

# Brain Tumor 101

**Shanna Armstrong, RN**

Neuro Oncology Nurse Clinician

UC Brain Tumor Center

# Objectives

- § Identify the different parts of the brain
- § Describe how each part of the brain works
- § Connect each part of the brain with how a problem in that area affects a brain tumor patient
- § Explain the function of each cranial nerve and an associated problem with each
- § Explain the types of brain tumors, their grades, and aggressiveness

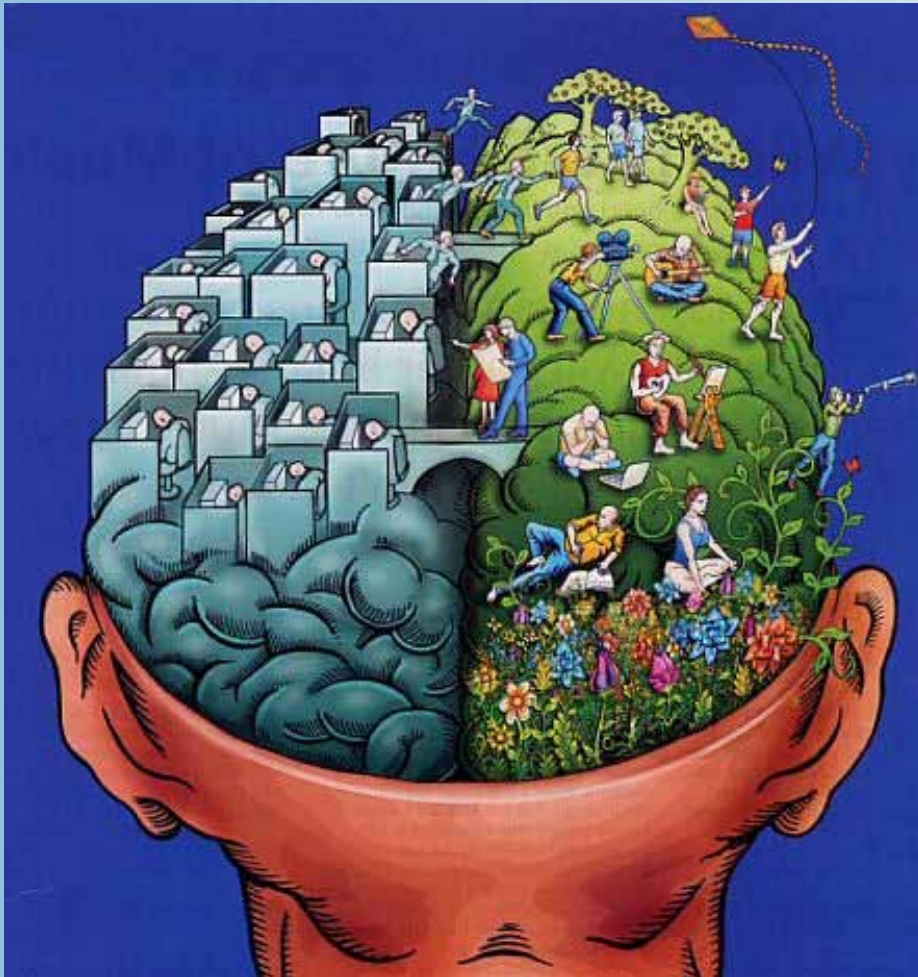
# Anatomy

## § **Monro- Kelly Hypothesis**

- The brain as a box
- 3 equal parts
  - Blood
  - Brain
  - Spinal fluid



# Anatomy



## § Two cerebral hemispheres

- Right – creative
- Left – technical

## § Left v. Right dominance

- 95% of right-handed people have left-hemisphere dominance for language
- Only 18.8% of left-handed people have right-hemisphere dominance for language function
- 19.8% of left-handed people have bilateral language functions

# Anatomy

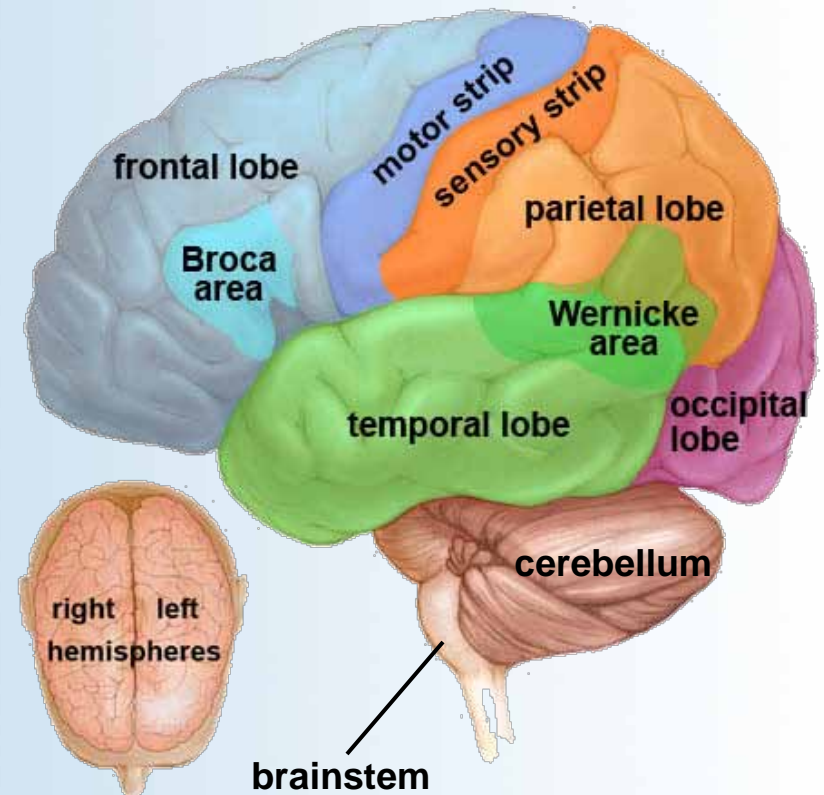
## § Cerebral hemispheres made up of lobes

