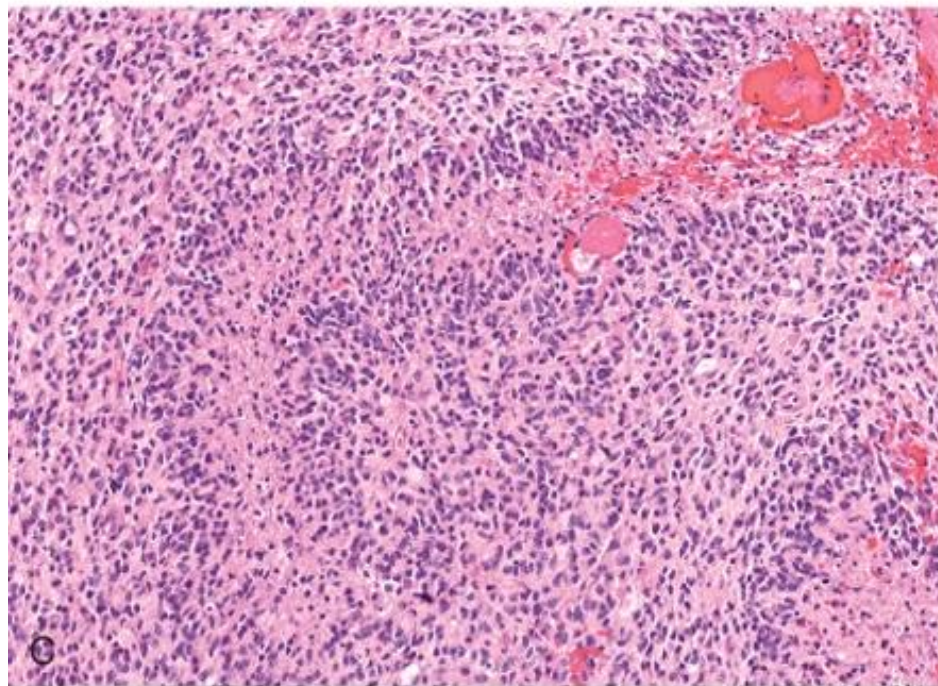
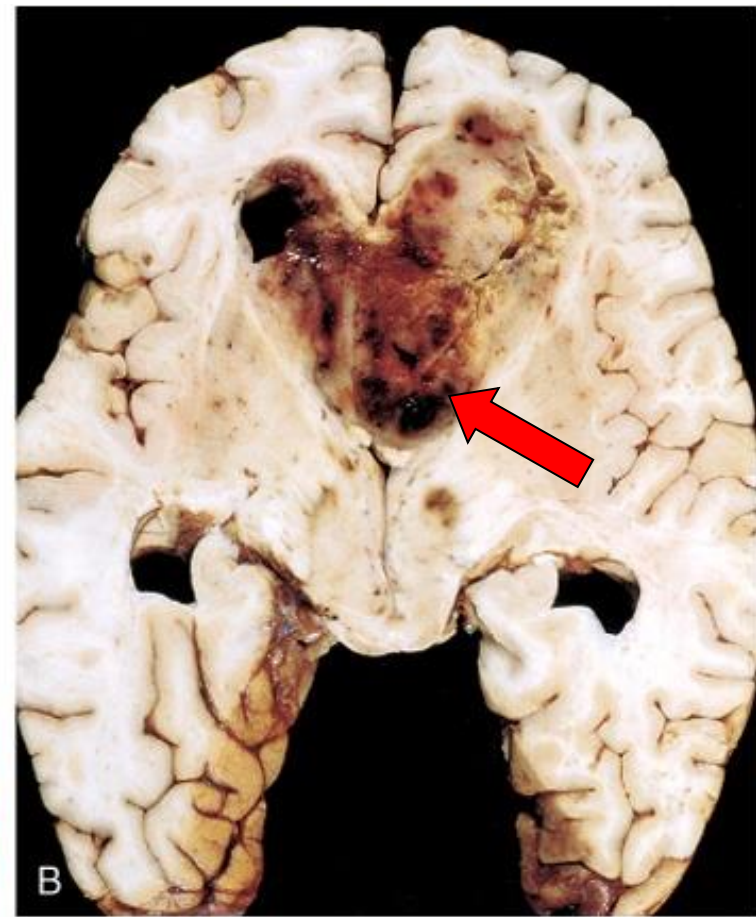
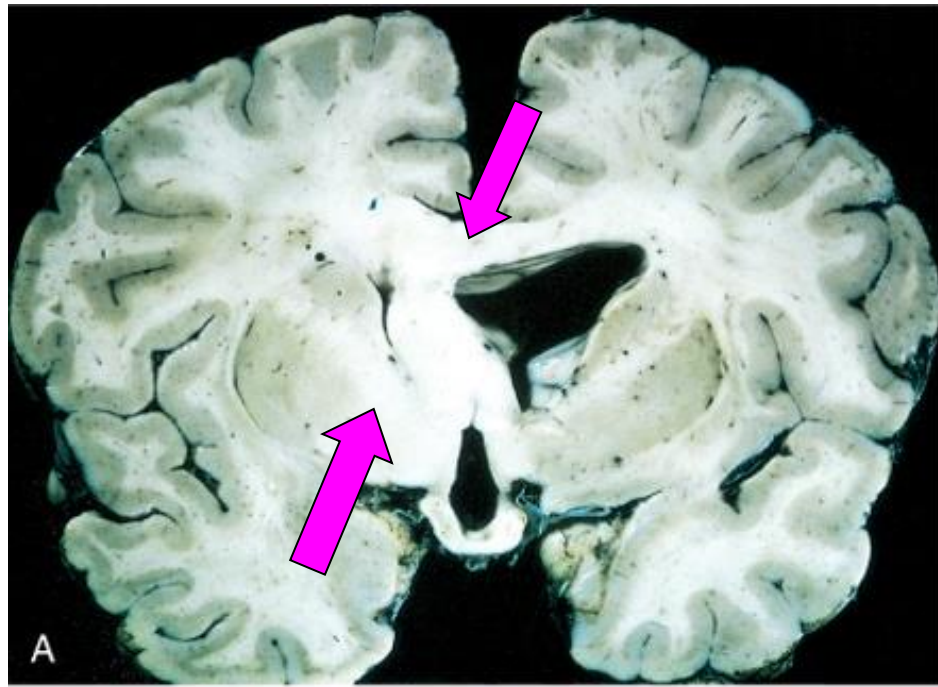




PATHOLOGY

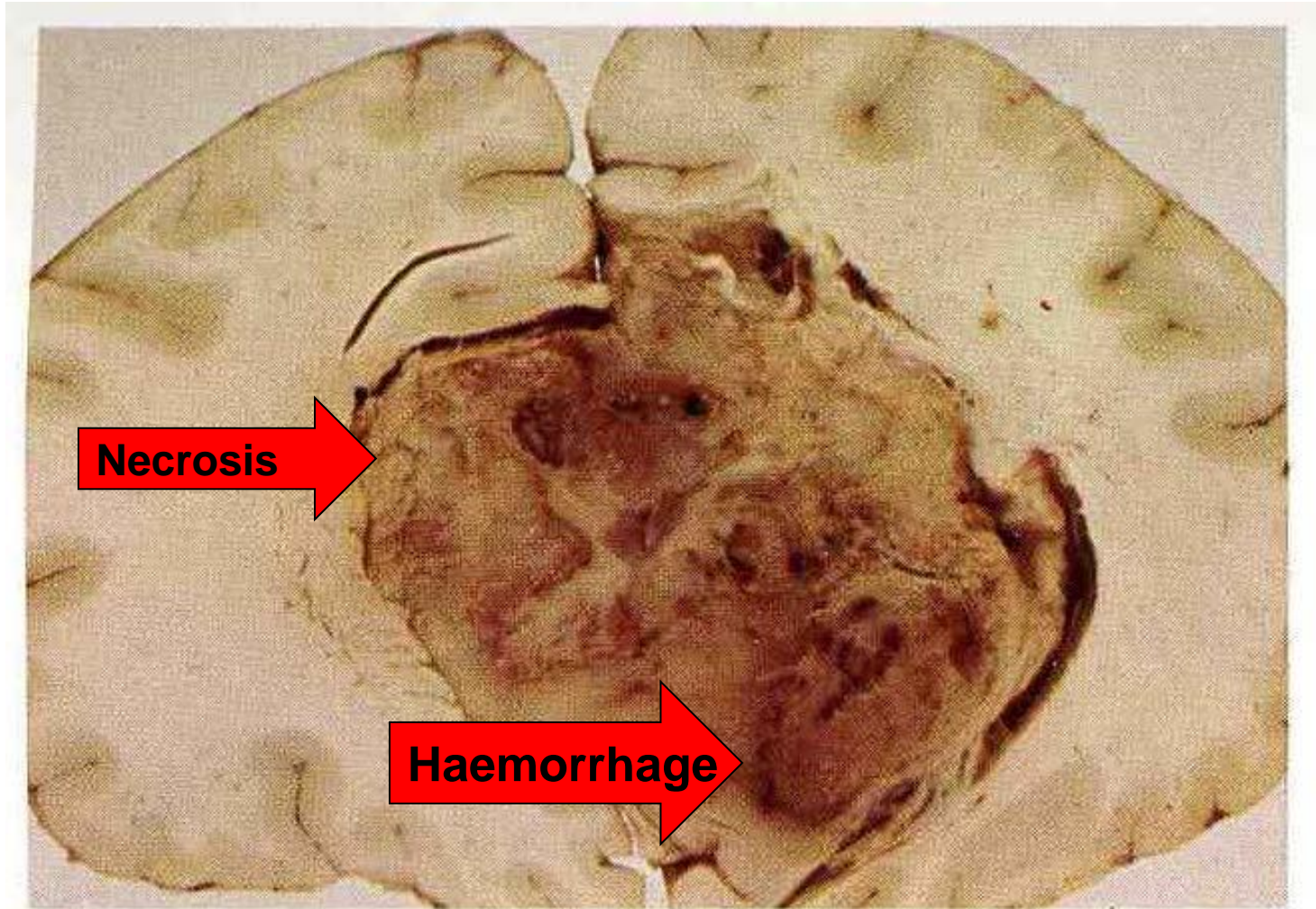
DONE BY : Volunteer



F23-22: A, Low-grade astrocytoma is seen as expanded white matter of the left cerebral hemisphere & thickened corpus callosum & fornices.

Glioblastoma: B, Necrotic, hemorrhagic, infiltrating T; histologically **C,** show (1) high cellularity + (2) pseudo-palisading of T cell nuclei around necrosis.

F 9-67: **Glioblastoma multiforme**. Massive tumor infiltrating the corpus callosum & both cerebral hemispheres; showing yellow-white (necrotic) & reddish-brown (hemorrhagic) areas.

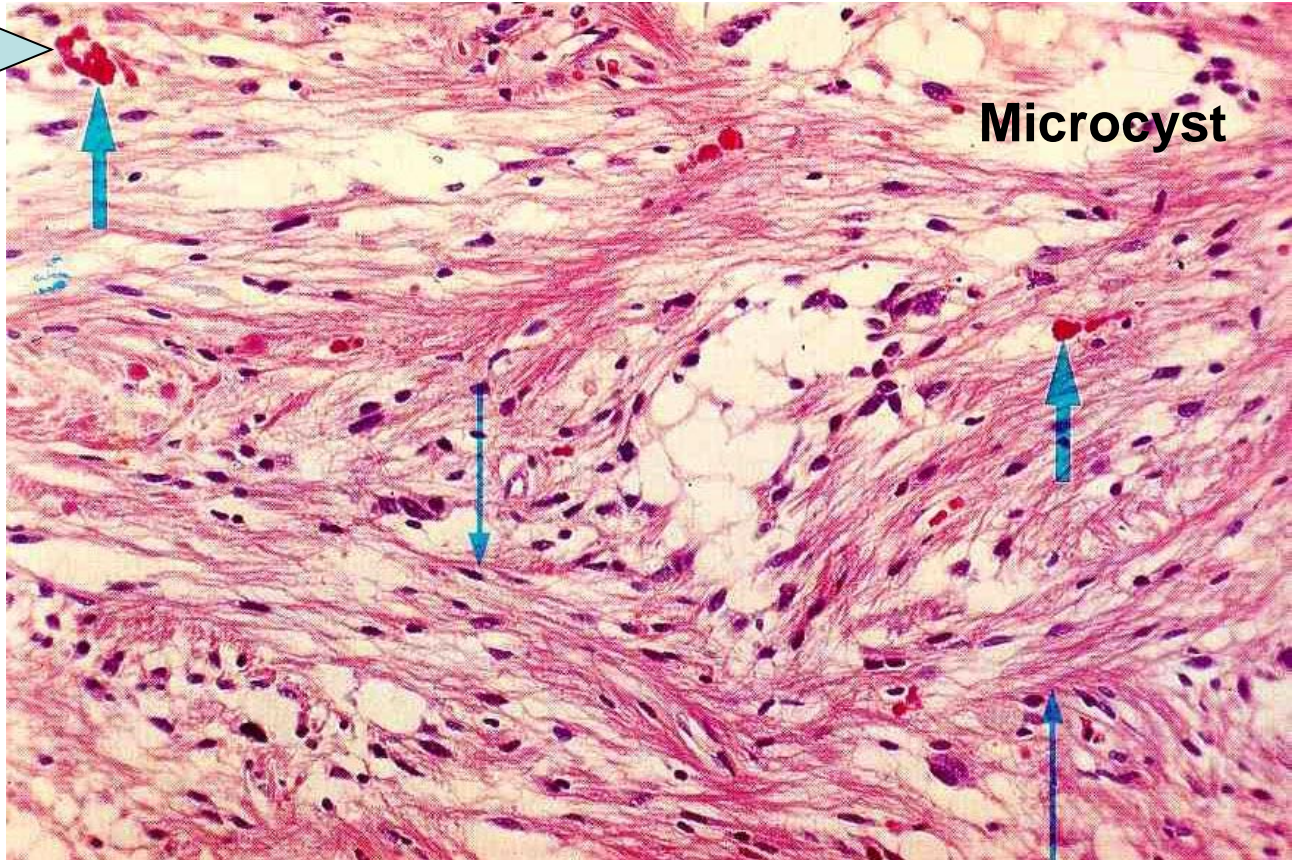


9.67 Glioblastoma multiforme

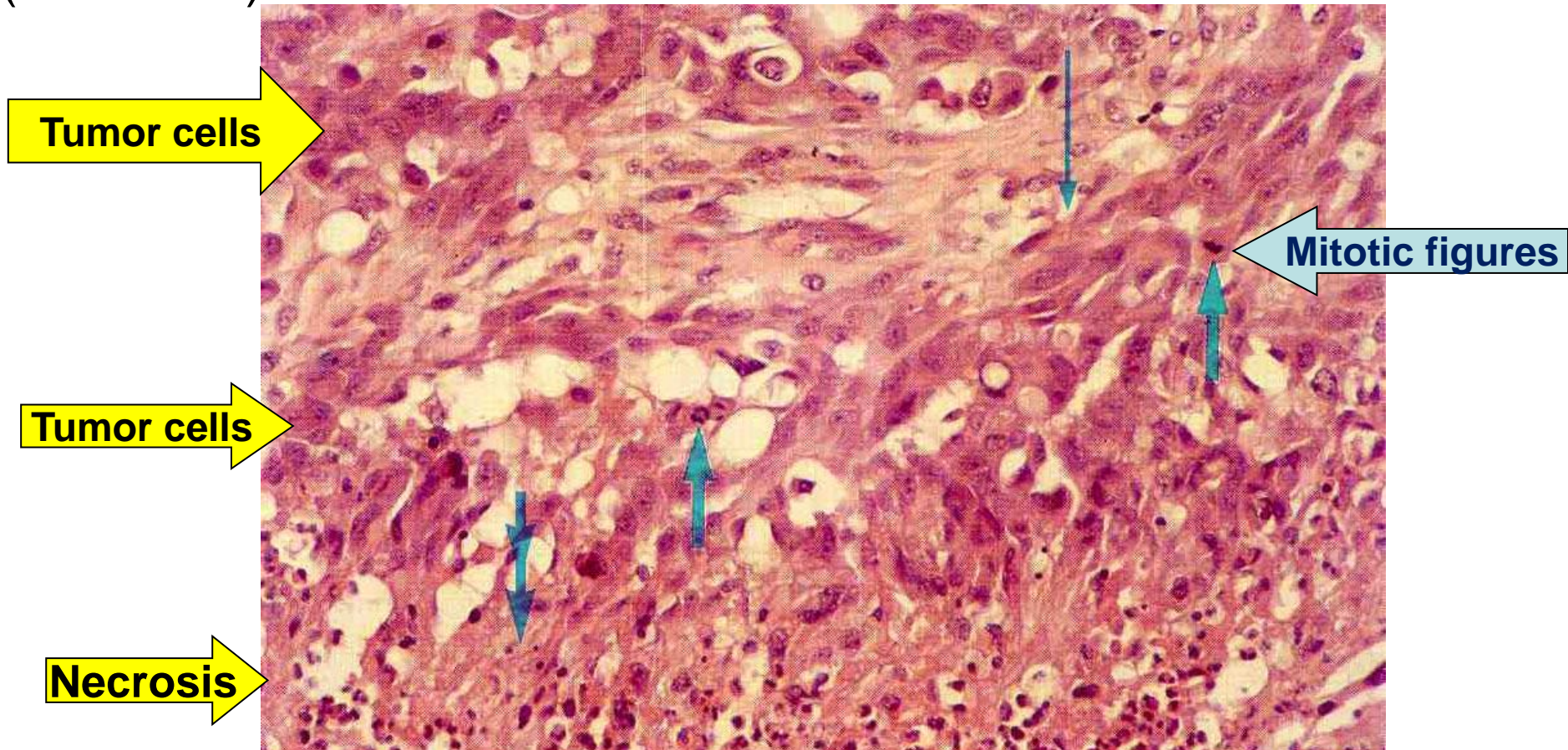
■ 4.31: **Astrocytoma (Fibrillary): brain X 200.**

Consist of mature-looking neoplastic astrocytes with ill-defined cytoplasmic boundaries & pleomorphic ovoid/elongated basophilic nuclei. Their **neurofibrillary processes** are well-developed & abundant & arranged in large eosinophilic bundles (thin A), within which there are collections of fluid (**microcysts**). The dens red bodies (thick A) are **Rosenthal fibers**.

