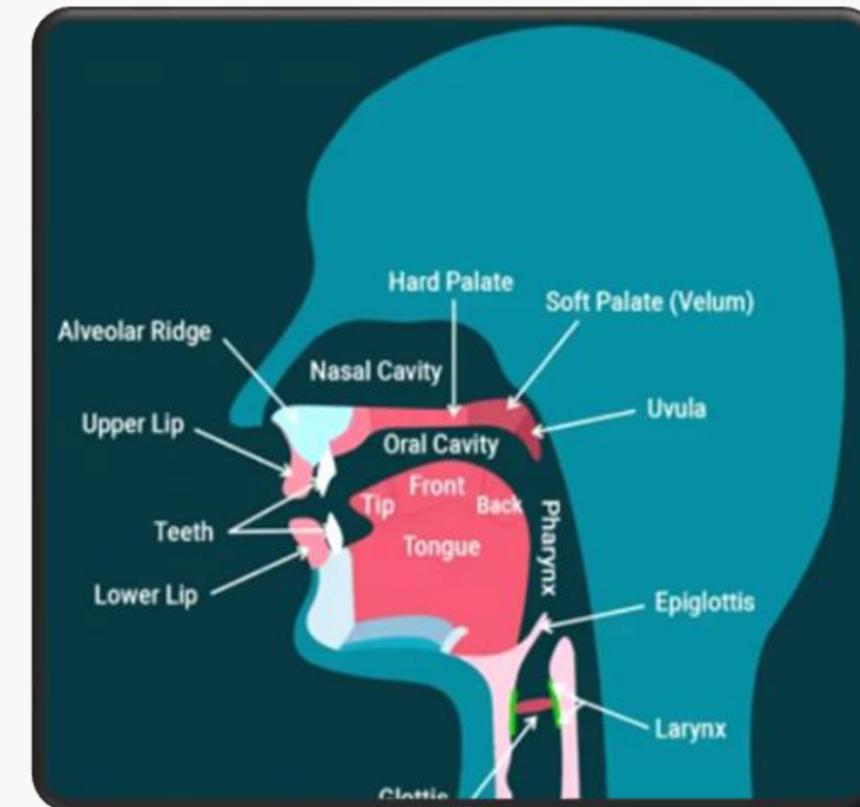
The larynx houses the vocal folds.

Phonatory system



Vocal Folds

Vocal folds vibrate to create voice sounds.



Articulatory system

Oral cavity (lips, teeth, tongue, hard palate, soft palate) and nasal cavity.

nose

Your tongue never gets tired... even though it never stops working!

tongue

الصدر يكون في الرئتين
فانصة
Lungs, trachea

الكينز
صوت
vocal cords
(voice box)

Neural Control of Speech Mechanisms

Brain Areas

such as areas
4, 17, 18, 19,
22, 39, 40, 41,
42, 44, 45

face region
hand region
motor area
فهم ما قرأت
تساعد في تكوين الأفكار
فهم ما سمعت
تساعد في تكوين الأفكار
التنفيذ (اليه عضلات)
التنفيذ (الغلق)
دون فهم
دون فهم

الارادي
لا ارادي

Both central
and
peripheral
nervous
systems
work together
to ensure
normal
speech

Neural Pathways

brain stem
↑
descending
The corticobulbar tract and
cranial nerves (trigeminal (V),
facial (VII), glossopharyngeal (IX),
vagus (X), XI (Accessory) and
hypoglossal (XII)) are crucial
pathways that transmit
signals from the brain to the
speech-producing muscles.