- Frontal
- Parietal
- Temporal
- Occipital

## § Cerebellum

## § Brain Stem

## § Ventricular System



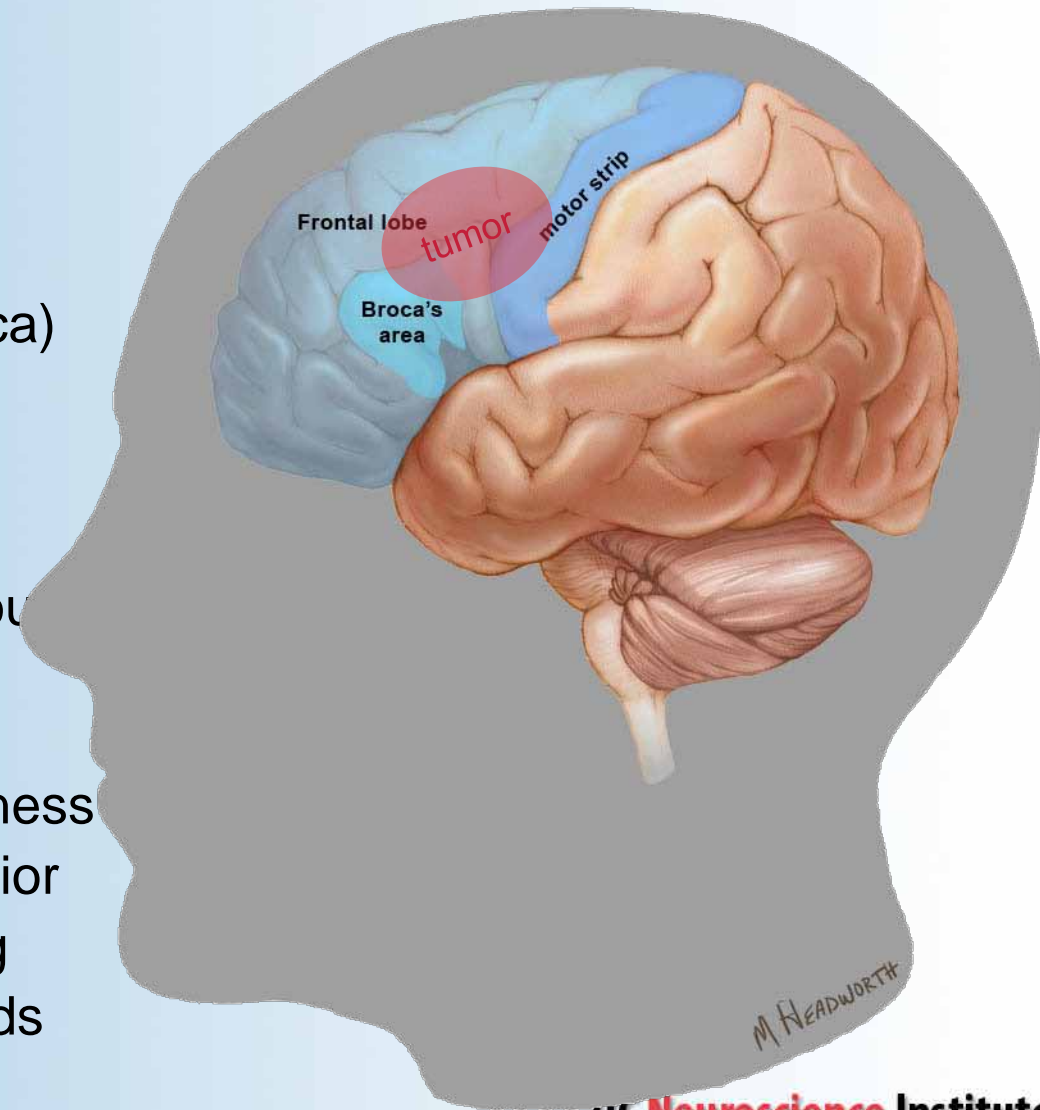
# Frontal Lobe

## § Normal functions

- Personality
- Inhibition
- Motor
- Expressive speech (Broca)

## § Tumor may cause

- Loss of movement (paralysis)
- Repetition of a single thought or word
- Unable to focus
- Mood swings, impulsiveness
- Changes in social behavior
- Difficulty problem solving
- Language: can't get words out (aphasia)