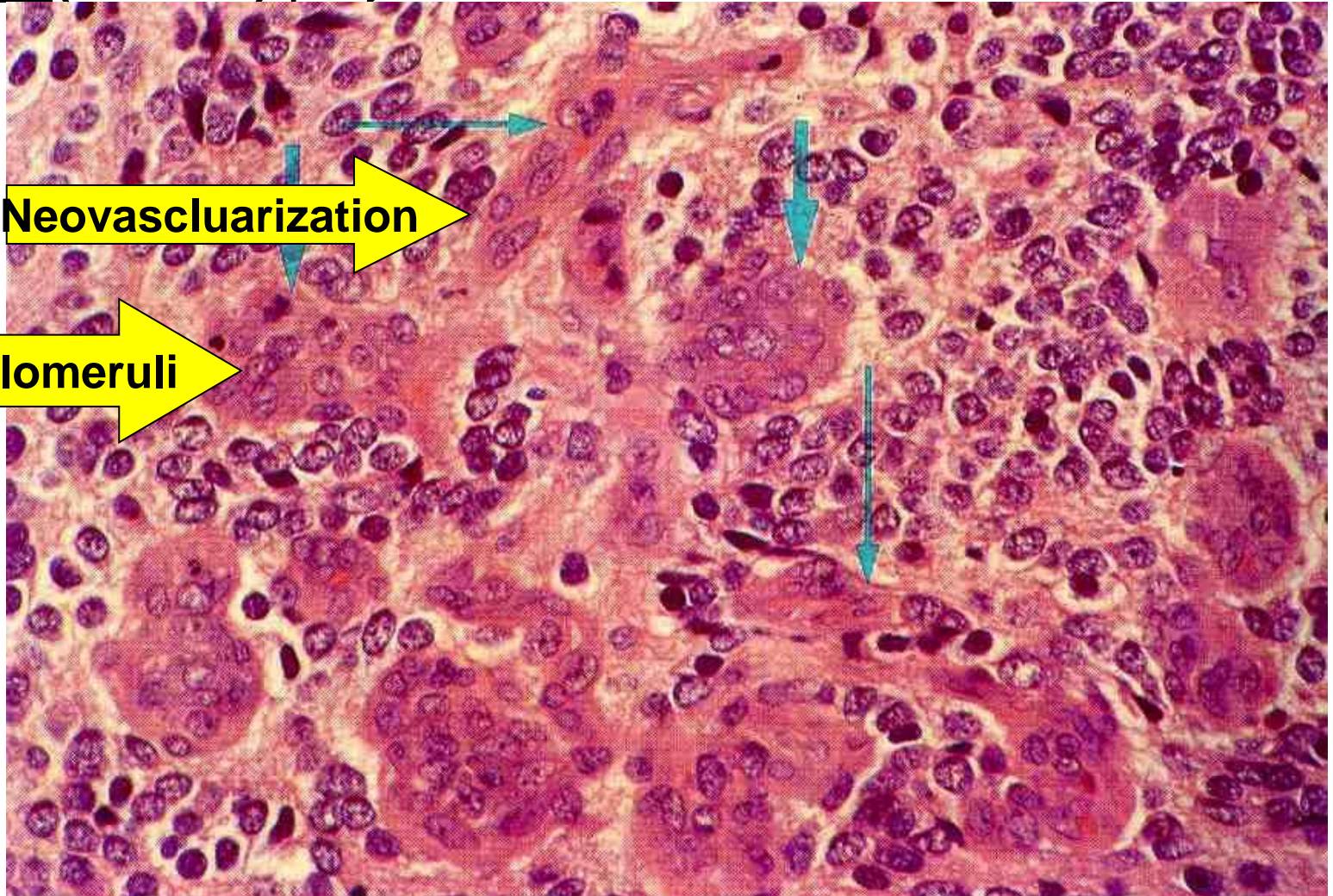
Rosenthal fibers



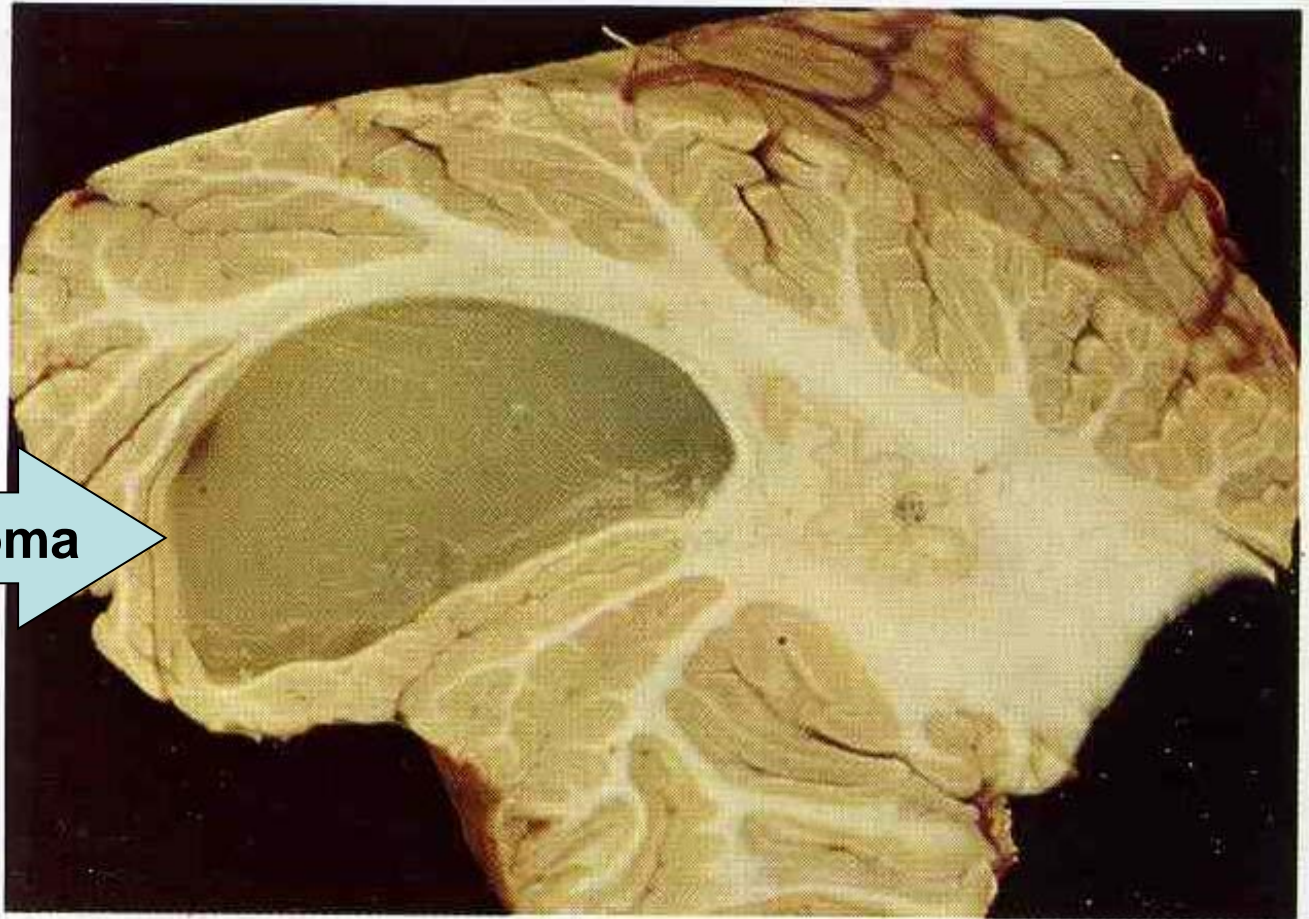
■ 4.35: **Glioblastoma multiforme: brain.** Grade IV out of IV astrocytoma. Cells are (1) very pleomorphic, most are elongated (**thin A**), with long fibrillary processes, elongated nuclei with round blunt ends & many contain prominent **nucleoli** & (2) some are multinucleated, & many show (3) mitotic figures (**thick A**), some are abnormal; (4) Necrosis is marked (**double A**).



■ 4.36: **Glioblastoma multiforme: Brain X360.** The tumor is very vascular, prominent (1) neovascluarization (**thin A**) lined by large plump EC with abundant cytoplasm. A prominent feature are 'Buds' of proliferating EC, resembling (2) miniature glomeruli (**thick A**) project from the surface of the BV.



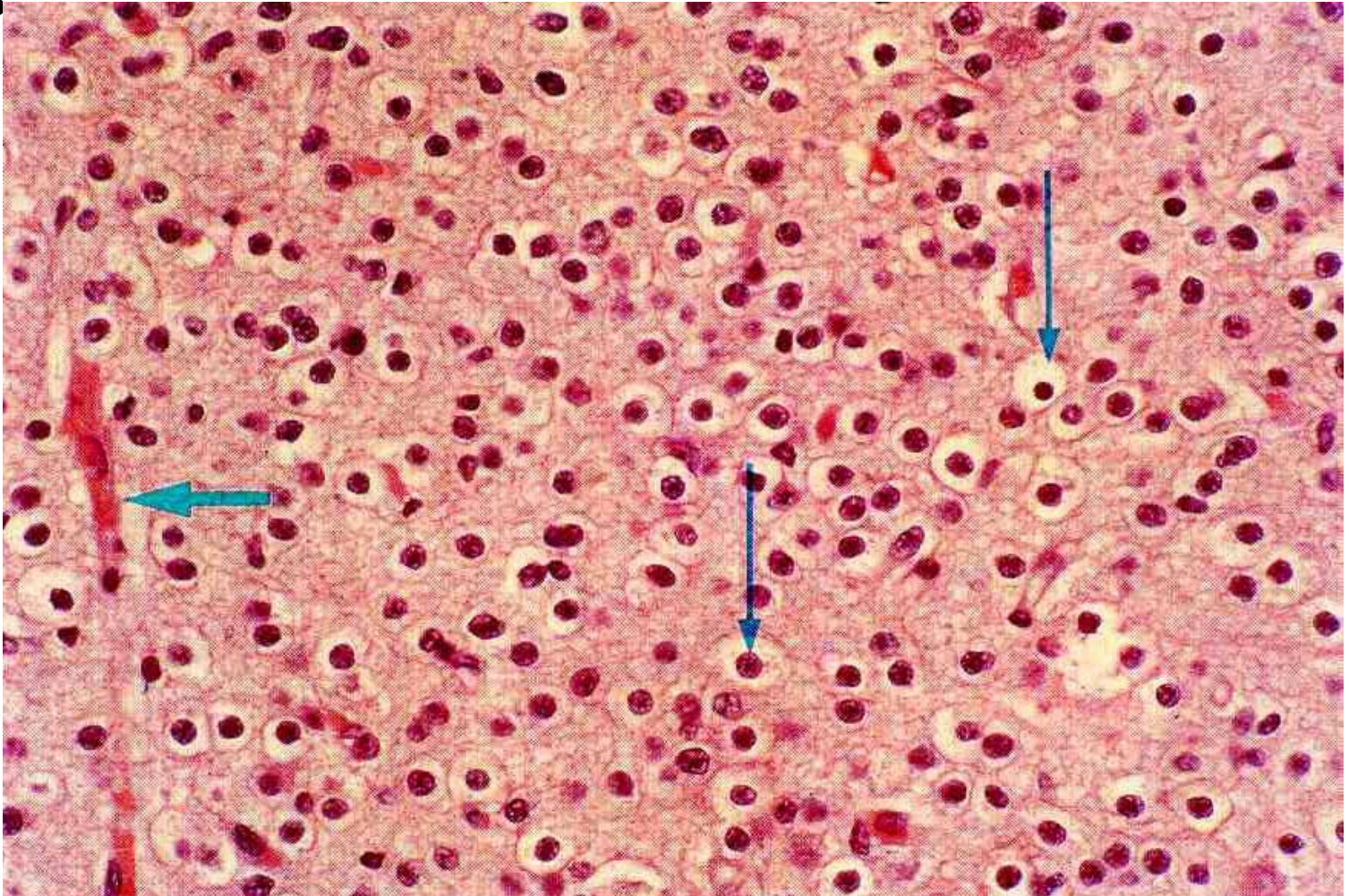
F 9-59: **Pilocytic (cystic) astrocytoma: cerebellum.** Crescentic **cyst** cavity, filled with gelatinous pale green fluid occupying the lateral lobe of the **cerebellar** hemisphere. The tumor is slowly-growing & affects mainly **children & young adults.**



Cystic astrocytoma

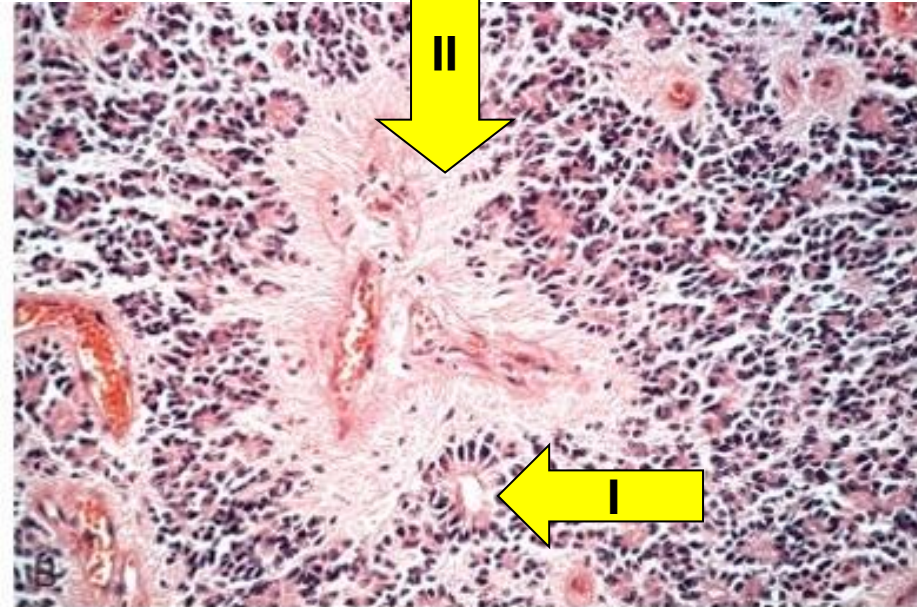
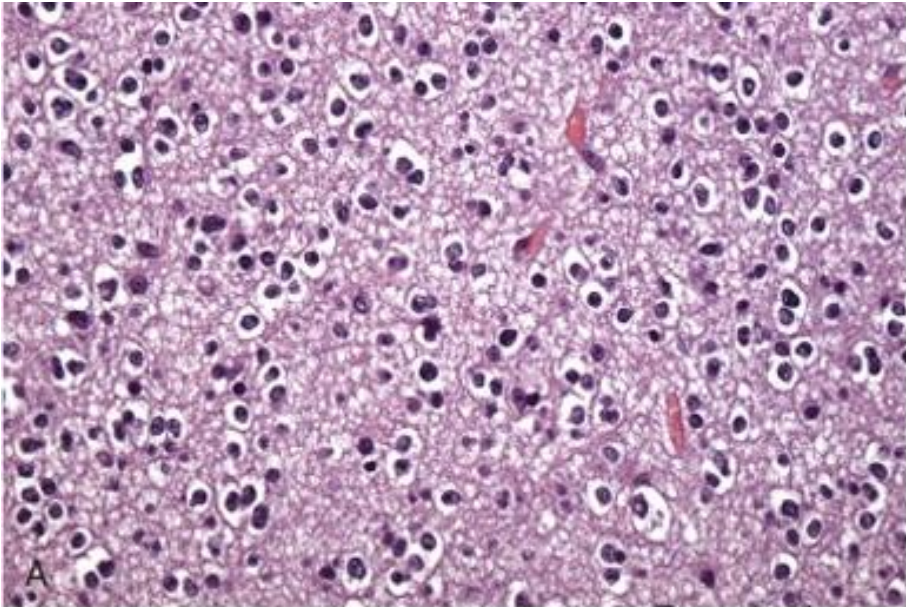
9.59 Cystic astrocytoma: cerebellum

■ **4.31:Oligodendroglioma: brain X360.** Highly cellular T, each cell has (I) a moderate amount of eosinophilic cytoplasm, bounded by a well-defined membrane & (II) a small rounded darkly basophilic nucleus, surrounded by a perinuclear, large clear halo (thin A), appearance called '**boxing**' of the nucleus



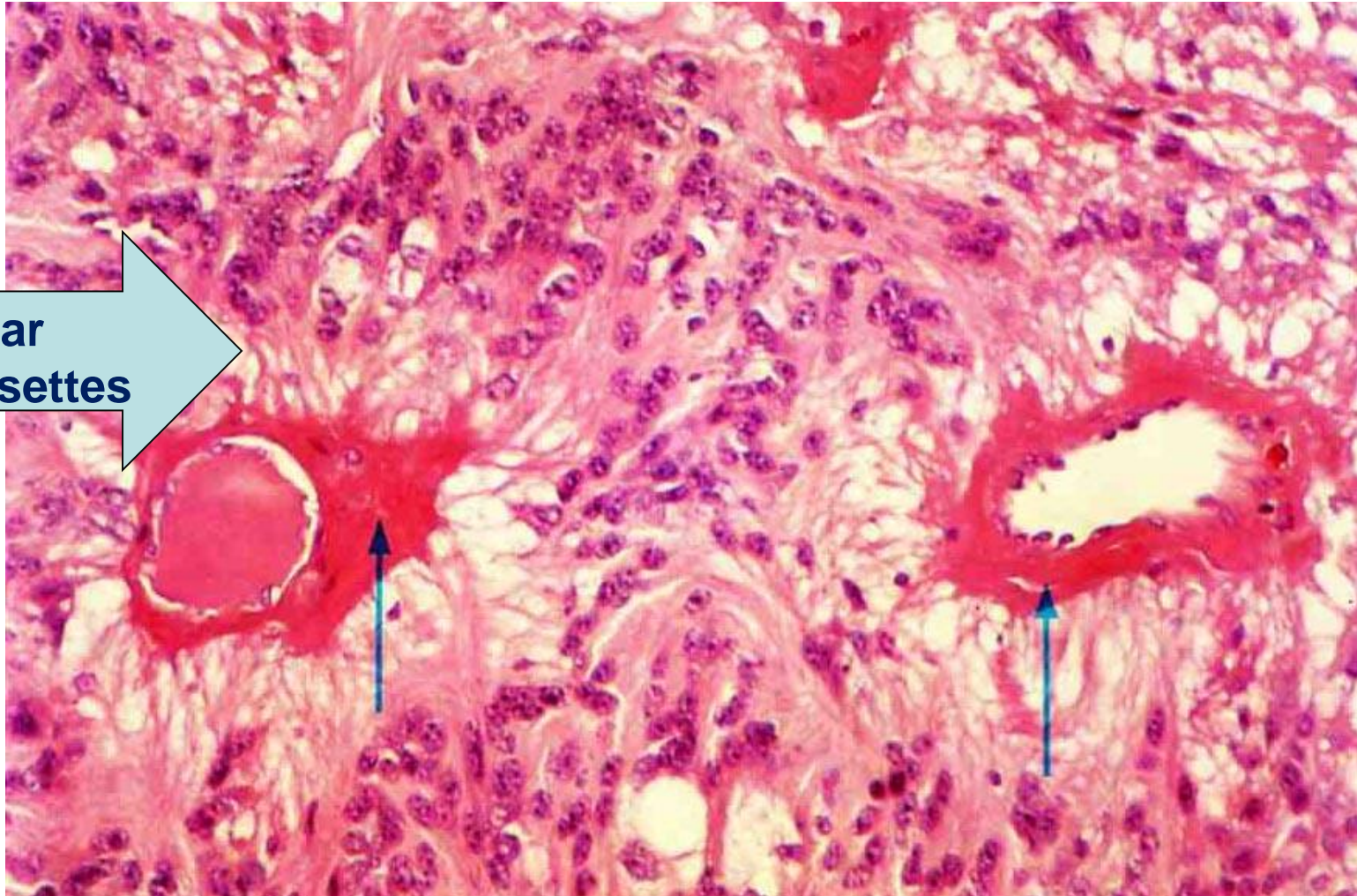
F23-23: **A, Oligodendroglioma.** Regular cells having round nuclei, with a cytoplasmic halo.

