

## Brain cells.

Neuroectodermal.

1) Astrocytes

i) Blood Brain Barrier.

ii) Wound Healing/Repair.

Ependymal injury (don't  
↓ Regenerate)Subependymal granuloma.  
(astrocytes)2) Oligodendrocytes - myelination of CNS.3) ependymal cells

Fatty-acid Binding proteins/w.

\* Mature astrocytes.

↓  
Radial glial system.↓  
Neurogenesis of Cortical layers.

mesodermal.

modified

macrophages

↓  
Microglial cells.↓  
modified Lipid

Lipophages

↓  
Griffith cells

Hortega cells

1) Red neurons - Hypoxic ischemic injury  
because of apoptosis + necrosis, cytoplasm - Red.

2) Rosenthal fibres - Both tumor + inflammation.

→ Tumor Juvenile Pilocytic Astrocytoma

→ Inflammation → Gliosis

Composition - heat shock proteins Hsp-27  
αβ crystalline.

3) Alzheimer Type II astrocytes - No association with  
Alzheimer's disease.  
Due to liver cell failure

↓  
Hyperammonemia

↓  
Swollen astrocytes - Alb. Type - II

Alzheimer Type II astrocytes - Progressive multifocal  
leucoencephalopathy

Jcpolyoma virus

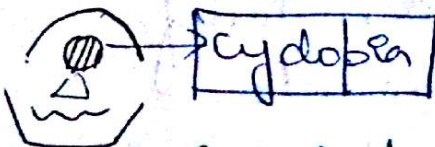
↓  
Oligodendrocytes

↓  
Ground glass nuclei.



Foetal brain Anomalies

1) Holoprosencephaly: (Whole Foetal brain fused)  
No Rt / Lt Cerebral Hemispheres.



→ Sonic Hedgehog gene mutation

NTertation genes

NToapogenesis

Home box Hox

Sonic Hedgehog genes

Decide Anterior-Posterior axis.

[Head-Tail pattern]

Patterning of limbs  
midline structures of  
Brain & Spinal cord

Neuronal Migration disorders

Normal migration - 12-16 weeks (Completed migration)

1) Lissencephaly

Loss of gyri → Agyria - Flat Brain

Lis-1 gene mutation

2) Polymicrogyria

3) Neuronal Heterotopia

4) Agenesis of Corpus Callosum

Batwing Deformity - Radiologically

5) Agenesis of Cranial nerves

Kind-Brain Syndromes

- Dandy-Walker Syndrome - Cystic dilatation of  
IV ventricle

↑ post. fossa volume (↑ CSF - Hydrocephalus)

**I**  
quadrigeminal/plate  
Tectum intact.



∴ only downward displacement  
of cerebellar vermis.

**II** Arnold-Chiari.



Damage of  
quadrigeminal  
plate/tectal  
plate.

Cerebellar Hemiation

Banana Sign.

Chiari → neural tube defect

## Vascular

### Hemorrhages

Intracerebral  
(m/c type of Bleed)

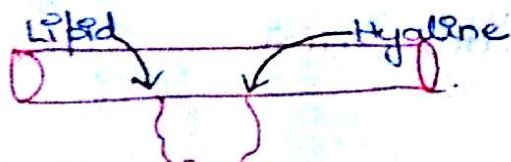
SAH.

m/c cause - Trauma

→ HTN.

m/c A: Middle Cerebral A.

↓  
Lenticulostriate branch.



Lipohyalinosis of BV

↓  
Aneurysm.

Charcot-Bouchard aneurysm.

↓  
Basal ganglia (m/c)  
putamen.

Berry aneurysm

congenital aneurysm / saccular

→ can also be w/ Atherosclerosis

- Tunica media defect.

m/c Site: Ant Cerebral A,

Ant. communicating A - Junction

Least Common:

Vertebral Artery

HTN encephalopathy

Binswanger disease

## Infections:

1) m/c fungal meningitis - Cryptococcus.

Site - Virchow-Robin Space

mucicarmine stain - Red Cryptococcus

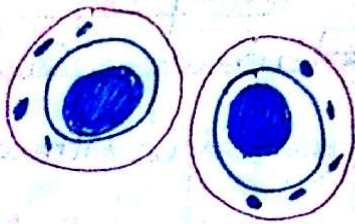
2) TB meningitis -

m/c presentation - Diffuse meningoencephalitis

characteristic - Basal exudate.

m/c complication → Cerebral infarction.