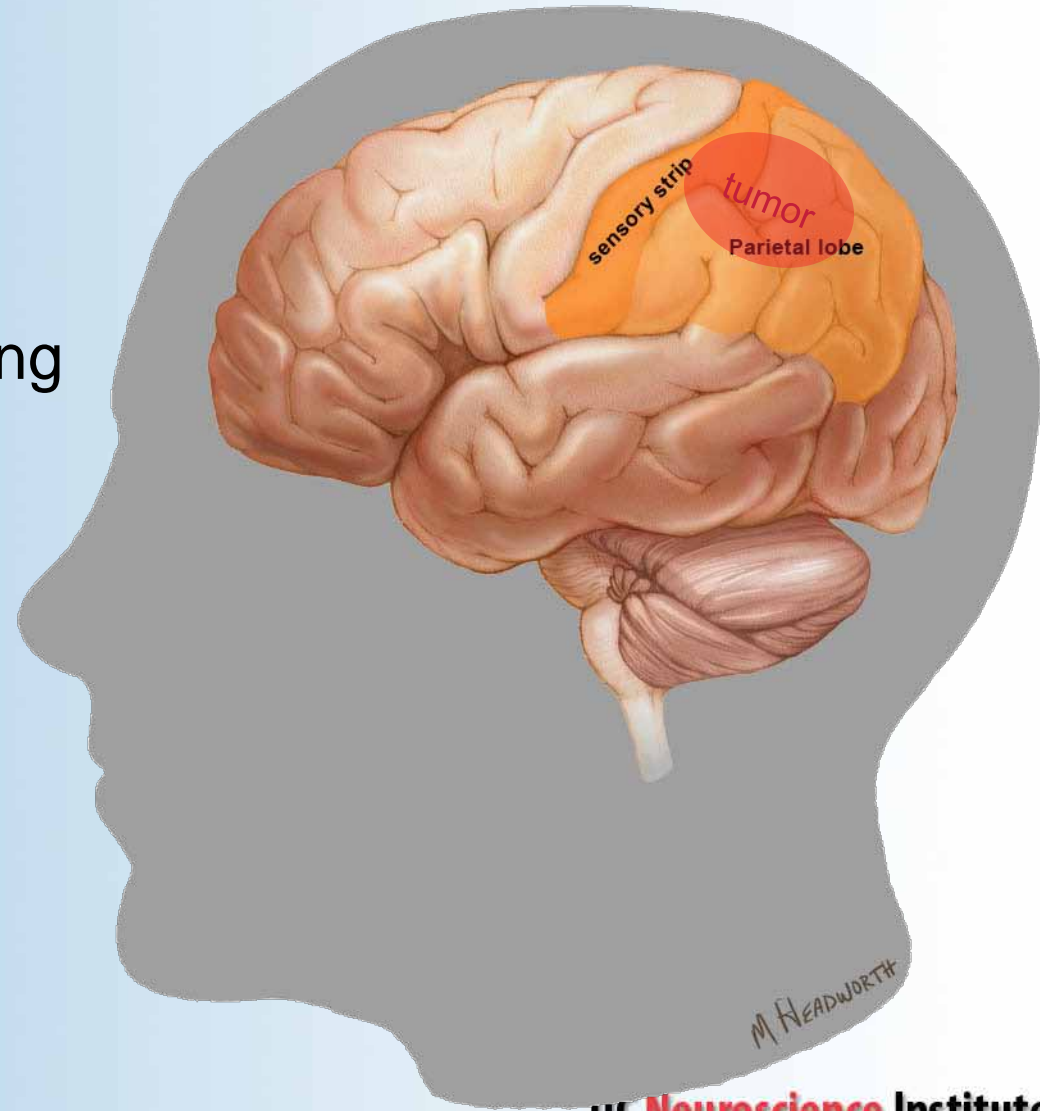
# Parietal Lobe

## § Normal functions

- Sensation
- Spatial perception

## § Tumor may cause

- Difficulty distinguishing left from right
- Lack of awareness or neglect of certain body parts
- Difficulty eye-hand coordination
- Problems reading, writing, naming
- Difficulty with math