B, Ependymoma: (I) tumor cells form round or elongated structures (**rosettes**, canals) resemble the embryologic ependymal canal, with long, delicate processes extending into a lumen & (II) **perivascular pseudo-rosettes**, with tumor cells arranged around vessels with an intervening zone consisting of thin ependymal processes directed toward the wall of the BV.



■ 4.38: **Ependymoma: brain X 360.** Two dilated BV, with thick hyalinized deeply eosinophilic walls (arrows); surrounded by tumor cells arranged around & attach to the walls of BV by their elongated filamentous (& very vacuolated) bases, so-called **Perivascular pseudo-rosettes.**

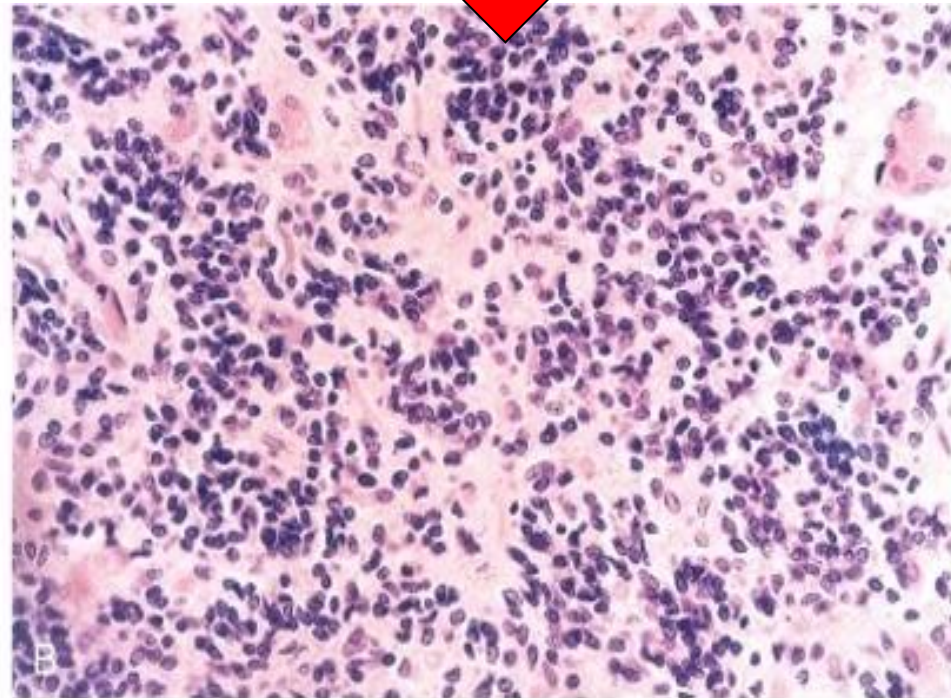
Perivascular
pseudo-rosettes



F23-24: Medulloblastoma: Brain

A, Sagittal section of brain showing medulloblastoma destroying the superior midline cerebellum.

B, **■** H, An extremely cellular tumor, with sheets of anaplastic ("**small blue cells**"). The individual tumor cells are small, with little cytoplasm & hyperchromatic nuclei; mitoses are abundant.

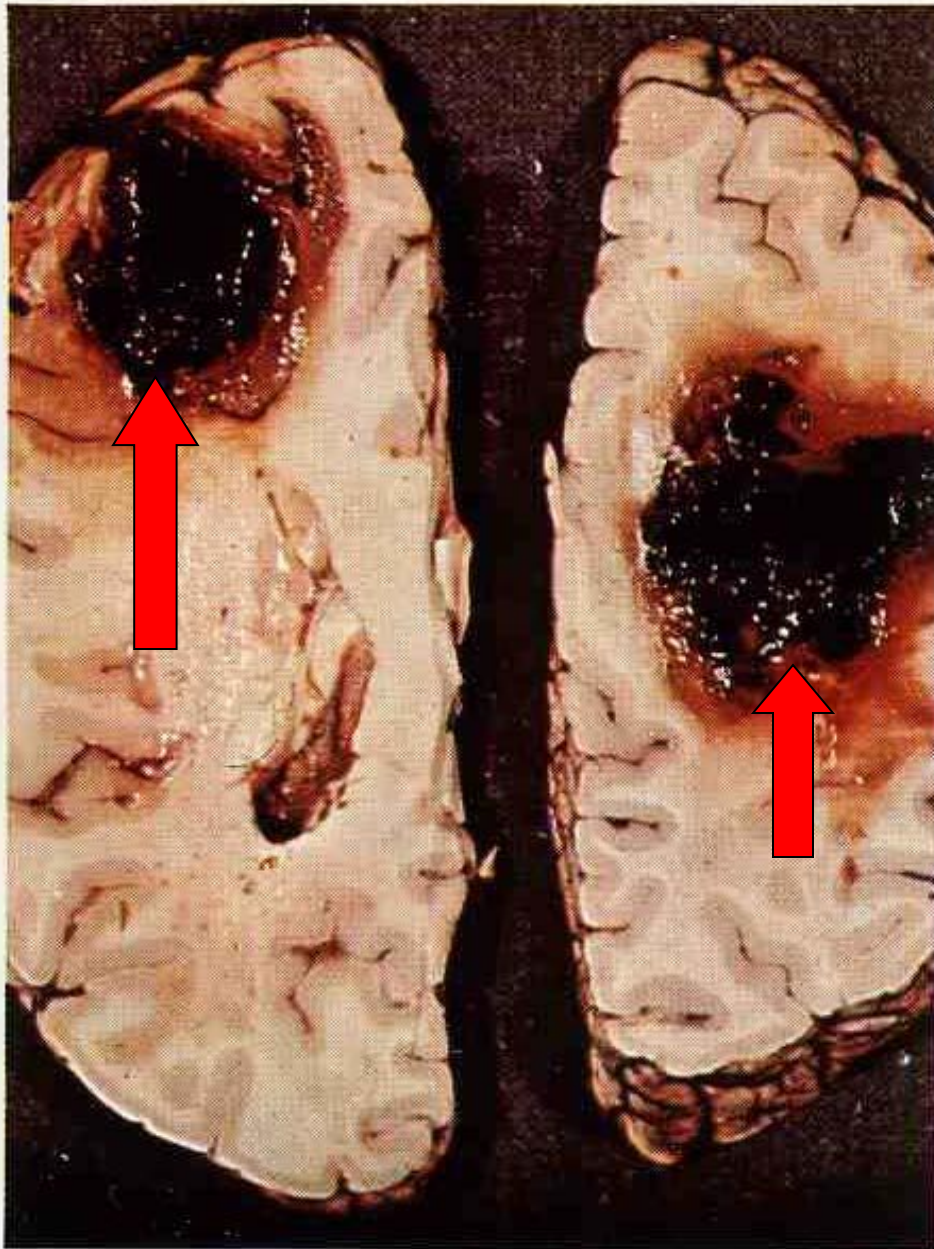


F 9-72: Medulloblastoma. Large, rounded, friable, necrotic & hemorrhagic well-demarcated, tumor expanding cerebellar hemisphere; occurring predominantly in children (5 to 8 yr) tumor tend to spread through CSF all over the brain & spinal cord.



Medulloblastoma

9.72 Medulloblastoma



F 9-79: Secondary choriocarcinoma: Brain.

☠ Two large hemorrhagic lesions are present (which resemble intracranial hemorrhages).

Histology reveals secondary choriocarcinoma in the brain

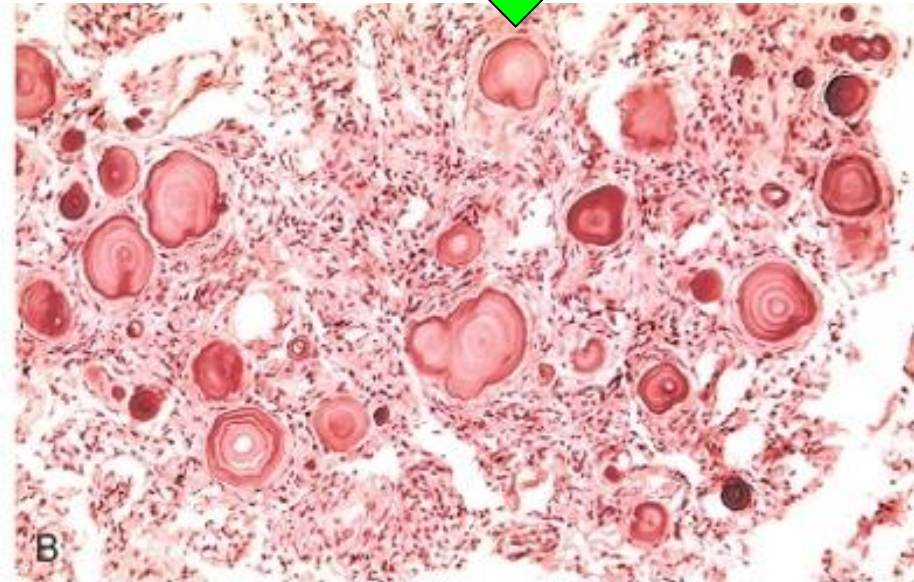
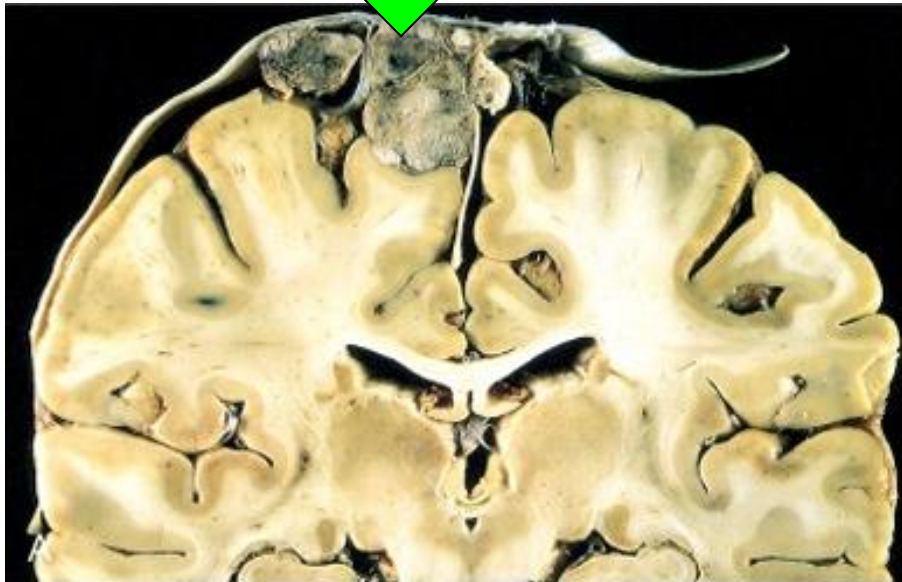
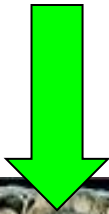
The patient was a 36 years old man with testicular choriocarcinoma.

9.79 Secondary choriocarcinoma: brain

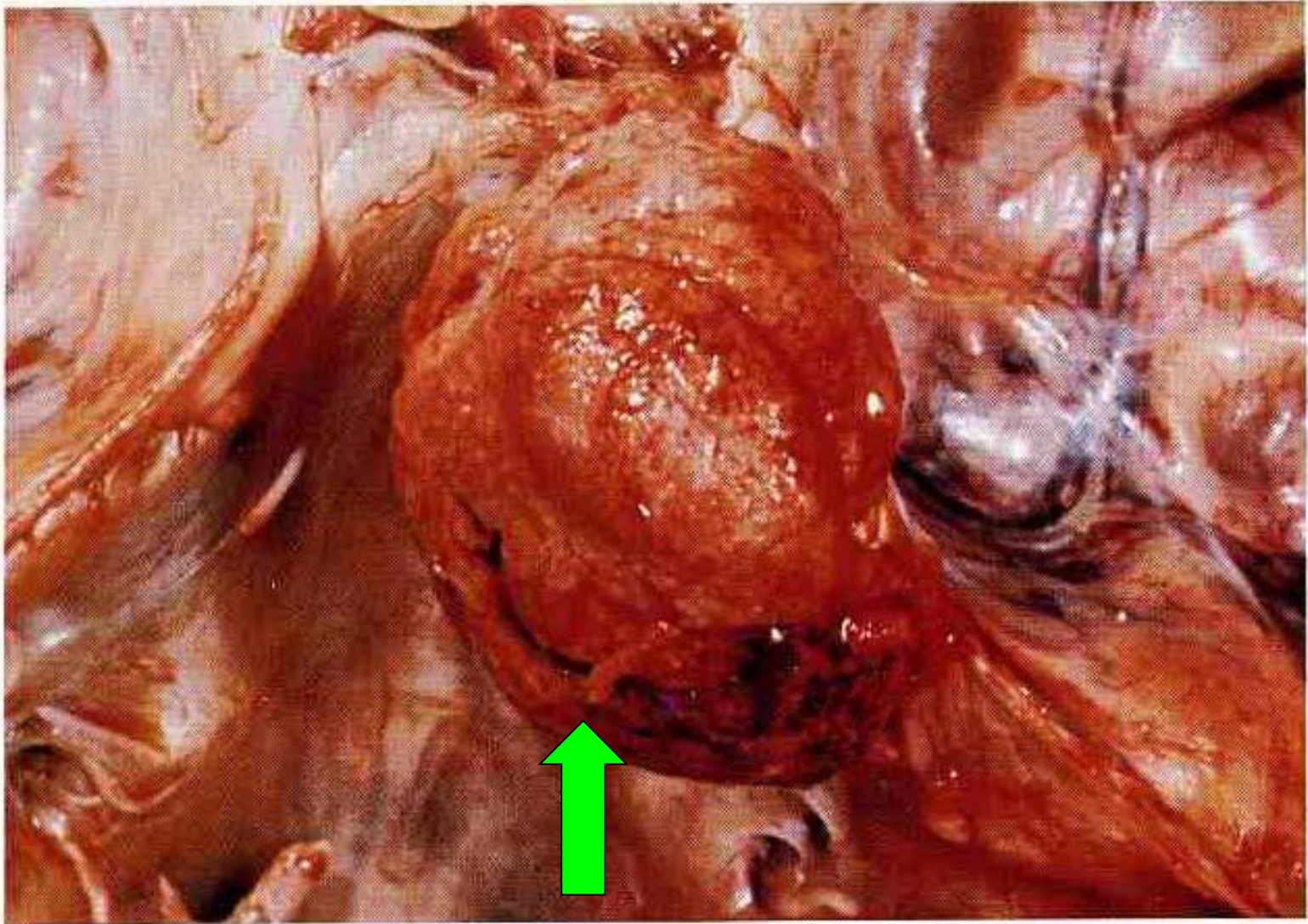
F23-25: Meningioma.

A, Parasagittal multilobular meningioma *attached* to the *dura* with *compression* of the underlying brain; but it is easily separated from it

B, ■ H, Whorled pattern of cell growth & psammoma bodies.