3) Cytomegalovirus → Periventricular Calcification & Necrosis.



Cells are enlarged.

Basophilic inclusions in nucleus

Cytoplasm

CD4 < 200 - Pneumocystis Carini.

CD4 < 50 - CMV.

HIV: TB, CD4 count > 300.

Atypical TB CD4 count < 50.

Lymphoma < 200/μL.

HIV meningitis - AIDS dementia complex.

HIV carried by - macrophages, Dendritic cells, T cells

Chaudekistic complex

Cortex Spared.

only, Sub-cortical area affected.

m/c Cause of Space occupying Lesion → Toxoplasmosis

m/c Cause of Space Occupying Tumor → iCNS lymphoma

Histology - most Chaudekistic - microglial nodules

→ white matter necrosis

→ Demyelination

→ Perivascular inflammation

Spinal Cord - Vascular myelopathy → Postero lateral, Dorsolateral Tract

Vascular

↓  
Subacute combined Degeneration

~~Vasculitis~~

~~Viral Inclusions~~

Rabies - Negri Bodies (cytoplasmic) eosinophilic.

Hippocampus → m/c Site in Dogs.

Brain stem - m/c & most Severe form of encephalitis

Cerebellum - Negri Body - m/c Site:

# CSF - Analysis

**Normal**  
Clear & colourless  
↑  
Fungal Viral  
↑  
Clear & colourless

**TB**  
Cobweb  
coagulum  
↑(max)

**Bacterial**  
yellowish  
pus like

↑

**WBCs** - Lymphocytes (0-5/cub) Neutrophils ↑  
(15-40 mg/dl)

Lymphocytes >>> Lymphocytes

Decrease ↓

↓

40-70 mg/dl

**Sugar**

Normal

15-40 mg/dl

**Protein**

↓ (mild)

116-122 mg/dl

**Chloride**

↑↑

↓ ↓ ↓

Severe  
Reduction

Normal

↑

Protein ↑ - (N) cell count ↑

www.FirstRanker.com

↑ Albumin - cell count - Normal - Albumino-lymphological dissociation

- 1) Guillain-Barre Syndrome
- 2) Late Stage of polio
- 3) Intracranial Neoplasm

Prion disease - Infectious protein.

→ Longer incubation period.

$P_{apc}$  - (N),  $\alpha$ -H<sub>2</sub>O<sub>2</sub>  
protease sensitive.

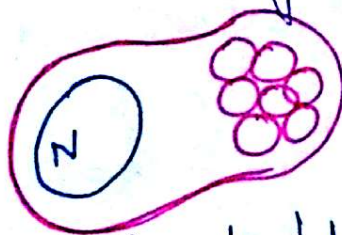
↓ conformational change  
sc

$P_{ap}^{sc}$  - sc-Scrapie (1st to discover)

$\beta$ -pleated Sheets [Congo Red] +ve.  
protease Resistant.

m/c Cause: Iatrogenic (NeuroSurgery / Corneal Transplant)

Bx:



Cluster of grapes  
Spongiform neurons.

Types: i) Creutzfeldt Jacob

ii) Fatal familial insomnia No Spongiform neuron

iii) Scrapie.

iv) Kuru.

v) NTad - low disease / Bovine Spongiform

# 1) Alzheimer's disease.

→ m/c Cause of dementia.

Sporadic  
misfolding of  
protein.

Hereditary  
Presenilin-1: Ch-19  
Presenilin-2 ch-1

Trisomy 21 - >40 years - Alzheimer's disease.

Ch 21

APP

Aβ amyloid

Damage Basal ganglia nucleus.

Nucleus - Basalis of Meynert.

NeuroTransmitter → Ach.

↓ Ach.

MR, progressive dementia.

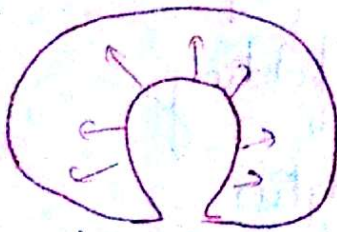
Gross:

Gyrus - atrophy  
Sulci - widening.

extrachromosome.