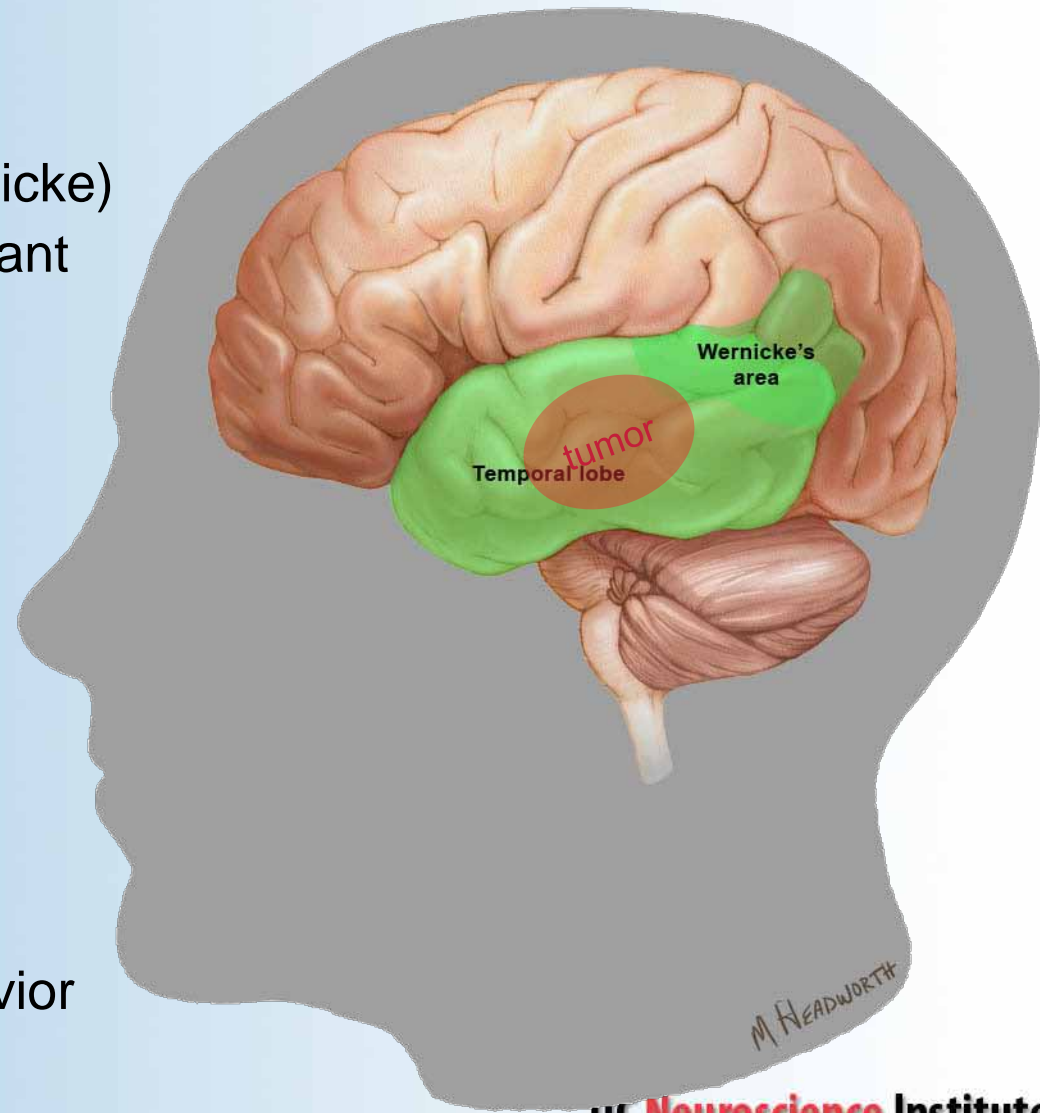
# Temporal Lobe

## § Normal functions

- Memory
- Receptive speech (Wernicke)
- Dominant vs. non-dominant

## § Tumor may cause

- Difficulty understanding language and speaking (aphasia)
- Difficulty recognizing faces
- Difficulty naming / identify objects
- Problems with short and long term memory
- Changes in sexual behavior
- Increased aggressive behavior