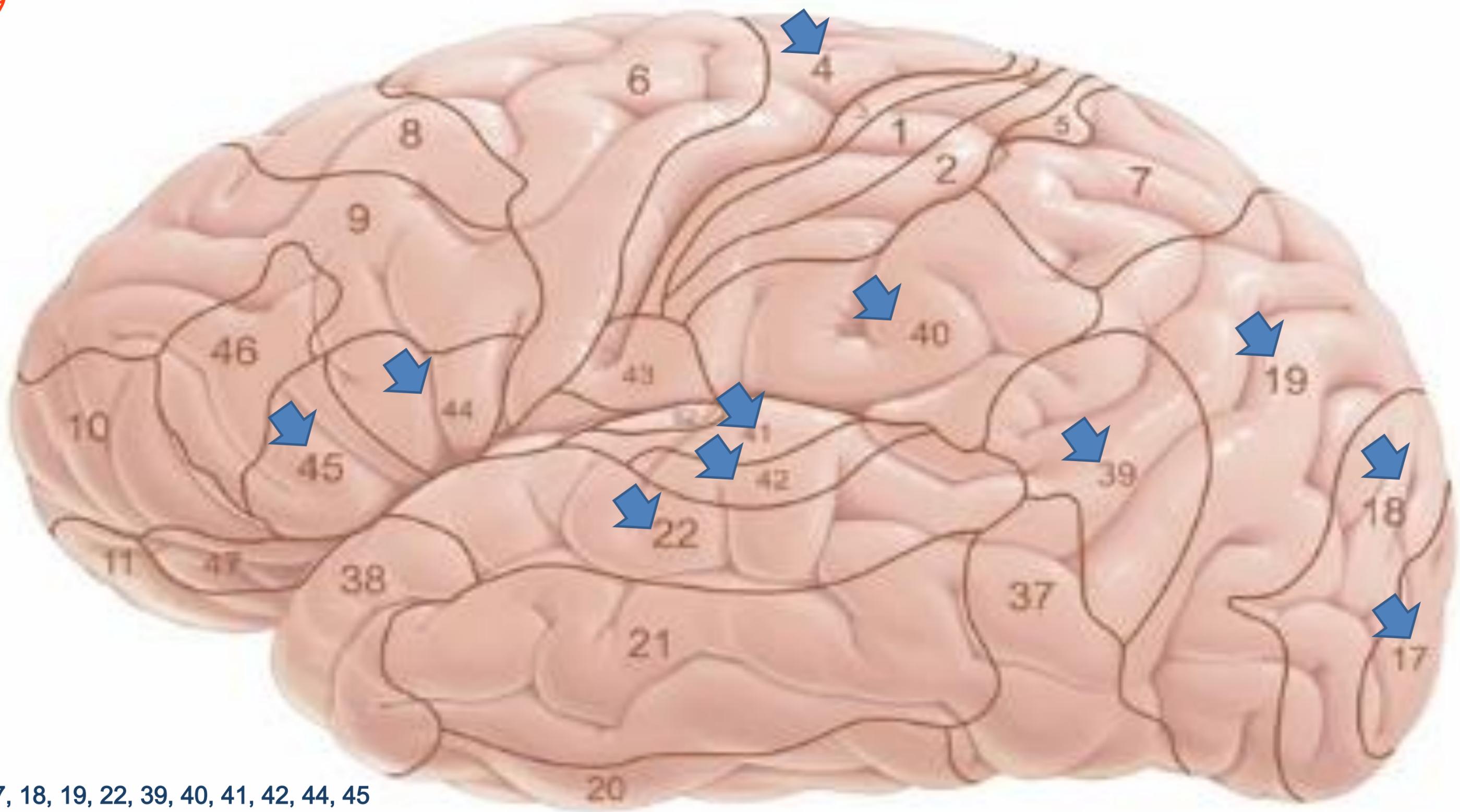
Peripheral

The fastest speakers on Earth can talk at (over 600 words per minute)