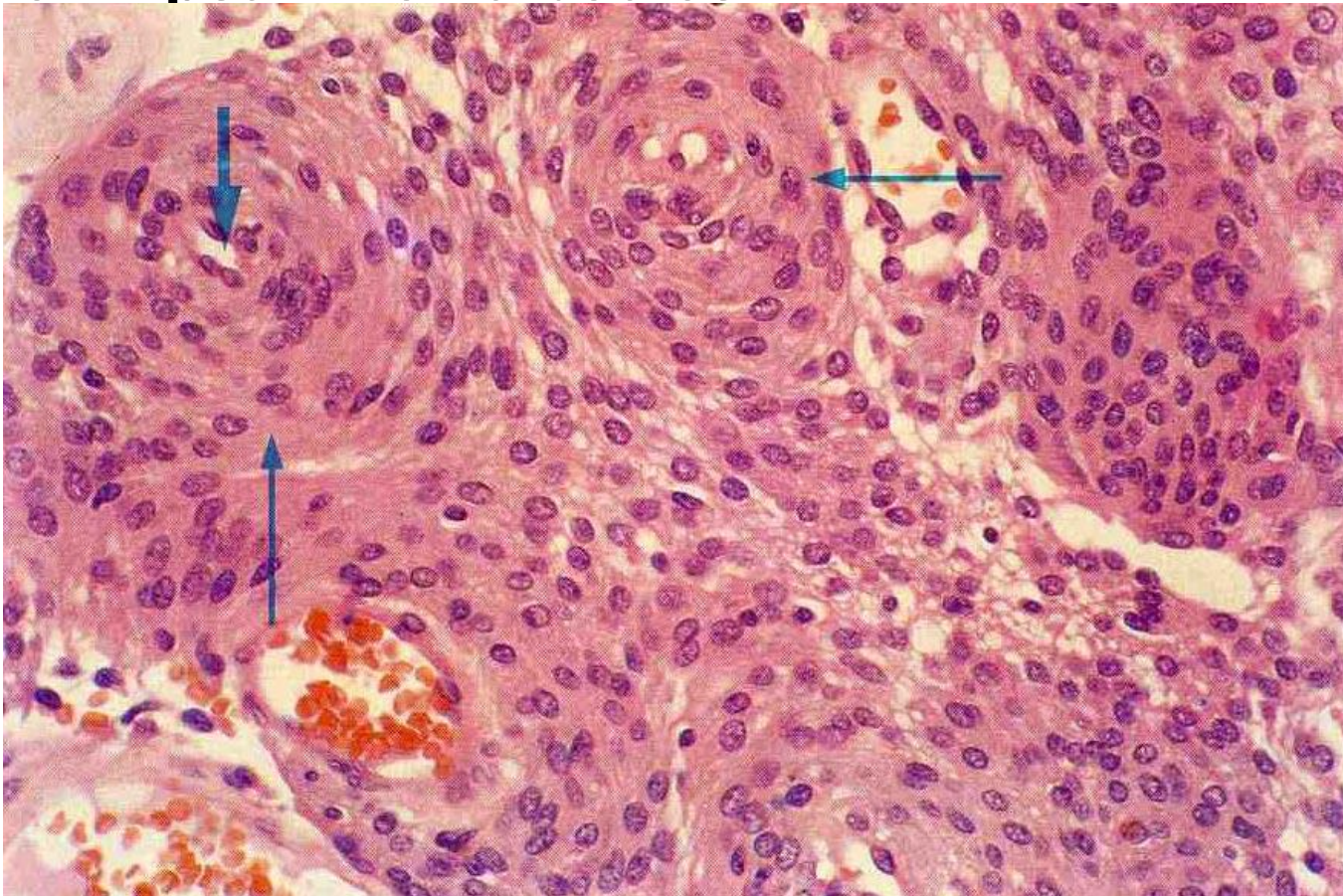


F 9-51: **Meningioma.** A large smooth, lobulated, pink-red tumor situated posterior to the dorsum sellae (skull base).



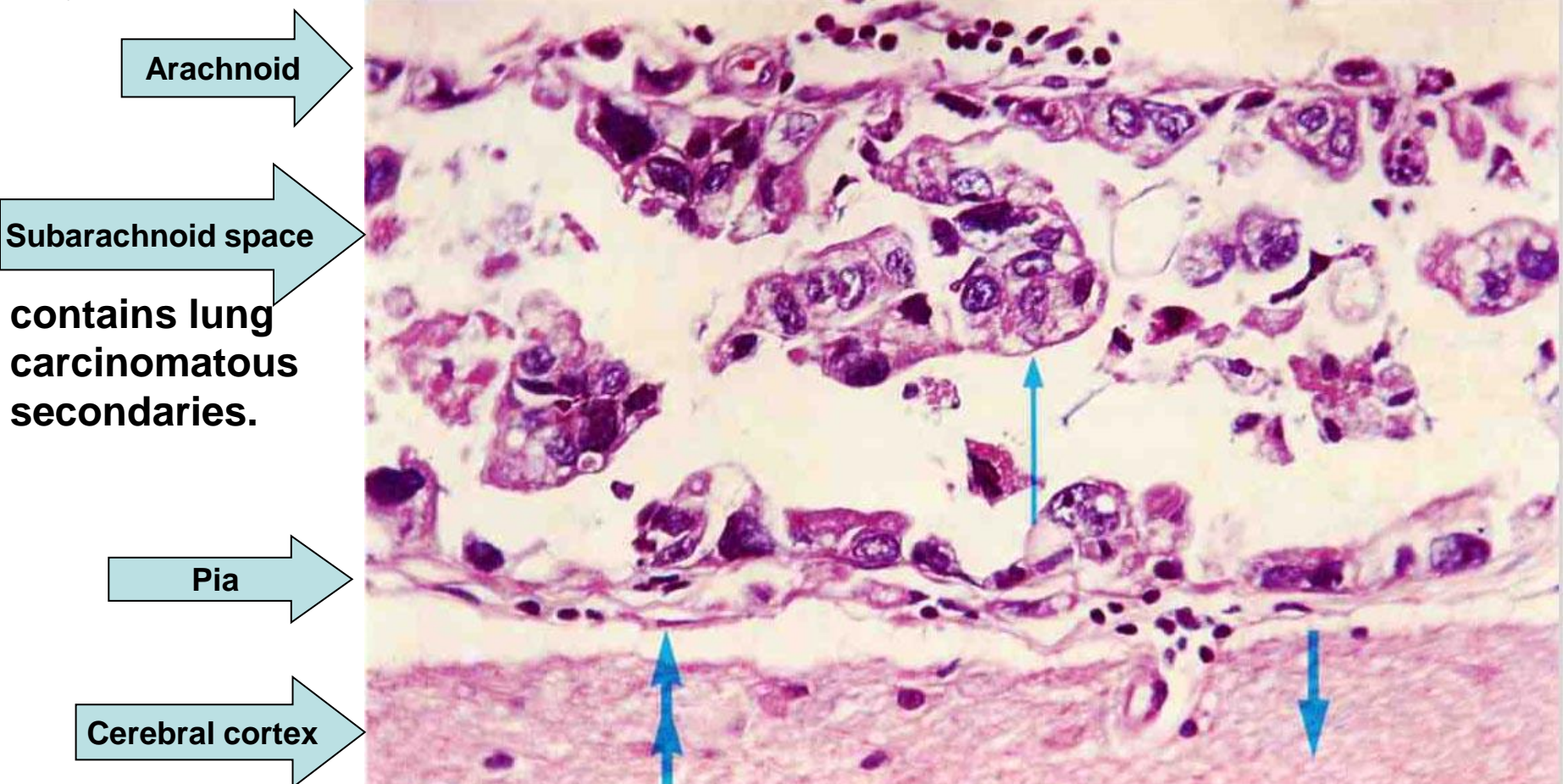
9.51 Meningioma

■ 4.30: **Meningioma, Transitional type. X360.** 5 Compact **whorls** of uniform tumor cells (thin arrows), having abundant eosinophilic cytoplasm, & ill-defined boundaries. The nuclei are uniform ovoid & vesicular & their chromatin is pale & finely granular. A small cavity at the center of the whorls (thick A) is seen, & the central cells eventually become hyalinized & may calcify to form '**psammoma bodies**'.



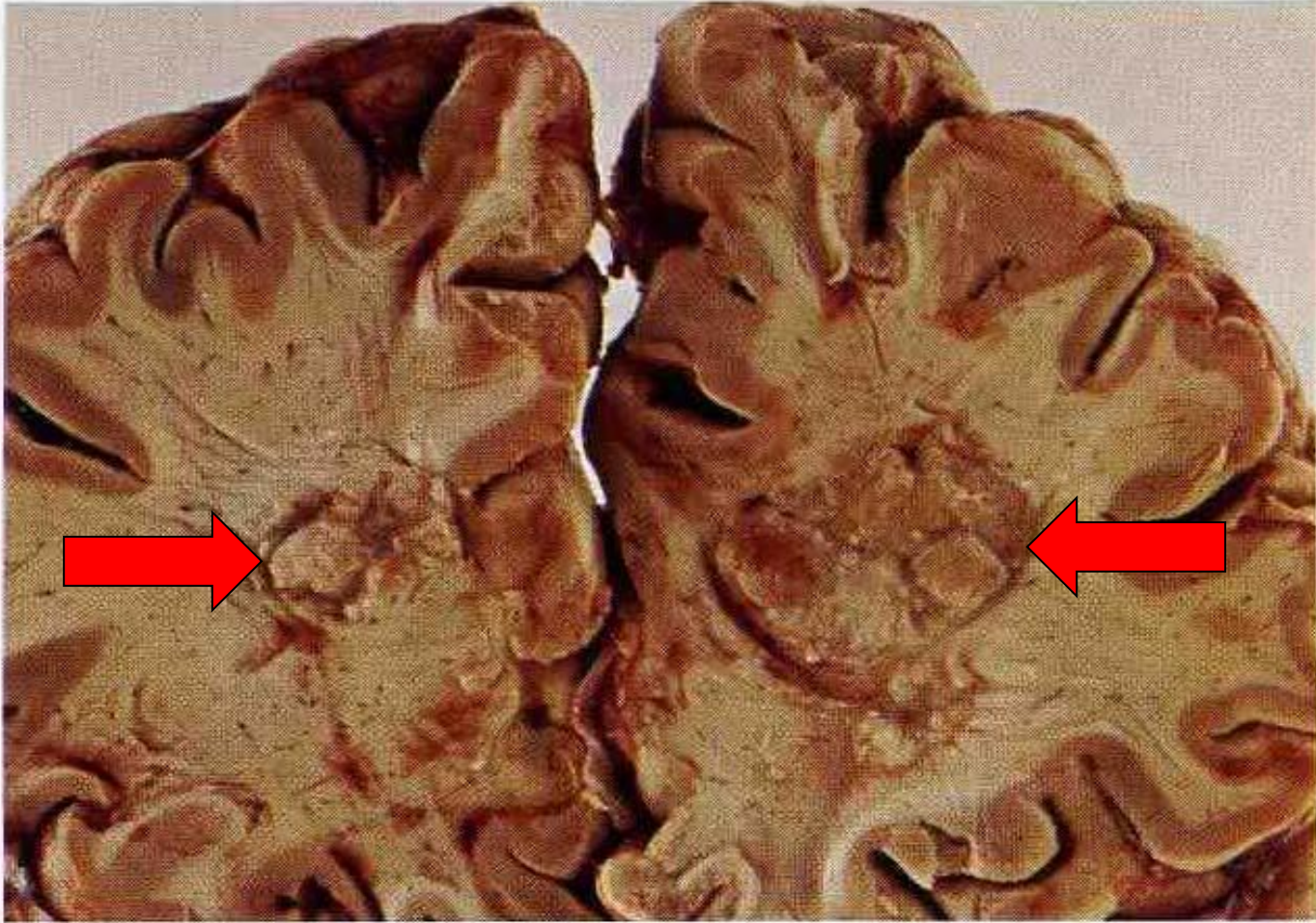
■ 4.48: **Secondary carcinoma: brain X160.**

The **subarachnoid space** contains malignant • **carcinomatous cells secondaries** (thin A) from the **lung** with very pleomorphic, large pale vesicular nuclei & prominent nucleoli & vacuolated cytoplasm. Such lesion may give rise to clinical signs & symptoms very similar to • **bacterial meningitis**.



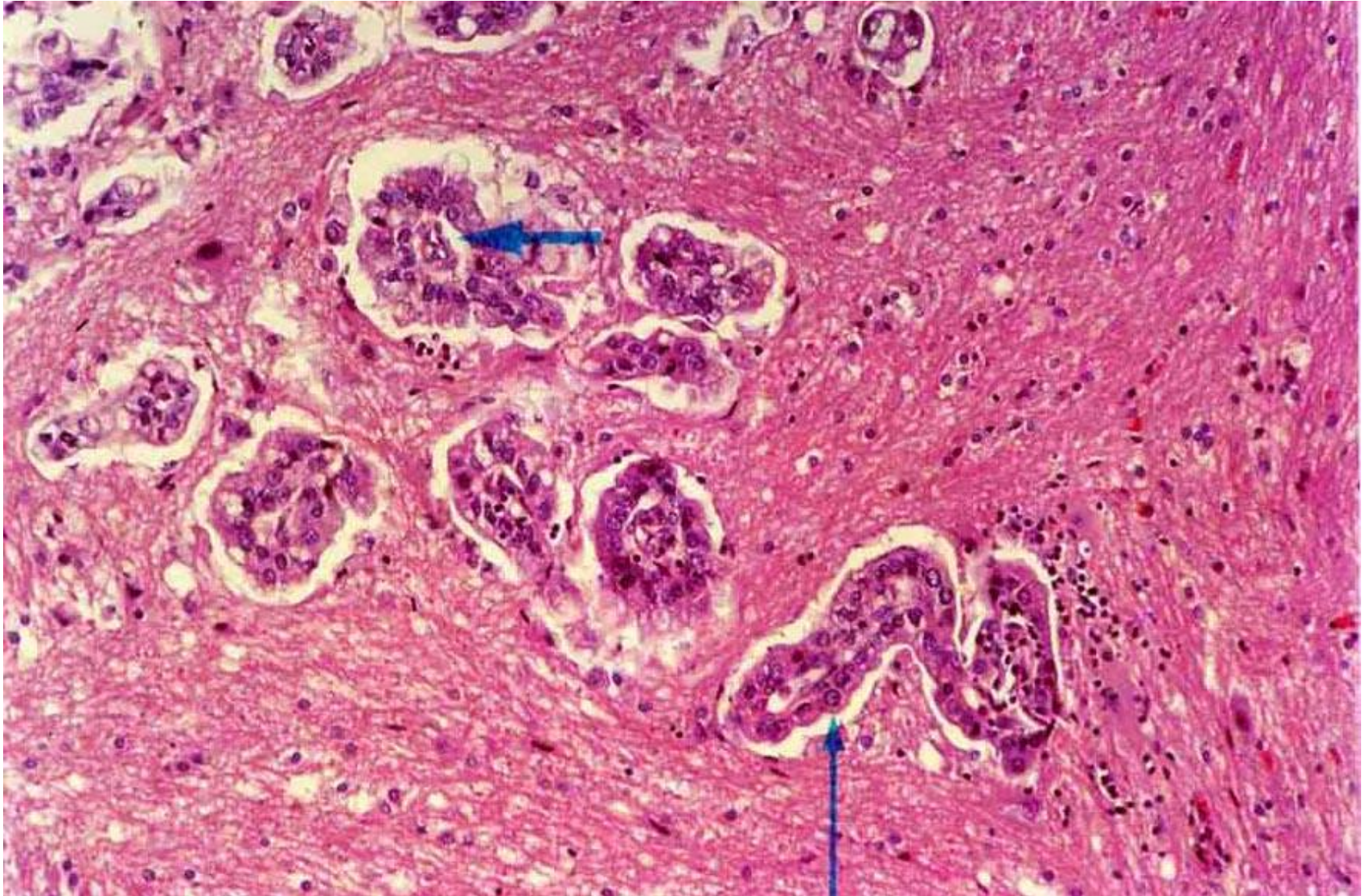
F 9-76: Secondary carcinoma: brain.

The patient had carcinoma of the breast. Frontal region section shows two large necrotic secondary deposits in the central white matter of both cerebral hemispheres.



9.76 Secondary carcinoma: brain

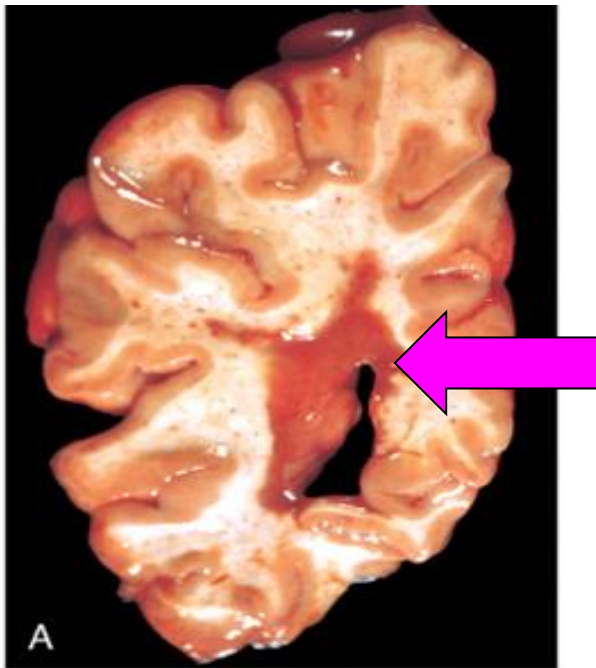
■ 4.47: **Breast carcinomatous secondaries in the brain.** Well-differentiated , papillary adenocarcinomatous (thin arrow) tumor secondaries infiltrate the brain white matter.



F23-26: **Metastatic melanoma.** Metastatic tumors secondaries are **distinguished** grossly from most primary CNS tumors by their (1) **multicentric** & their (2) **well-demarcated margins**.