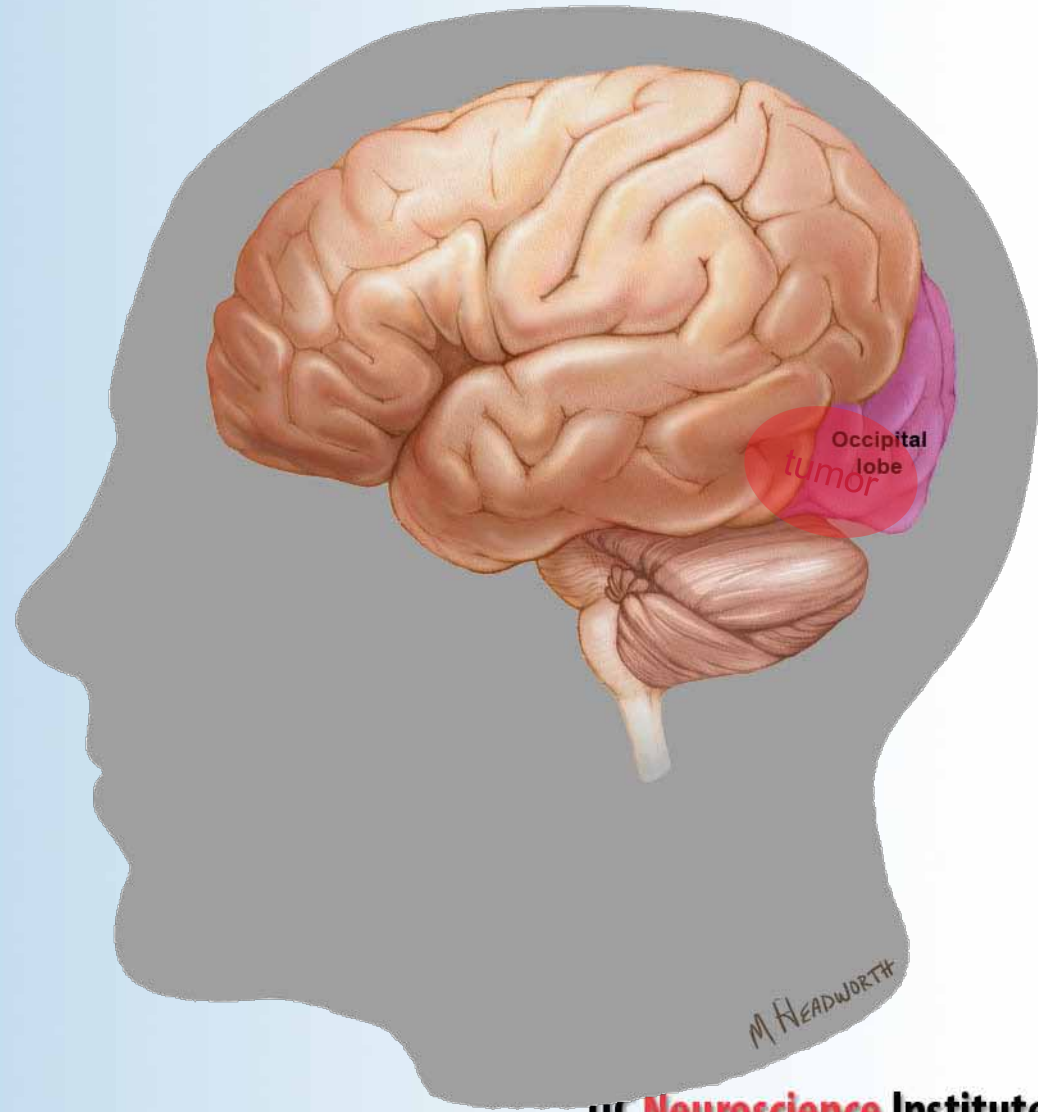
# Occipital Lobe

## § Normal functions

- Vision

## § Tumor may cause

- Defects in vision or blind spots
- Blurred vision
- Visual hallucinations



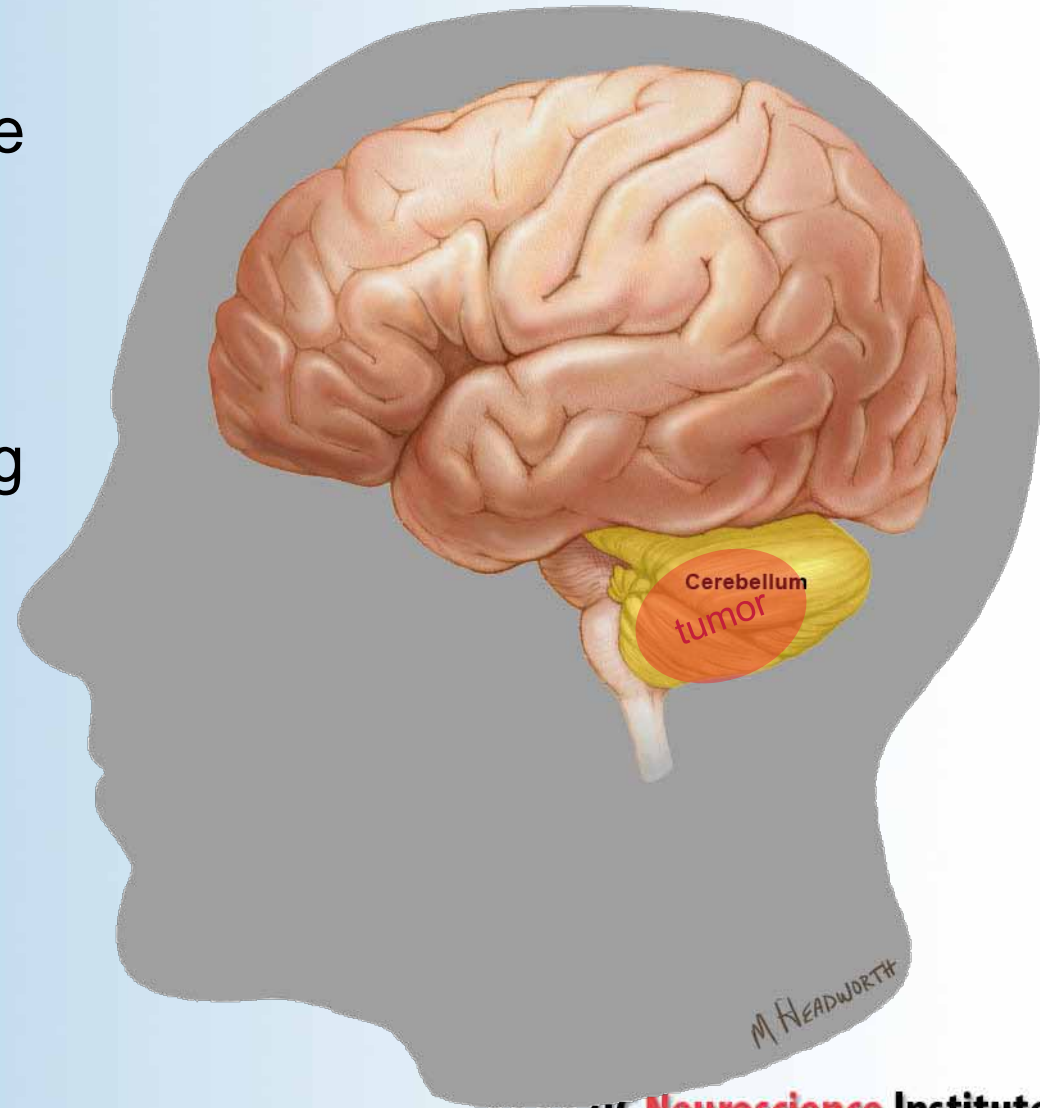
# Cerebellum

## § Normal functions

- Coordination and fine motor movements
- Balance

## § Tumor may cause

- Difficulty coordinating fine movements
- Difficulty walking
- Tremors
- Dizziness
- Slurred speech