Cerebral Cortex **Brodmann** Areas

قسمت
بنیادی
مکان

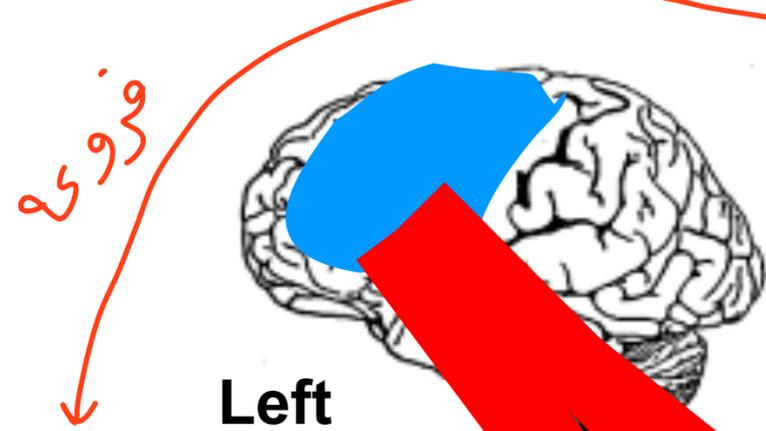
HISTOLOGY



Areas 4, 17, 18, 19, 22, 39, 40, 41, 42, 44, 45

Pyramidal Tract

→ descending tract



Left Internal Capsule
Corticospinal Tract

Motor areas, somatic sensory areas

مناطق حسية جسمية

3

3, 4, 6
Motor nuclei of cranial nerves

Corticobulbar tract

نازل من ال cortex
فقط هاد الفرع الي
بشارن الكلام

5, 7, 9, 10, 11 and 12
→ cranial nerves

Midbrain

Pons

Medulla

Corticospinal tract

1
→ spinal cord

AHCs

Spinal Cord

Centers of Speech

هناك مناطق
بعضها أصعب
من سلاسل
هايك ورائي

هم المحافظة

كلام
مكتوب

Primary auditory area (41-42)
تسمع الكلام دون فهمه فقط سمع

Aud. Assoc. area (22)
منطقة الفهم
understand meaning of impulse



Ideational area

Wernick's area
منطقة الأفكار

- Form thoughts
- Choose words needed for expression of these thoughts

area 45 Exner's area
program the movement of muscles of the hands

Motor area 4 hand region



Hand muscles

Primary visual area (17)
قرأت الحروف بدون فهم

Vis. assoc. area (18-19)
منطقة الفهم
understand meaning of impulse

General interpretative area

area 44 Broca's area
program the movement of muscles of articulation

Motor area 4 face region



Pierre Paul Broca 1824-1880



Speech muscles

كلام منطوق

Sensory aspect

Motor aspect

مناطق نفس المبدأ
(تشارك في تكوين الأفكار)
area 22, 39, 40

منطقة التنفيذ (الخطوة)
area

Speech centers

Area	Function
(1) Wernicke's area (general interpretative area)	Interpretation of auditory & visual information to <u>form a thought</u>
(2) Broca's area (area 44)	Co-ordination of vocalization
(3) Hand skills area (Exner's area)	Co-ordination of hand movement
(4) Auditory areas: A. Primary auditory area (41, 42) B. Auditory association area (area 22)	Hearing Understanding the meaning (interpretation) of spoken words
(5) Visual areas: A. Primary visual area (17) B. Visual association areas (18,19)	Vision (written words & images) Understanding the meaning of written words.

area program

الفهم
تكوين أفكار
(مجردة)

التعبير الصوتي
عمل خطة

السمع والفهم

القرأ والفهم

Types of Aphasia

فقدان القدرة على الكلام →

الفرق بينه وبين dysarthria لأنه حساس و motor sensory →

Type	Defect	Area damaged
1- Auditory aphasia (word deafness)	<u>Inability to understand spoken words</u>	Auditory association area → 22 in superior temporal gyrus
2- Visual aphasia (word blindness)	<u>Inability to understand written words</u>	Visual association area → 18/19 in occipital lobe
3- Wernicke's aphasia (fluent aphasia)	Inability to interpret the meaning of spoken or written words or express thoughts in words (meaningless & excessive talk is characteristic)	Wernicke's area ✓
4- Broca's aphasia (non fluent – motor aphasia)	Inability of the vocal cords to produce words instead of noises. Speech is poorly articulated, produced slowly & with great effort (limited to 2 or 3 words)	Broca's area ✓
5- Motor apraxia (agraphia)	Inability to express thoughts by written words in absence of paralysis Hand movements become uncoordinated & useless	Hand skill area ✓

← الاسم الكلامي

← معنى الكلام

الدسماء الأخرى
موضع سؤال
↑ اسم آخر