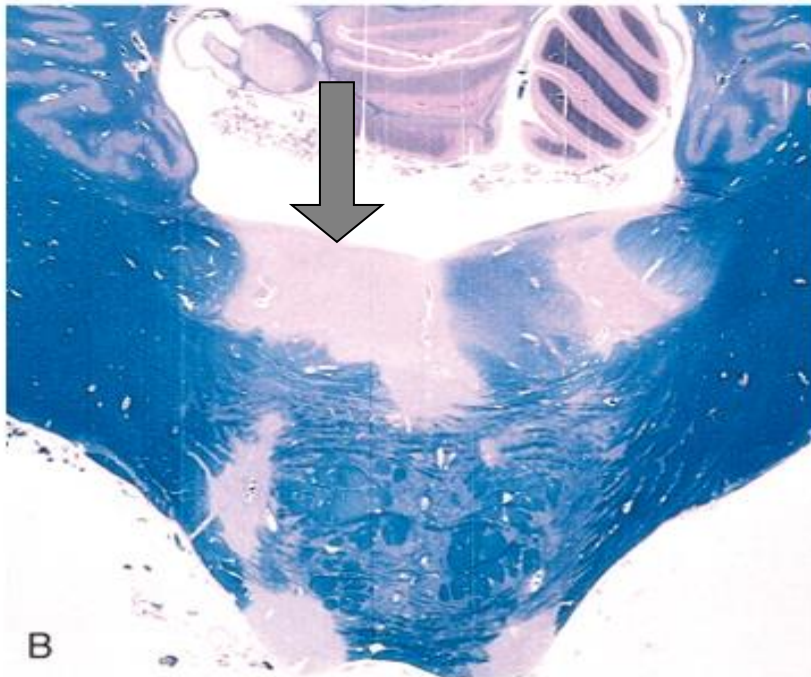
☠ The dark pigment in the **15** tumor secondaries in this brain section is characteristic of malignant melanoma.





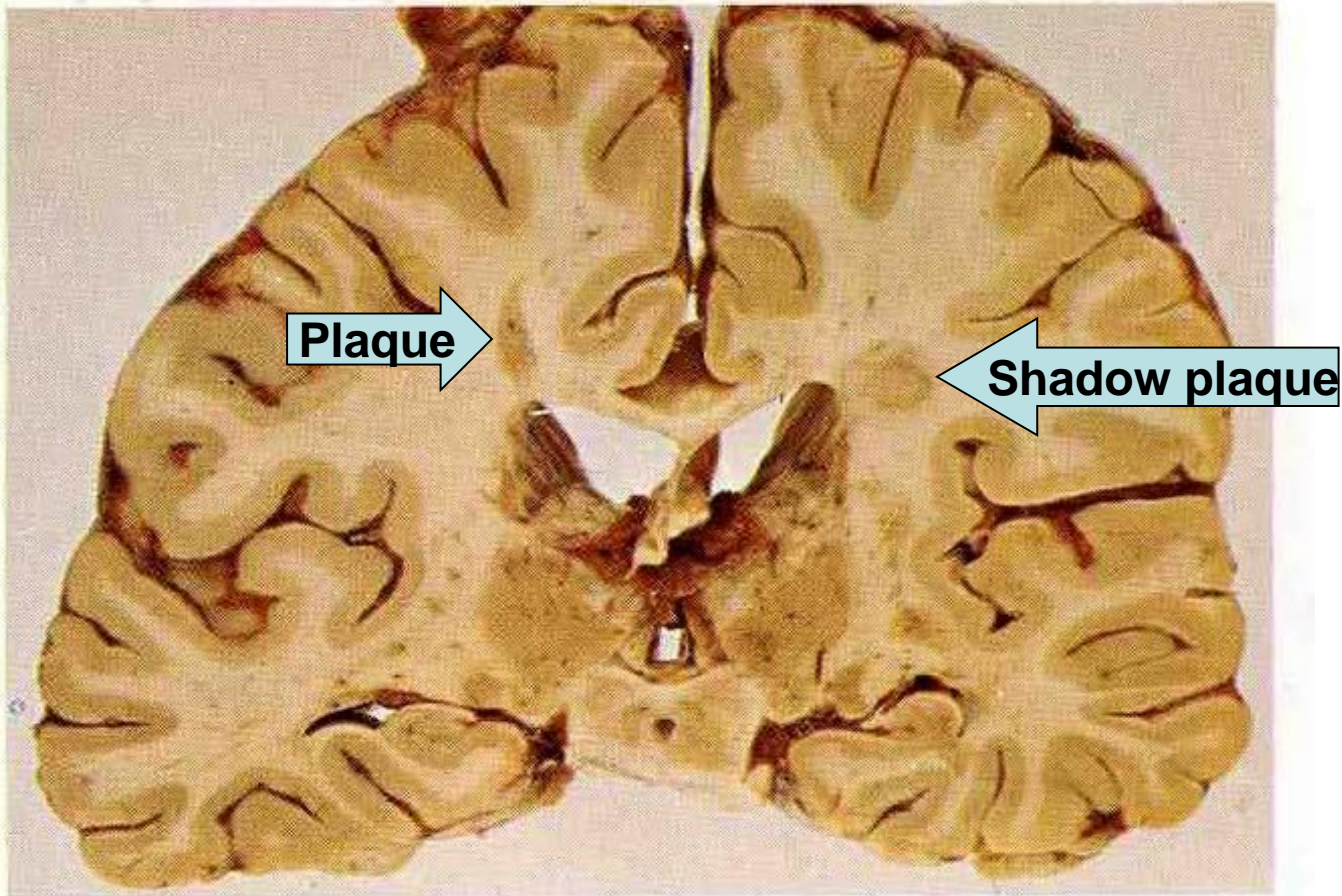
F23-27: Multiple sclerosis

A, Fresh brain section showing a well-circumscribed, slightly depressed, gray-tan, irregularly shaped plaque around occipital horn of the lateral ventricle.



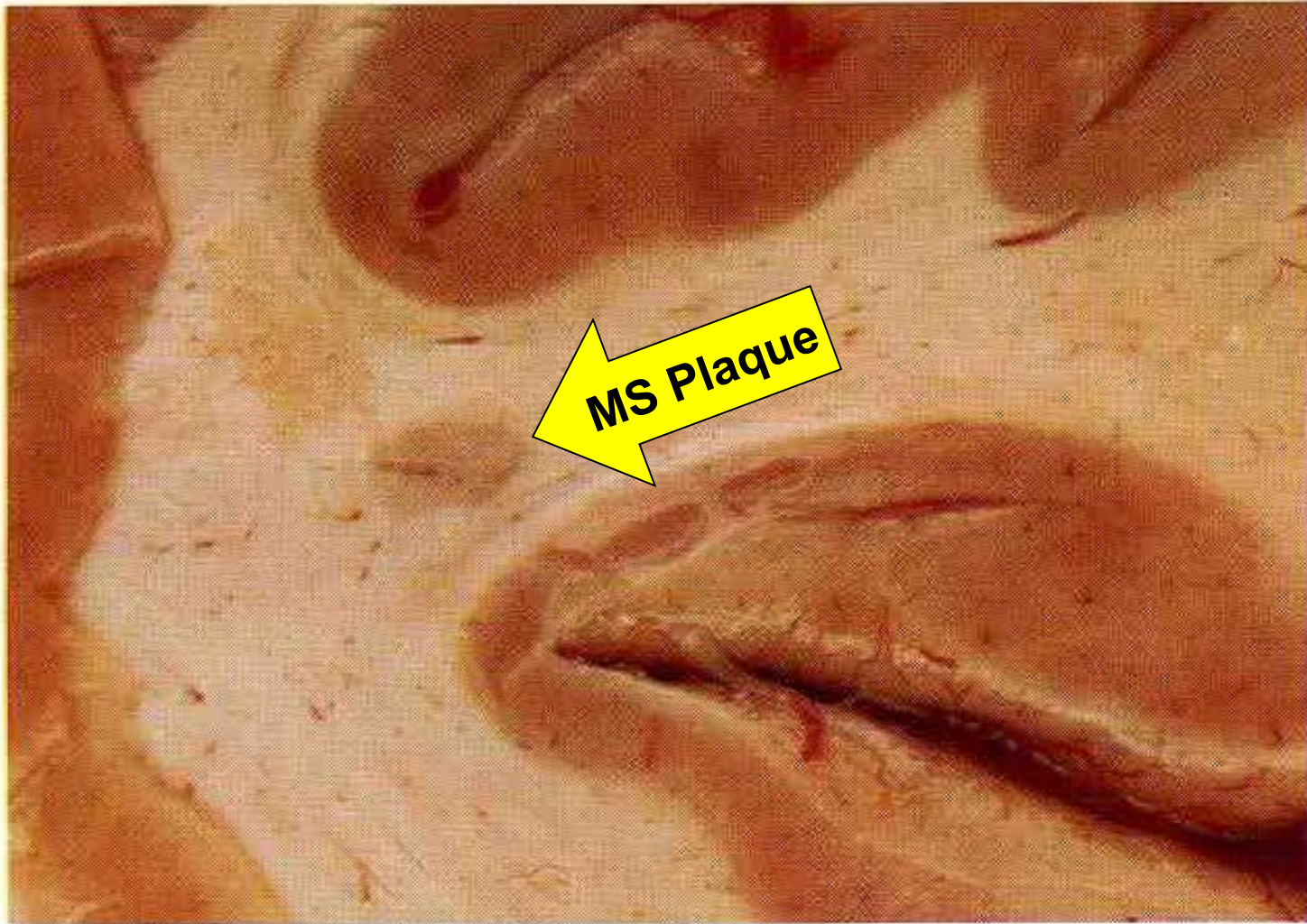
B, Unstained region of demyelination (**MS plaque**) around the fourth ventricle. (Luxol fast blue-PAS stain for myelin.)

F 9-26: **Multiple sclerosis: brain.** Coronal section of the brain showing well-defined greyish-brown chronic plaques of demyelination at the upper angles of both lateral ventricles within the white matter of the centrum semiovale. The right plaque shows features of **'shadow plaque'**.



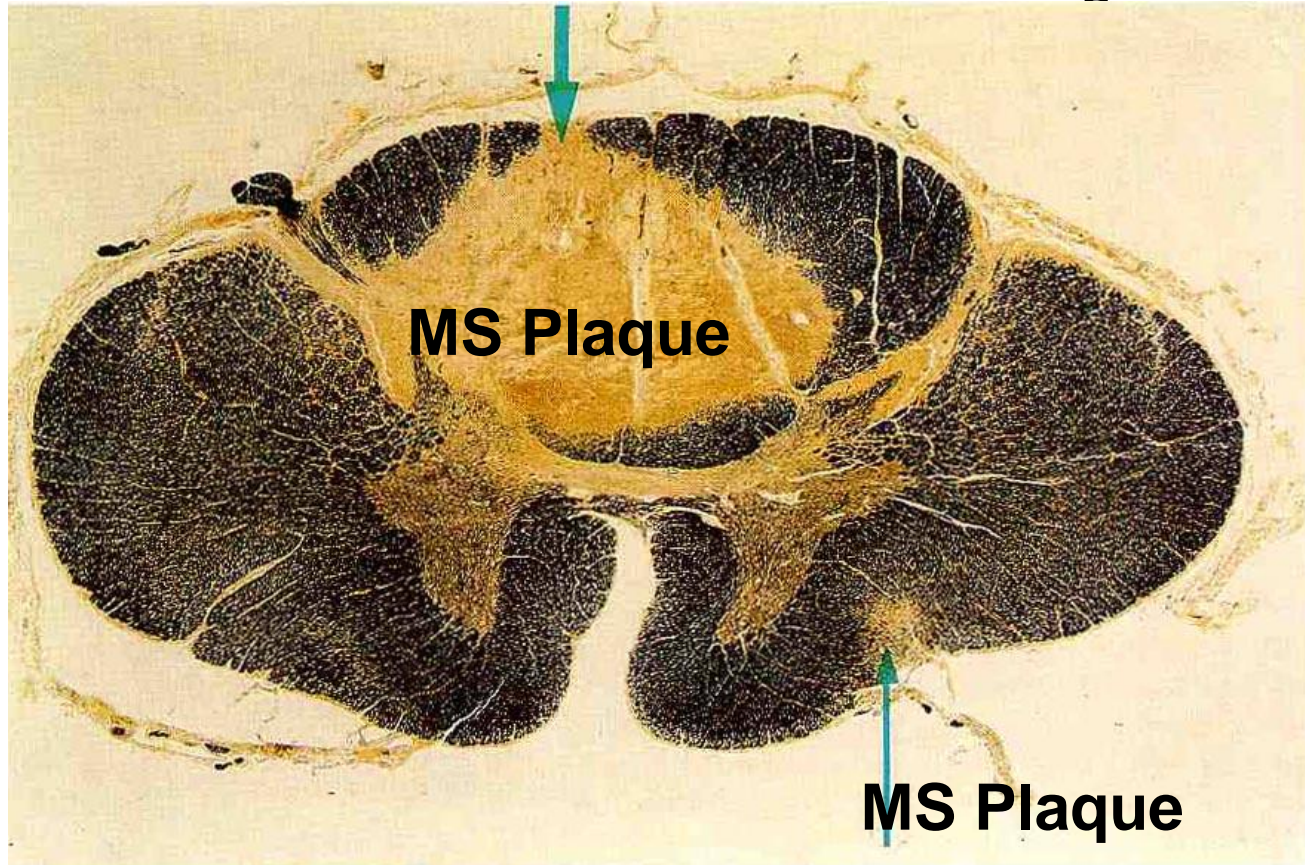
9.26 Multiple sclerosis: brain

F 9-27: Multiple sclerosis (MS) : brain. Close-up view. A recently-formed oval, pinkish-grey plaque is present in the white matter beneath the cortical ribbon. This is a characteristic site.



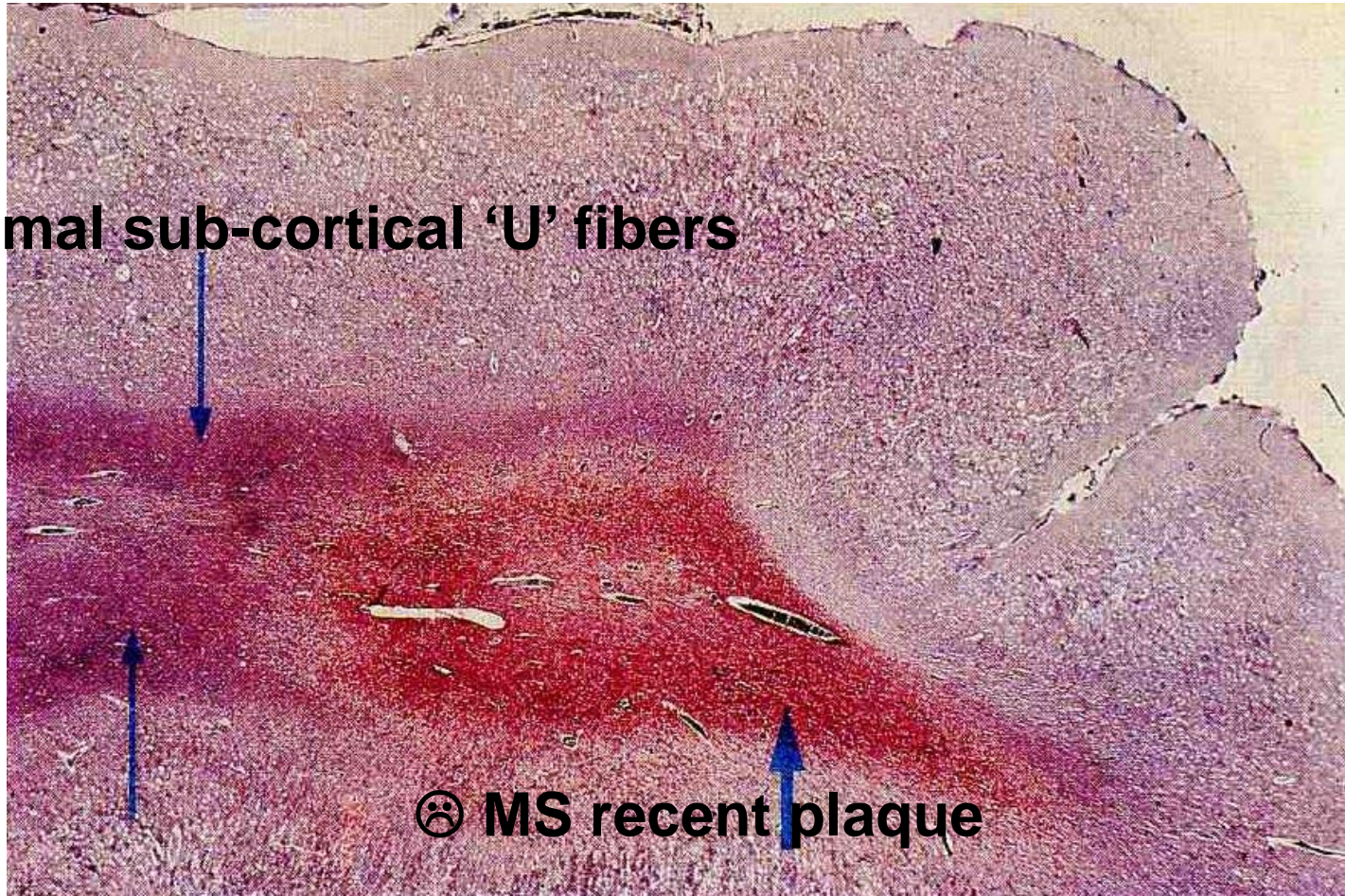
9.27 Multiple sclerosis: brain

■ 4.21: **Multiple sclerosis (MS) X9.** Cervical spinal cord section, stained by the Weigert-Pal method, which colors the myelin black, **showing 2** plaques of demyelination: (1) a small round one in the ventrolateral part of the cord (thin A), (2) much larger, **irregular** shaped one (thick A) which affects most of the posterior columns, with **complete loss of the myelin & sharp line of demarcation** between it & the surrounding tissues.



■ 4.23: **Multiple sclerosis (MS): Brain, Sudan IV X11.** Frozen section of cerebellar recent plaque, stained with **Sudan IV** to show **fat (orange-red color, thick A)** from the presence of much stainable fat which comes from the breakdown of myelin lipids. Above & to the left of the plaque there is purplish-blue sheet of normal, unaffected sub-cortical 'U' fibers (thin A).