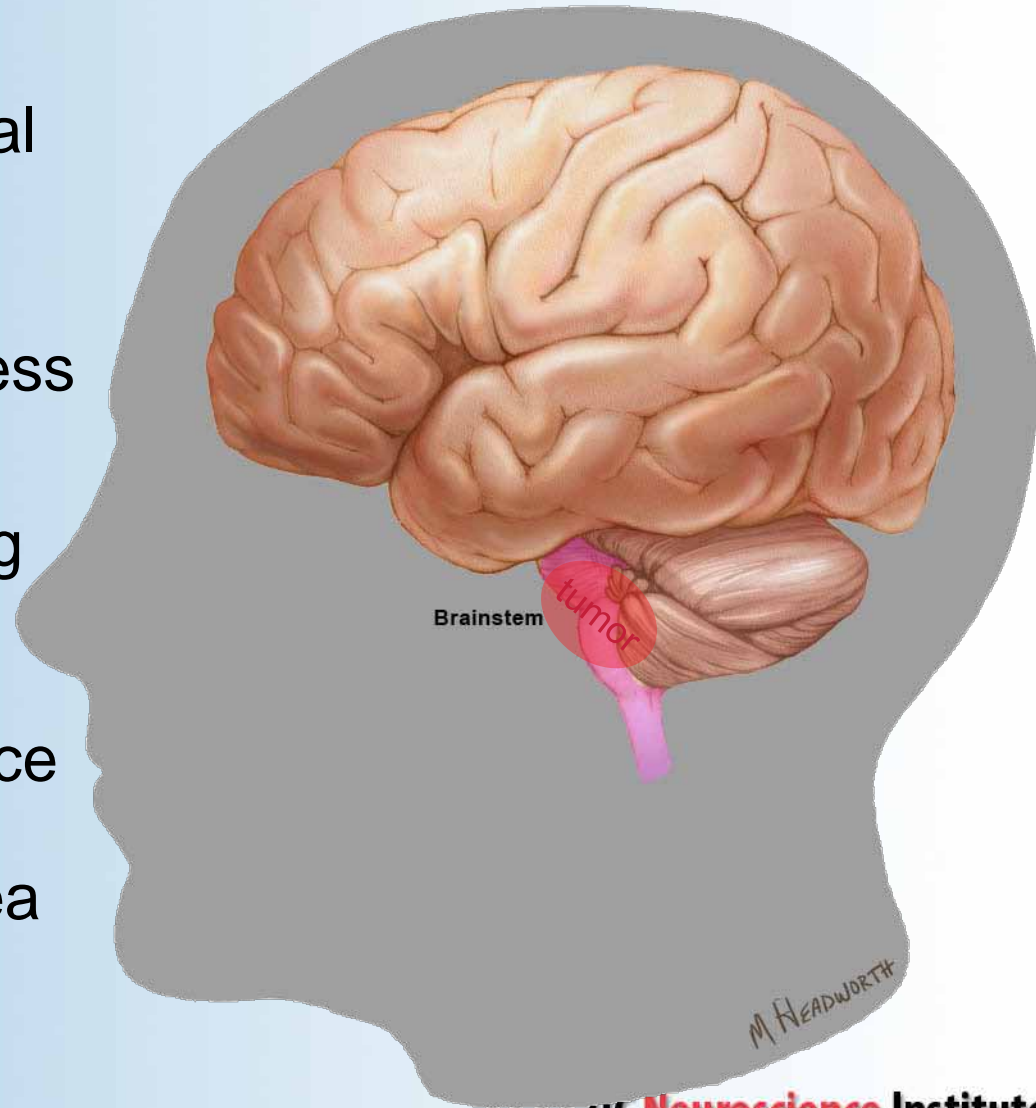
# Brain Stem

## § Normal functions

- Origin of many cranial nerves
- Respiratory center
- Level of consciousness

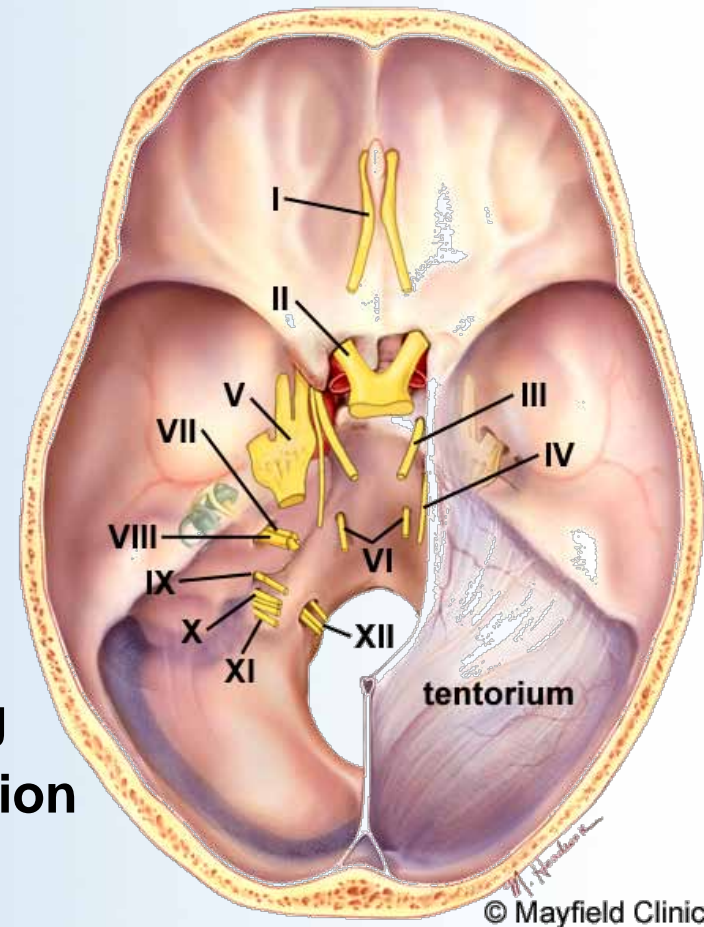
## § Tumor may cause

- Changes in breathing
- Difficulty swallowing (dysphagia)
- Problems with balance and movement
- Dizziness and nausea