Stress

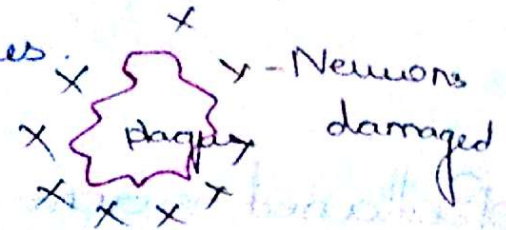
misfolding of protein.



Hydrocephalus ex vacuo:  
→ Alzheimer's  
→ Pick's disease

## Microscopy

1) Neuritic plaques - Senile Plaques  
extracellular.

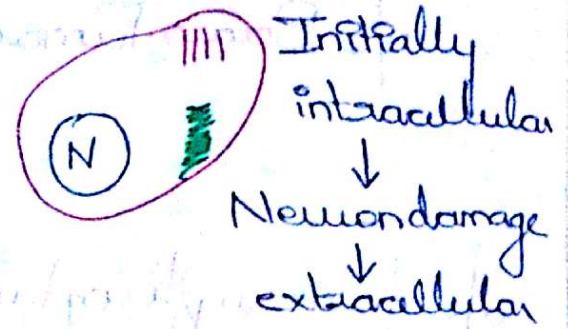


2) Neurofibrillary Tangles - Best correlates with  
Normal Tau protein

↓  
Hyperphosphorylation

↓  
Condensed Tau protein

↓  
Neurofibrillary Tangles



Bielschowsky stain.  
(appear dark)

3) Granulovacuolar degeneration

4) Hirano Bodies -  $\alpha$ -actin (paired)

Lewy Bodies -  $\alpha$ -Synuclein. Parkinsonism

gross: Pallor of Substantia nigra.  
due to loss of dopaminergic neurons

Pallor - Correlate to degree of Severity.

# Huntington's Disease

Ch-4

misfolding

↓  
Huntingtin

↓  
Damage Caudate nucleus

↓ GABAergic neurons

→ Ballooned neurons → Pick's disease

Lobar atrophy

## Brain Tumours

m/c Brain Tumours → metastasis

m/c i → Lung Ca.

[Small cell Ca]

m/c primary lung tumour -

meningioma > glioma

m/c i malignant Brain tumour (adults) - glioblastoma

Child

i° Brain malignant - medulloblastoma

Benign - Juvenile pilocytic astrocytoma

↓  
m/c Cerebellum

Cerebellar astrocytoma

# Astrocytoma

WHO I

JPA

Low grade  
no CSF mets

gemistocytic astrocytoma

Subependymal giant cell astrocytoma -  
arise in foramen monace

II - Diffuse

High grade

III - Anaplastic

CSF metastasis IV - Glioblastoma multiforme

## CSF metastasis

→ glioblastoma } astrocytoma

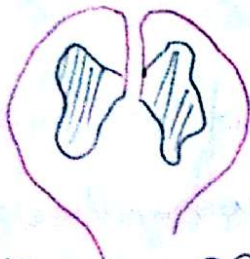
→ Anaplastic

→ 1° CNS lymphoma

→ Medulloblastoma

→ extragonadal germ cell tumor involving brain

Glioblastoma - m/c site - frontal lobe



Butterfly tumor (due to spread to adjacent lobe)

M/F

Pseudo-palisading



Serpentine necrosis

Palisading

Pseudo

Palisading Necrosis

Schwannoma - Inferior Vaginal Bump

Histology - True palisading

DDDDDDDDDDDDDDDD

Hypercellular - Antoni-A

Hypocellular - Antoni-B

DDDDDDDDDDDDDDDD

Hypercellular

Verocay Bodies

Lungs

1) Bronchial asthma - Reversible bronchospasm

2) Bronchiectasis

{ 3) Emphysema [pink puffers]

{ 4] Chronic Bronchitis (blue bloaters)

C-ORD

Bronchial asthma -

Chronic inflammation - ↑ Responsiveness of  
Bronchial mucosa.

Reversible - Bronchoconstriction

Etiology: Chromosome - 5q associated with atopy &  
bronchial asthma.

→ met strongly m/c alw - IL-13 gene polymorphism.