☺ **Normal sub-cortical 'U' fibers**



Normal motor units

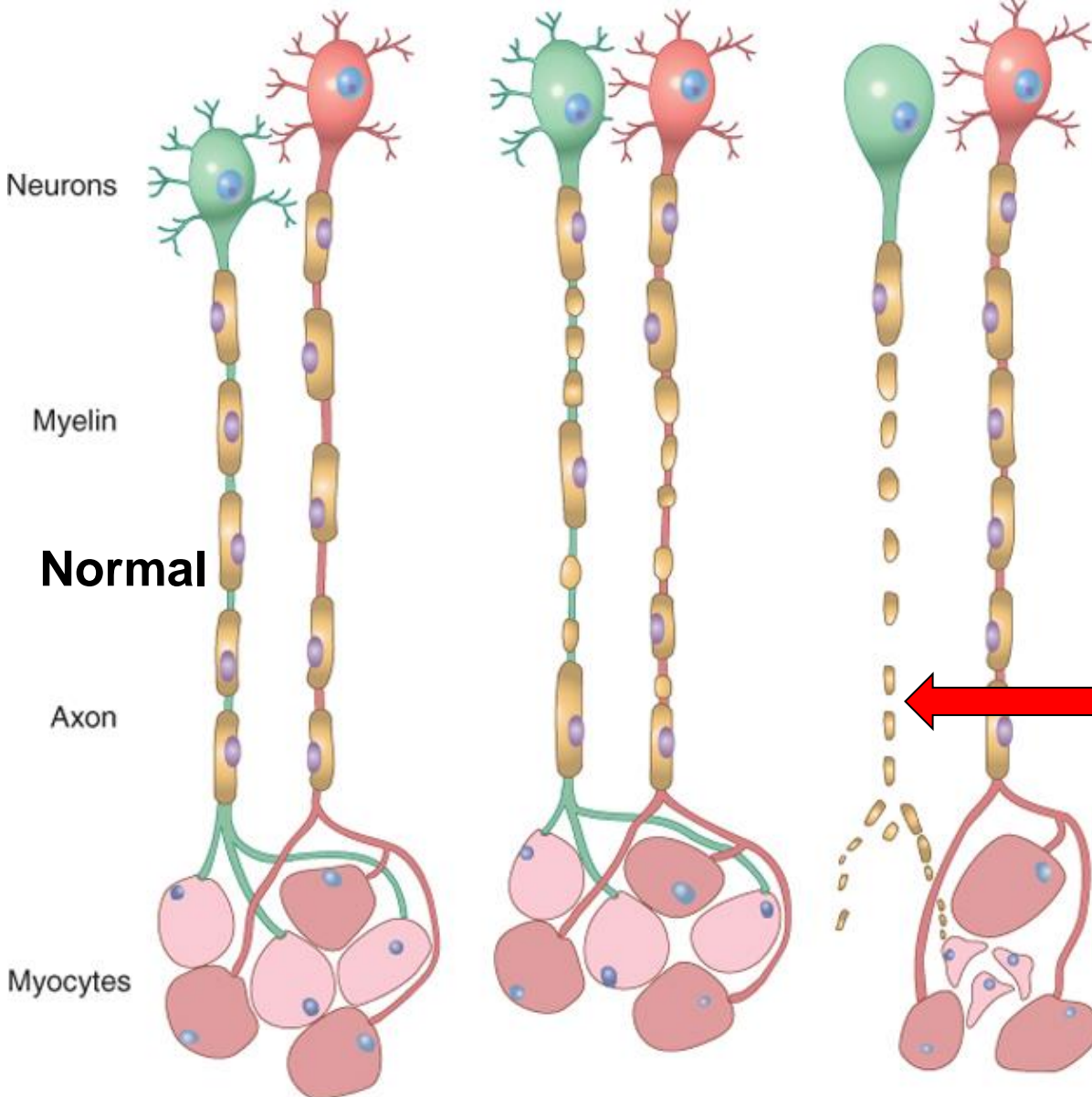
Segmental demyelination

Axonal degeneration

F23-32: ★ **Two adjacent Normal motor units.**

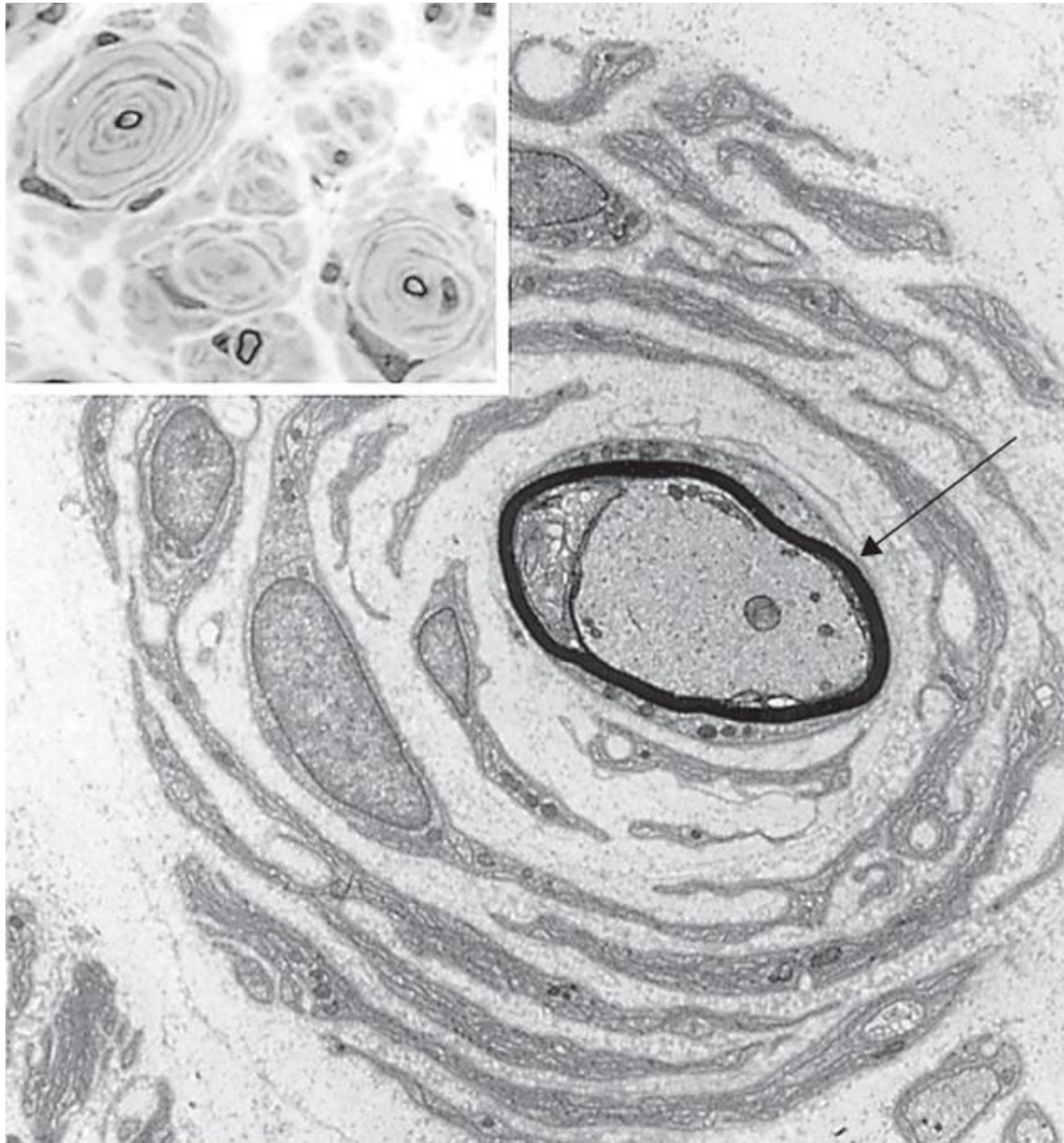
★ **Segmental demyelination:** Random internodes of myelin are injured & are remyelinated by multiple Schwann cells, while the axon & myocytes remain intact.

★ **Axonal degeneration:** The axon & its myelin sheath undergo anterograde degeneration (shown for the green neuron), with resulting denervation atrophy of the myocytes within its motor units.



■ 4.28: **Peripheral neuropathy: Sural nerve, X335.** A man of 43 who had drunk 25 pints of beer/day for years, P/ W S&S of peripheral neuropathy. Sural nerve biopsy, **stain for myelin {Solochrome cyanin, deep blue, arrow}** shows marked segmental ***demyelination of all the nerve fibers***. Another special stain however showed that the ☺ axons are intact.





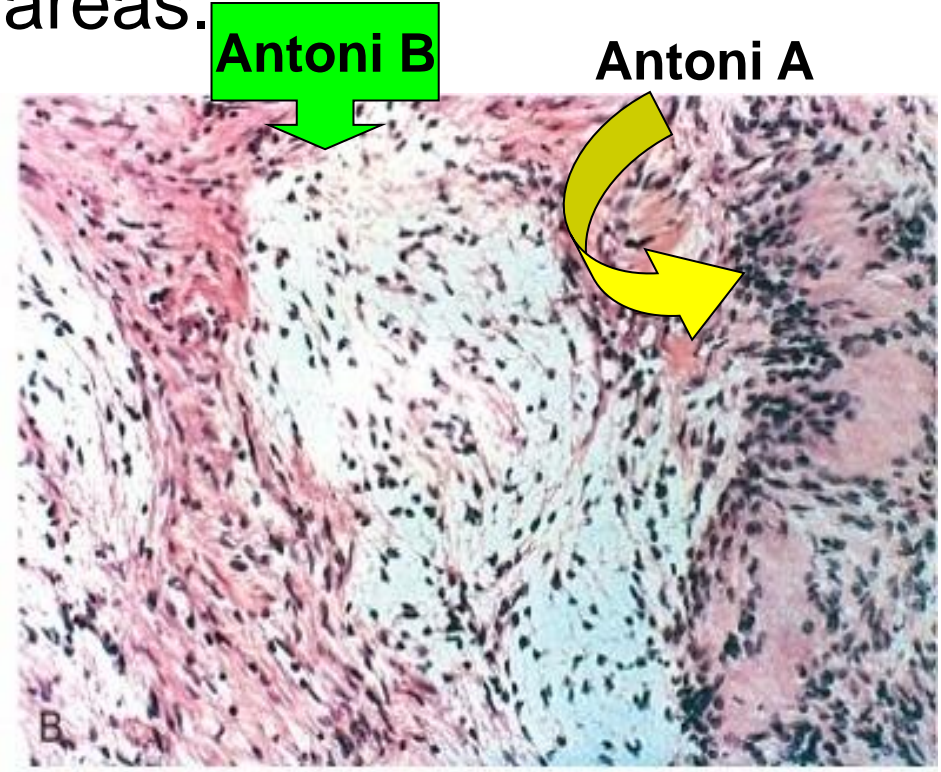
F23-33: **EM**
micrograph of a
single, thinly
myelinated axon
(arrow) surrounded
by concentrically
arranged Schwann
cells, forming an
onion bulb.

Inset, Light
microscopic LP
appearance of an
onion bulb
neuropathy,
characterized by
“onion bulb”
surrounding axons.

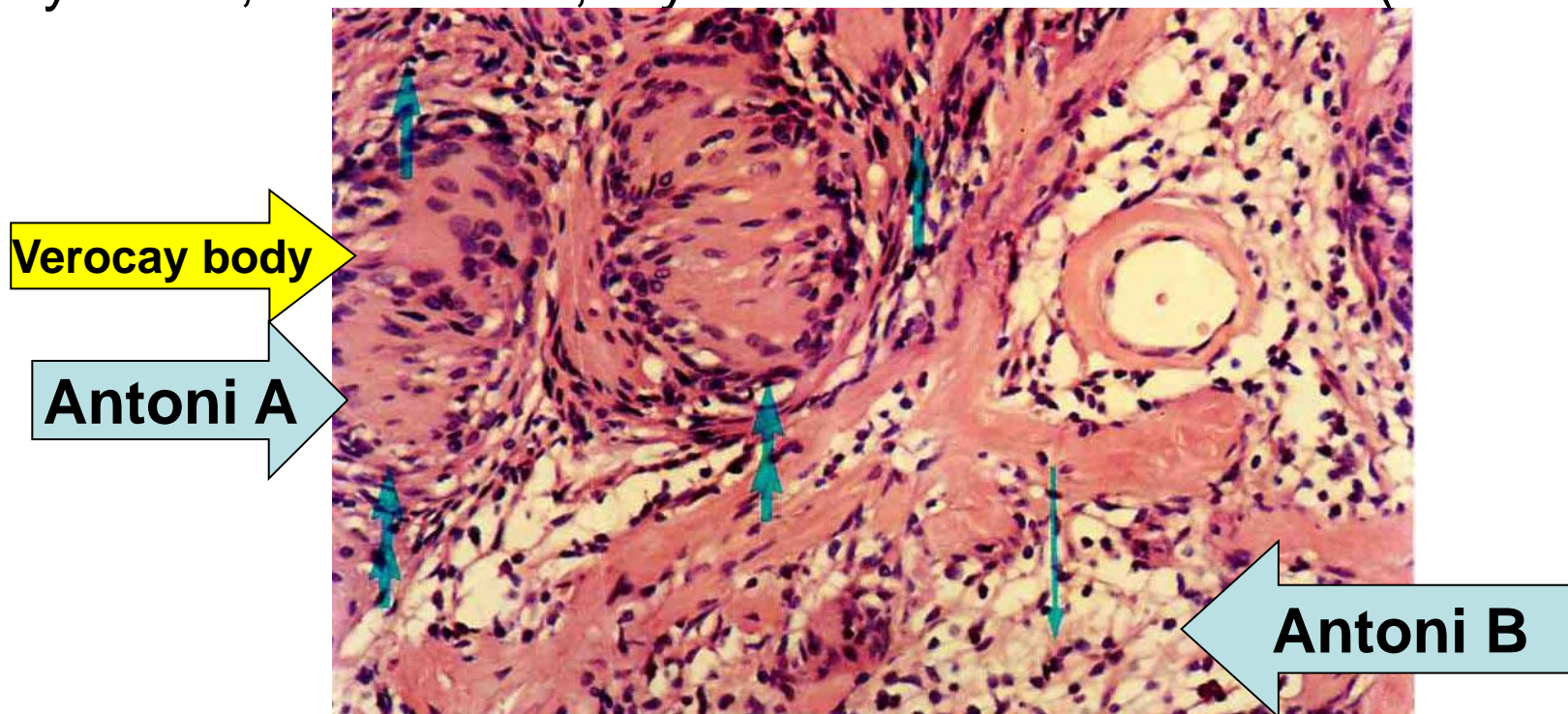
F23-34: Schwannoma.

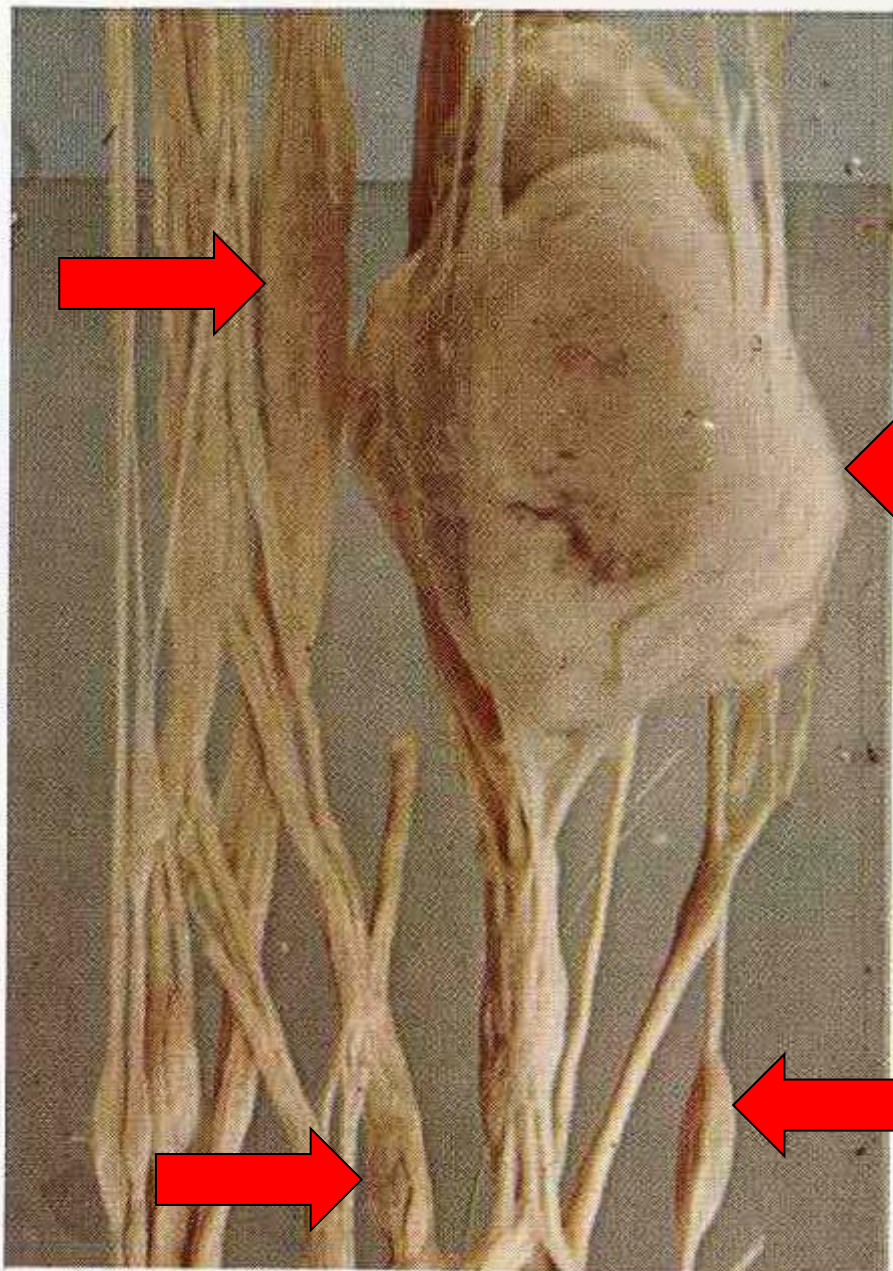
A, Bilateral eighth (8th) cranial nerve **Schwannomas.**

B, Tumor showing cellular areas (**Antoni A**), including **Verocay** bodies (far right), as well as looser, myxoid regions (**Antoni B**) areas.