# Cranial Nerves

|             |                          |                              |
|-------------|--------------------------|------------------------------|
| <b>I</b>    | <b>olfactory</b>         | <b>smell</b>                 |
| <b>II</b>   | <b>optic</b>             | <b>sight</b>                 |
| <b>III</b>  | <b>oculomotor</b>        | <b>eye movement</b>          |
| <b>IV</b>   | <b>trochlear</b>         | <b>eye movement</b>          |
| <b>V</b>    | <b>trigeminal</b>        | <b>face sensation</b>        |
| <b>VI</b>   | <b>abducens</b>          | <b>eye movement</b>          |
| <b>VII</b>  | <b>facial</b>            | <b>face movement</b>         |
| <b>VIII</b> | <b>vestibulocochlear</b> | <b>hearing, balance</b>      |
| <b>IX</b>   | <b>glossopharyngeal</b>  | <b>taste, swallowing</b>     |
| <b>X</b>    | <b>vagus</b>             | <b>heart rate, digestion</b> |
| <b>XI</b>   | <b>spinal accessory</b>  | <b>head movement</b>         |
| <b>XII</b>  | <b>hypoglossal</b>       | <b>tongue movement</b>       |



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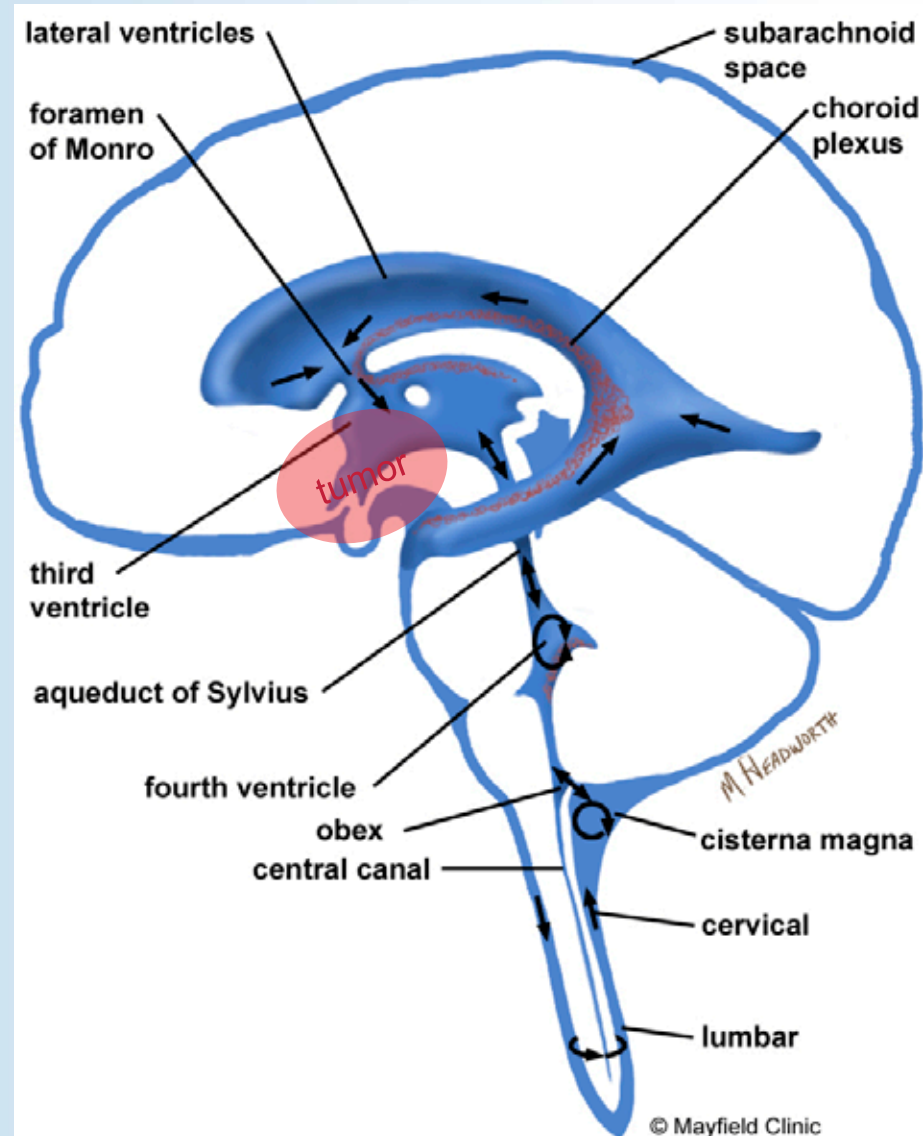
# Ventricular System

## § Normal functions

- Cerebrospinal fluid flow pathway
- Cerebrospinal fluid bathes and cushions the brain and spinal cord