■ 4.46: **Schwannoma: Spinal nerve X235. (I)** The **Antoni type A** tissue is highly cellular (thick A), consisting of elongated tumor cells arranged as long eosinophilic cords & compact ovoid bodies (Verocay bodies, double arrows). The nuclei are elongated, round & most of them are palisaded & located at the periphery of the ovoid bodies, whereas the centers of the bodies are occupied by a mass of fibrillary eosinophilic cytoplasm. (II) The **Antoni type B**, **less densely** cellular tumor cells with very loose, vacuolated, myxomatous stromal tissue (thin arrow).



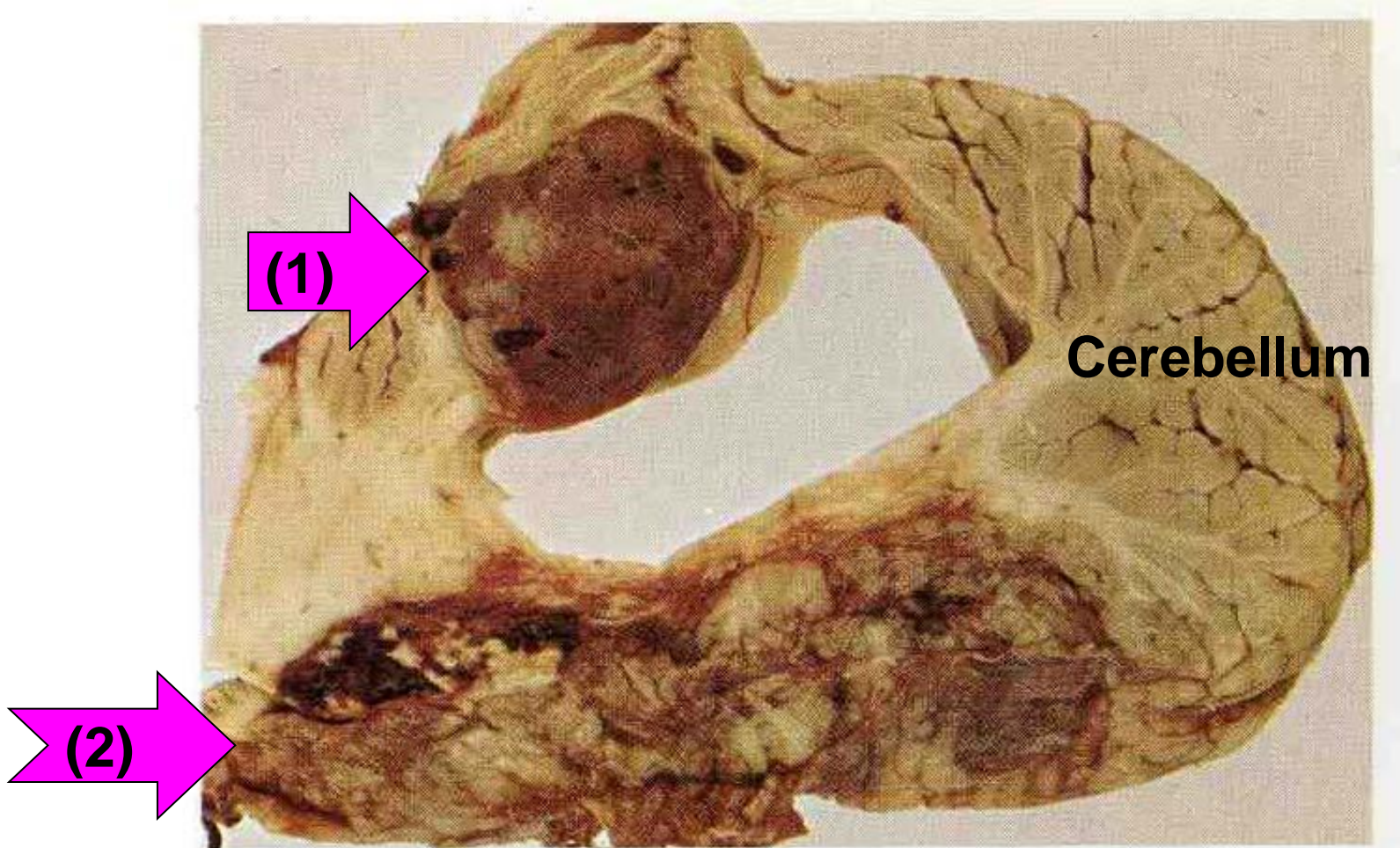


F 9-56: Plexiform neurofibroma: cauda equina.

A large, ovoid, lobulated neurofibroma has arisen from the nerve sheaths of the cauda equina. Several thickened nerves blend with the capsule of the tumor.

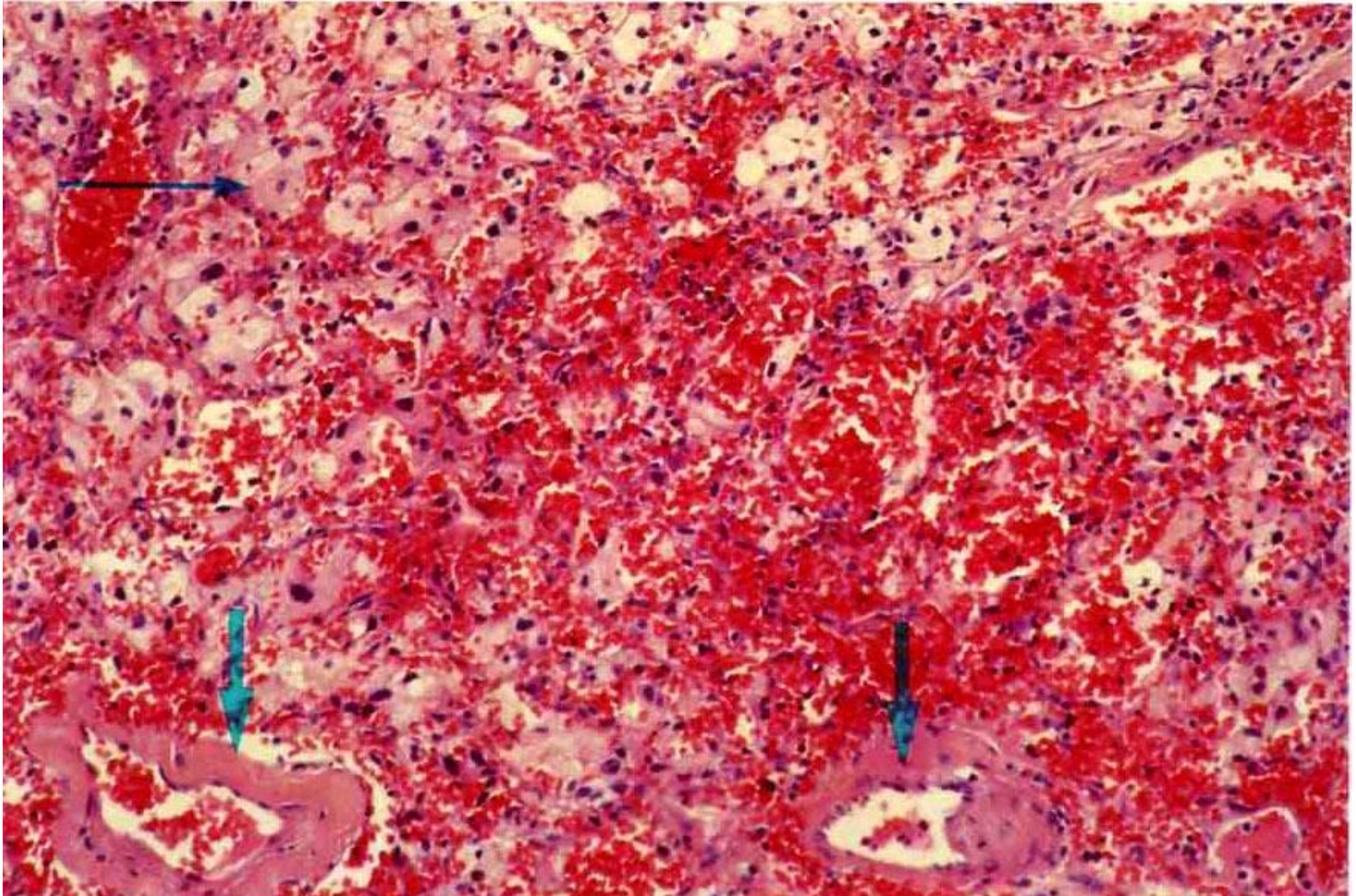
Many of the other nerves show small fusiform swellings (lower right).

F 9-73: **Hemangioblastoma: cerebellum.** The lateral lobe of the cerebellum contains large cyst cavity with two tumor nodules in its wall: **(1)** round, red-brown at top, & **(2)** larger brownish necrotic tumor mass in the bottom.

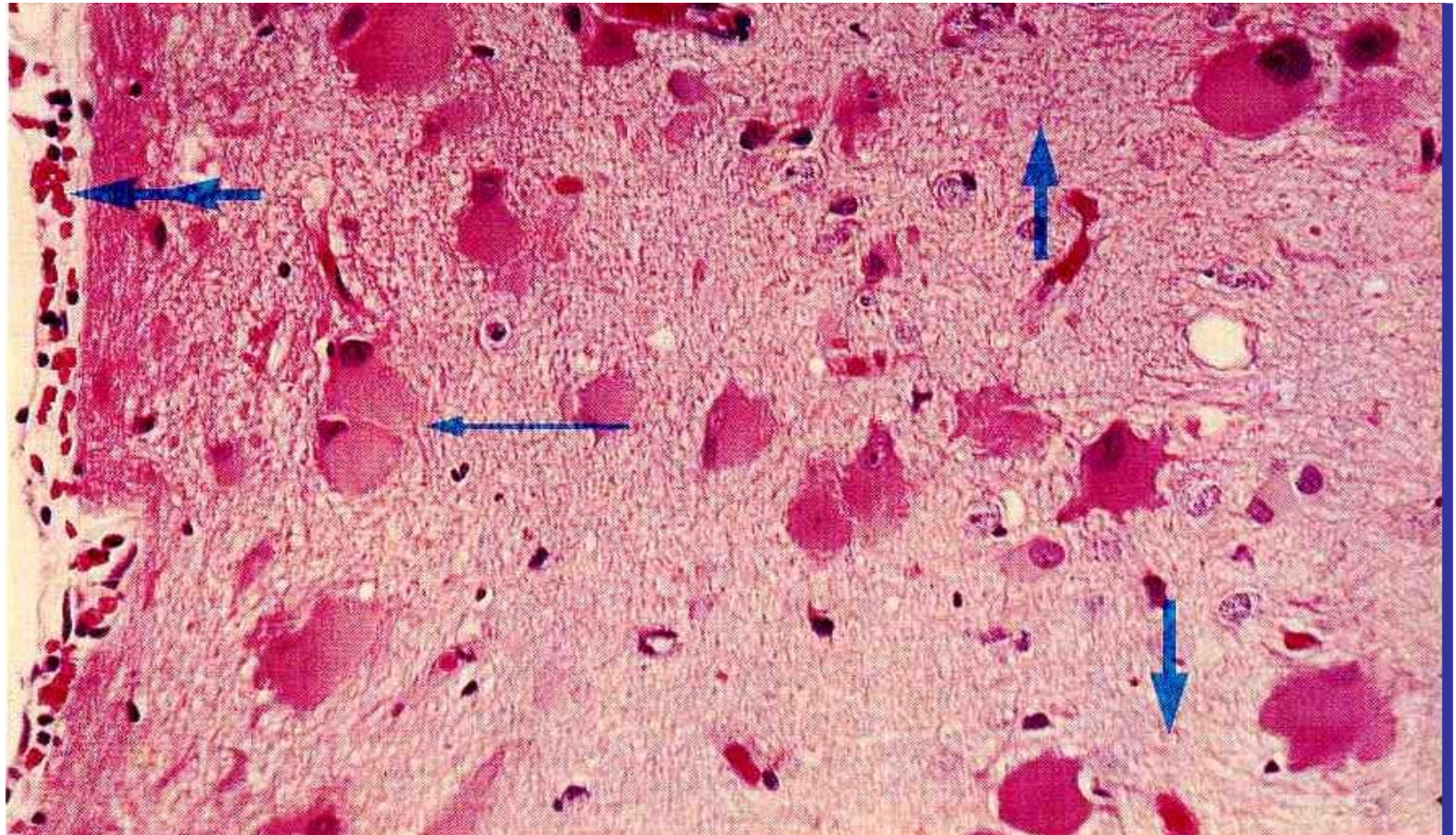


9.73 Haemangioblastoma: cerebellum

■ 4.43: **Hemangioblastoma, Cerebellum X150.** Consisting of (1) large number of very thin-walled dilated capillaries, with foci of hemorrhages, (2) intervening stromal cells with vacuolated lipid-rich cytoplasm & dens basophilic nuclei (thin arrow).



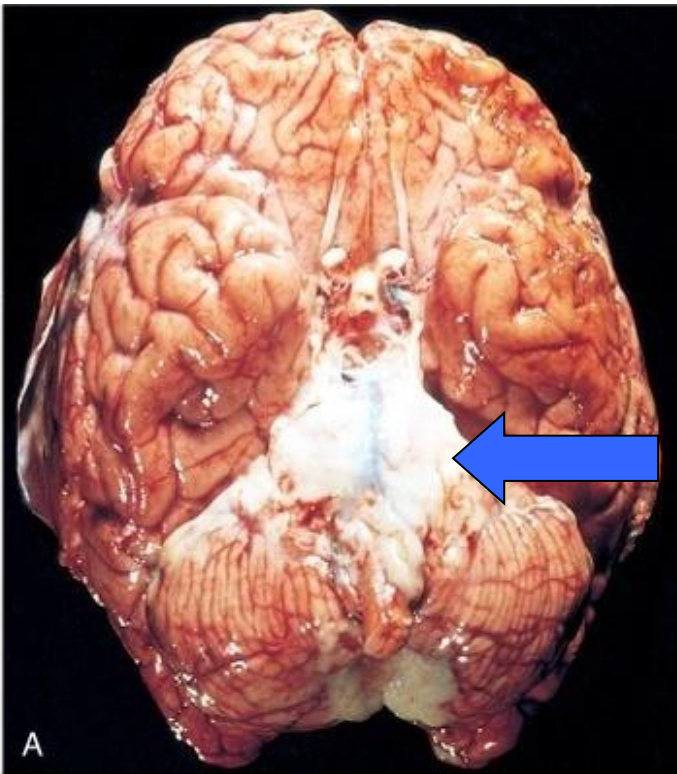
■ 4.13: **Tuberous sclerosis; Brain.** Part of Cortical hamartomas nodule (likened to **potatoes**), bounded by a dilated thin-walled BV (double arrow). The normal cortex has been replaced by tissue consisting of: (I) Abundant **glial fibers** (thick arrow) & (II) Characteristic TS **bizarre giant cells** (thin arrow) some have features of neurons & others of astrocytes.



F23-16: CNS Bacterial infections.

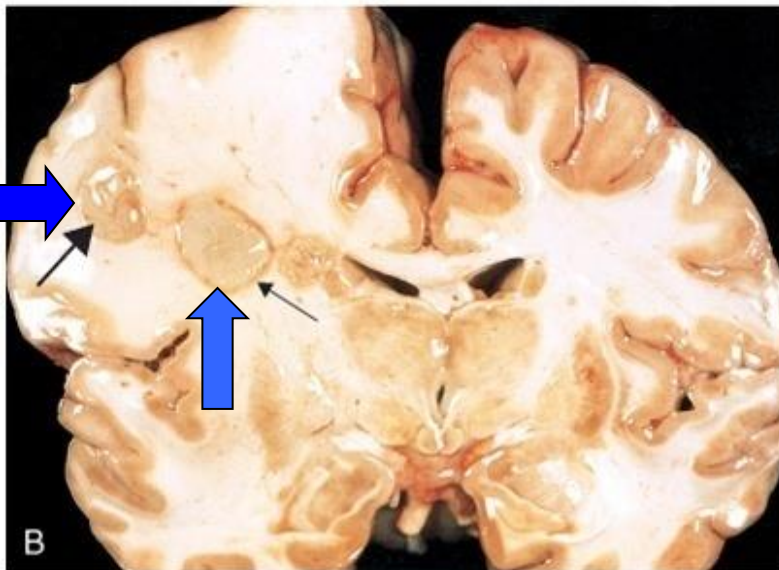
A, Pyogenic meningitis.