## § Tumor may cause

- Blockage of CSF
- Hydrocephalus

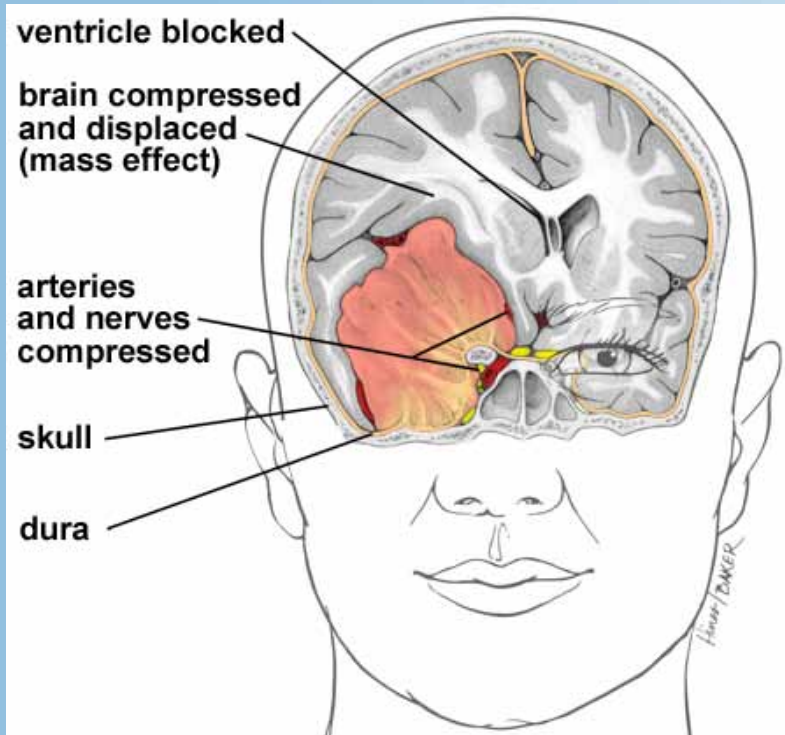


# Central Nervous System Tumors

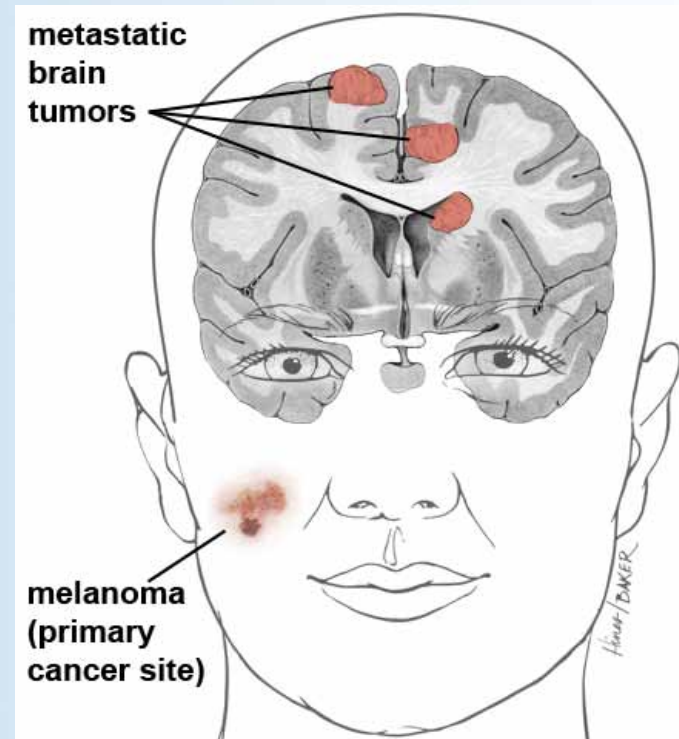
- § **Primary v. secondary**
- § **Classification system (WHO)**
- § **Benign v. malignant**
- § **De novo v. dedifferentiated**

# Brain tumors

**Primary -  
originates in brain**



**Metastatic (secondary) -  
cancer that spread to brain  
from somewhere else**



# World Health Organization

§ **Grading scale based on cell type and tumor aggressiveness**

§ **Applies to all tumors**

- Glioma – Grades I – IV
- Meningioma – Grade I – III
- Pituitary adenoma – Grade I
- Acoustic neuroma – Grade I

# Glioma Grading\*

## **Grade I** (pilocytic astrocytoma)

- Slow growing cells
- Least malignant

## **Grade II** (astrocytoma)

- Relatively slow growing cells
- Can invade nearby tissue
- Sometimes recur as a higher grade

## **Grade III** (anaplastic astrocytoma)

- Actively reproducing abnormal cells
- Infiltrate normal tissue
- Tend to recur, often as a higher grade

## **Grade IV** (glioblastoma)

- Rapidly reproducing abnormal cells
- Area of dead cells (necrosis) in center
- Form new blood vessels to maintain growth

# Brain tumor types

## Low-grade

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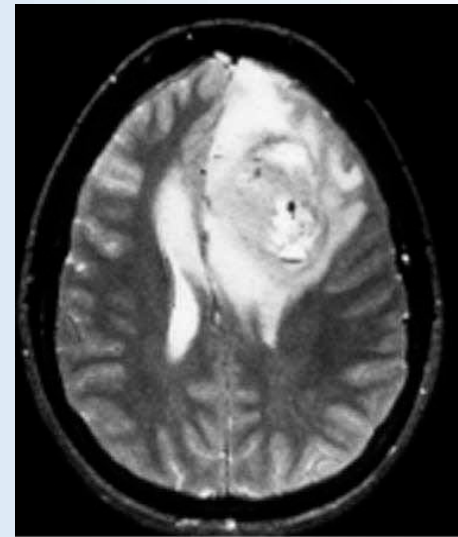
- § Meningioma
- § Pituitary adenoma
- § Acoustic neuroma
- § Low grade glioma – astrocytoma, oligo



## High-grade

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- § Anaplastic astrocytoma
- § Anaplastic oligodendroglioma
- § Glioblastoma (GBM)



# Rate of growth

- § Higher grade → faster the tumor is growing
- § Benign is slow growing (WHO I and II)
- § Malignant is faster growing (WHO III and IV)
- § Tumors can have characteristics of two different grades = mixed glioma, treatment is defined by the more malignant portion being the more aggressive portion

# Origin of tumor

- § **Primary versus Secondary Glioblastoma**
- § **Primary or De novo means “of the new” – a tumor that spontaneously arises**
- § **Secondary = one that has “dedifferentiated” or “evolved” from a lower grade tumor**
- § **Treatment is the same**
- § **Genetics are different**
  - Possible opportunities for unique treatments in the future directed at these genetic differences