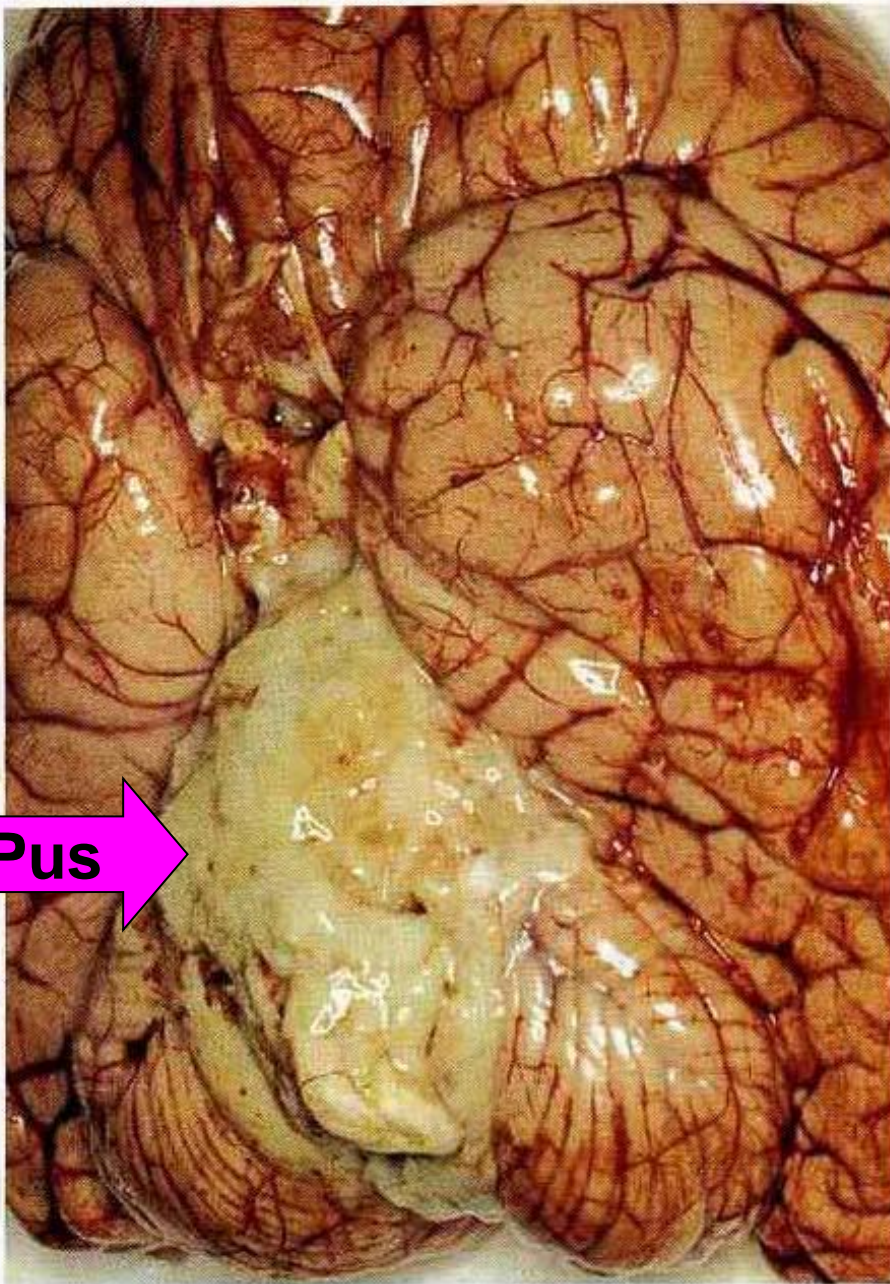
☹️ A thick layer of white pus covers the brain stem & cerebellum.



B, Two cerebral abscesses in the frontal white matter (arrows) .

Q: What is the possible route of infection in this case?

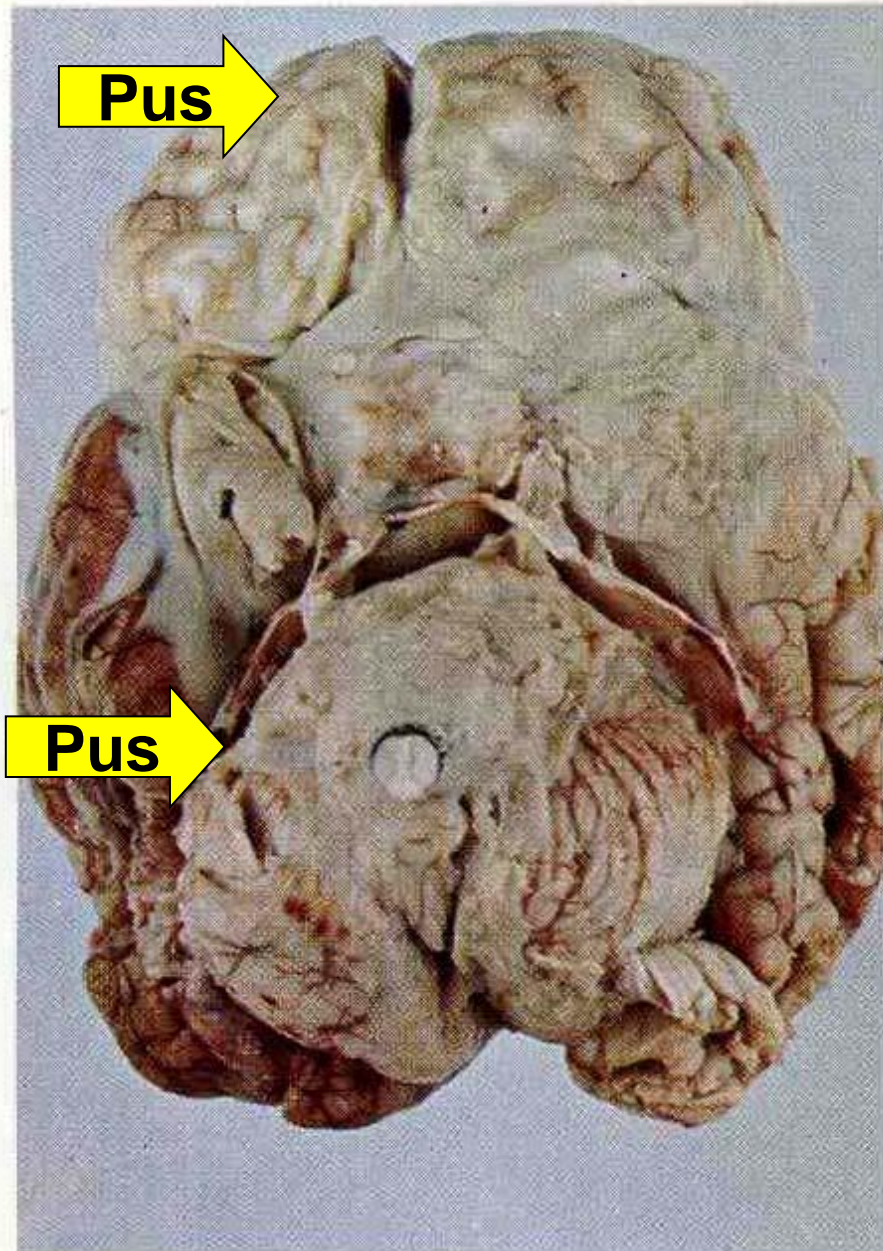




F 1-6: **Purulent meningitis.**

Brain under surface showing thick yellowish green purulent exudate (**Pus**) filling the subarachnoid space over the brain-stem & cerebellum.

* The patient had acute meningitis caused by staphylococcus aureus.



F 9-13: Acute purulent meningitis: brain.

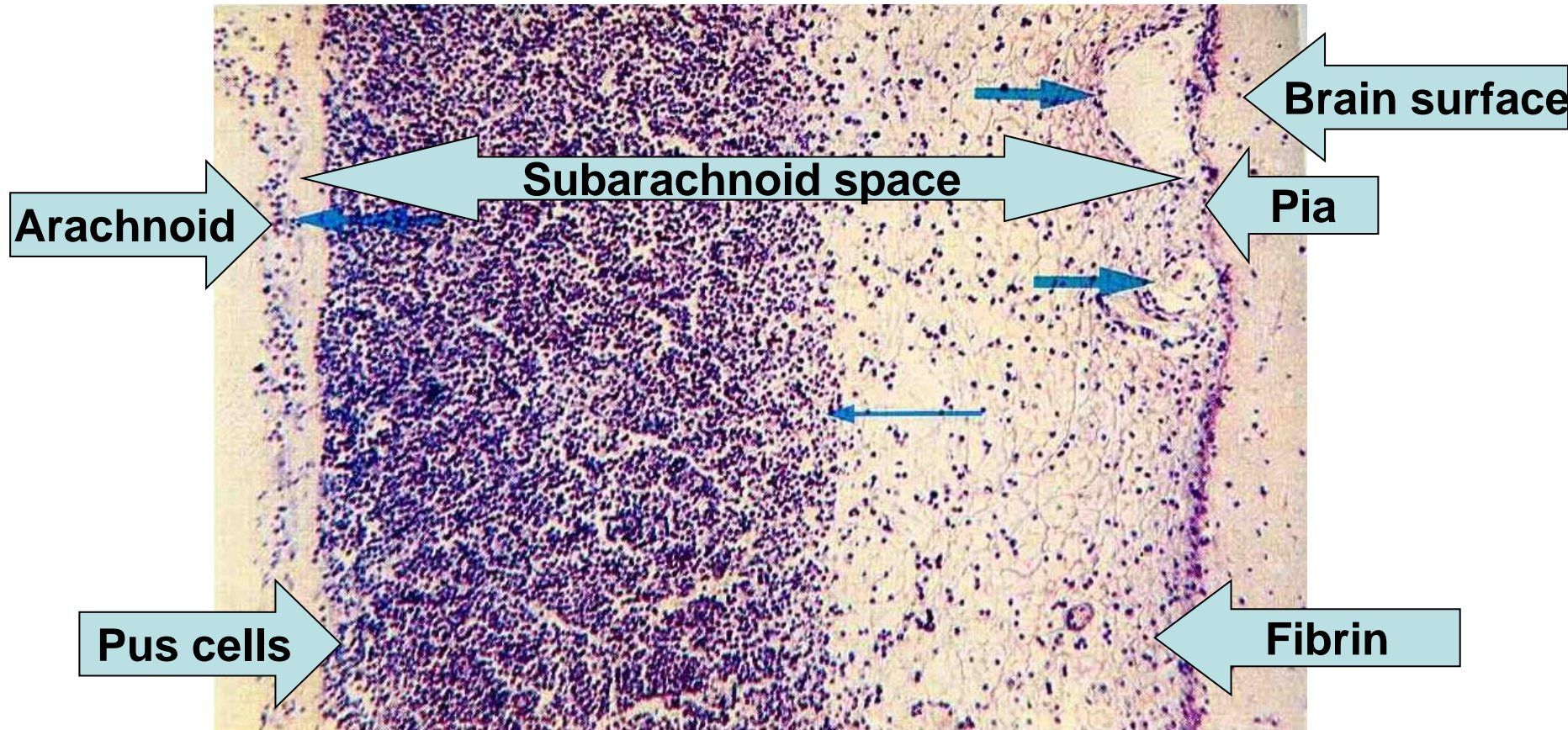
This shows the undersurface of the brain of a 5-month-old boy. The surface is covered by a shaggy greyish-green purulent pus.

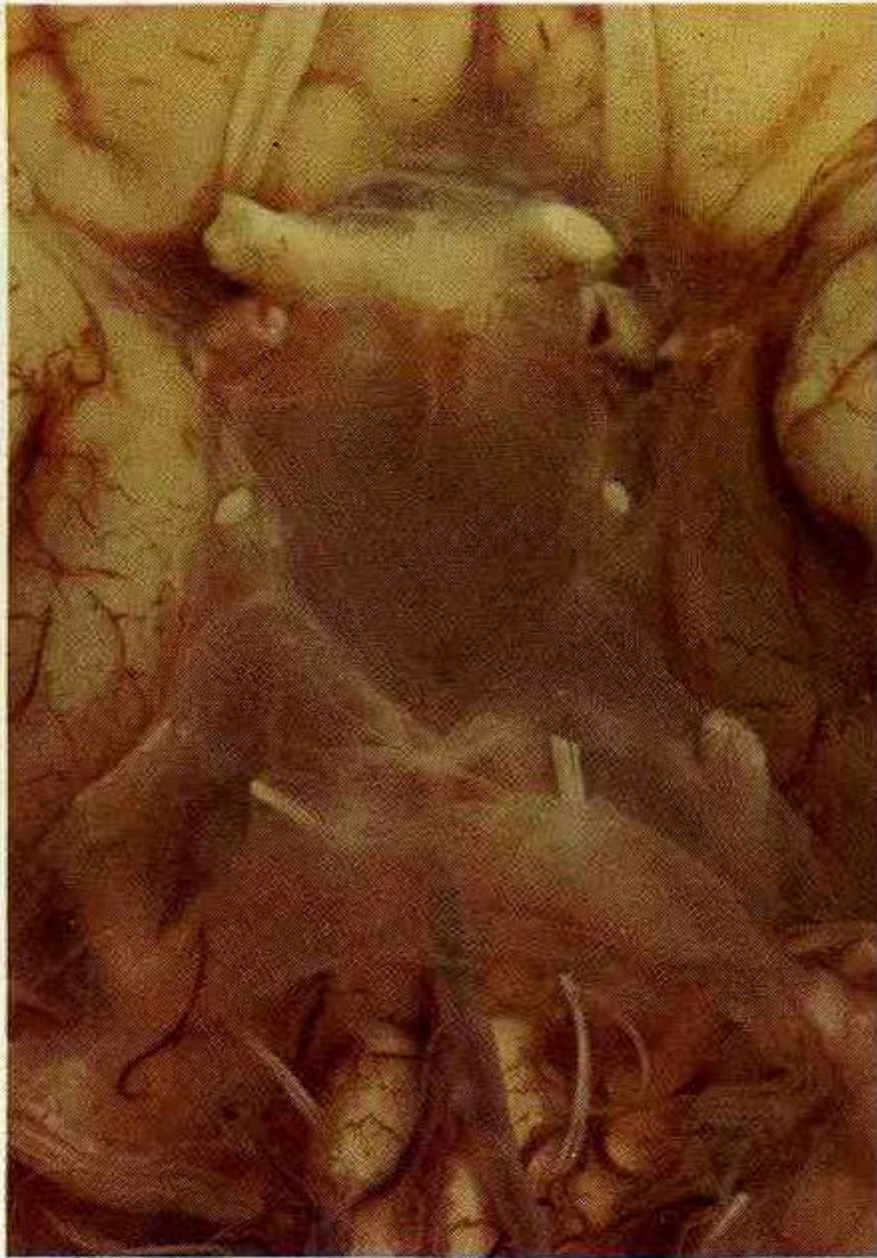
► A recent **ventriculo-atrial shunt** had been inserted for an obstructive hydrocephalus secondary to a craniopharyngioma. The causative bacteria was *Streptococcus pneumoniae*.

9.13 Acute purulent meningitis: brain

4.7: Acute pyogenic (purulent) meningitis. Brain X120.

Brain surface on the right & is covered by pia. ● The small BV on the surface of the cerebral cortex (thick arrows) are markedly dilated. ● The arachnoid membrane (double arrow) is infiltrated by a blue line of basophilic neutrophils. ● The subarachnoid space (between pia & arachnoid) is filled by thick layer of neutrophils (pus cells, thin arrow) & fibrin strands.





F9-14: **Leptomeningeal fibrosis: brain.**

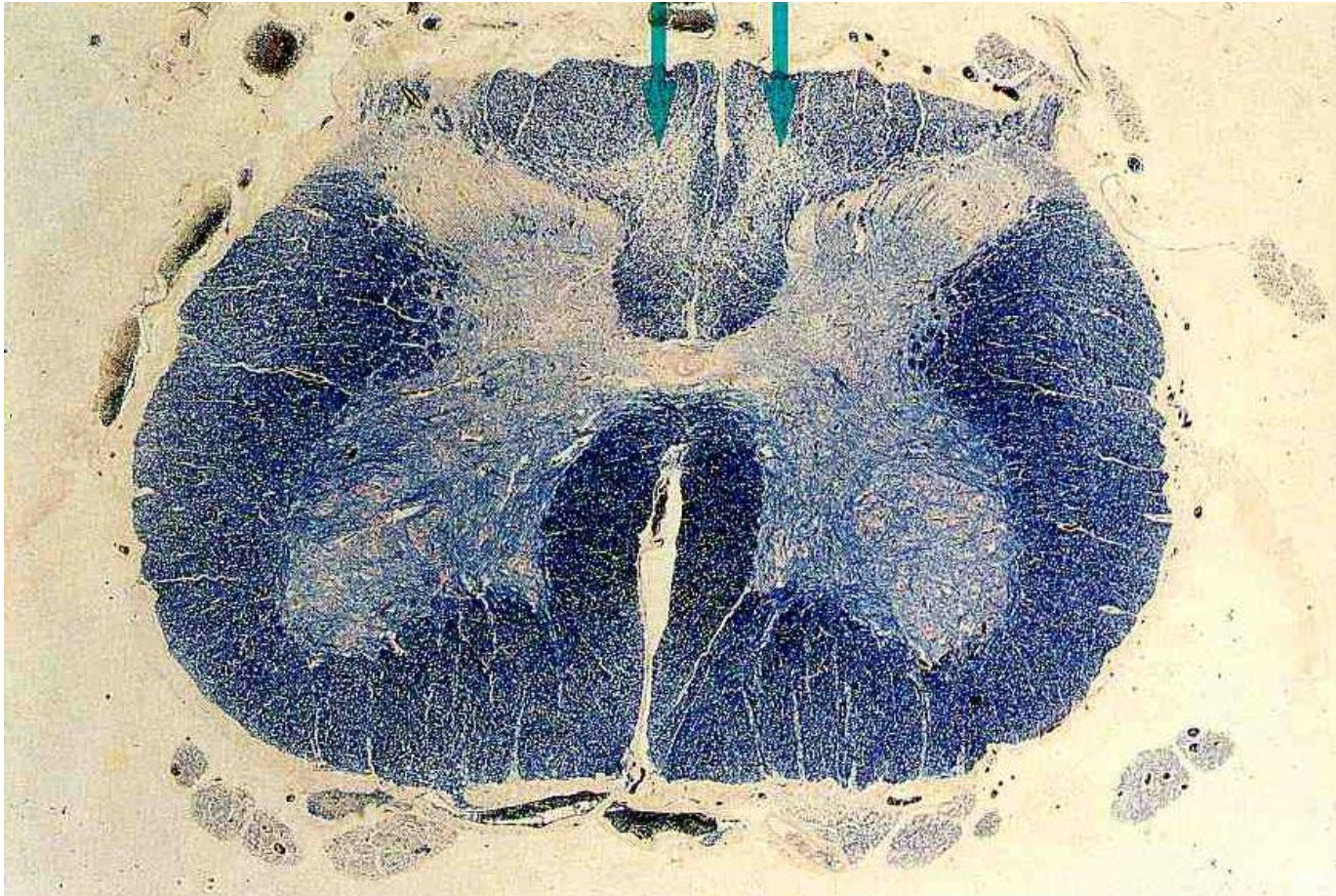
★ Organization & fibrosis of exudate (in pyogenic or TB meningitis) cause marked fibrotic thickening of the leptomeninges over the base of the cerebrum & brain-stem seen in this patient.

☹ **Effects?**

fibrous scarring may:

- (I) compress cranial nerves, leading to **paralysis**, &
- (II) obstructs the CSF flow causing communicating **hydrocephalus**

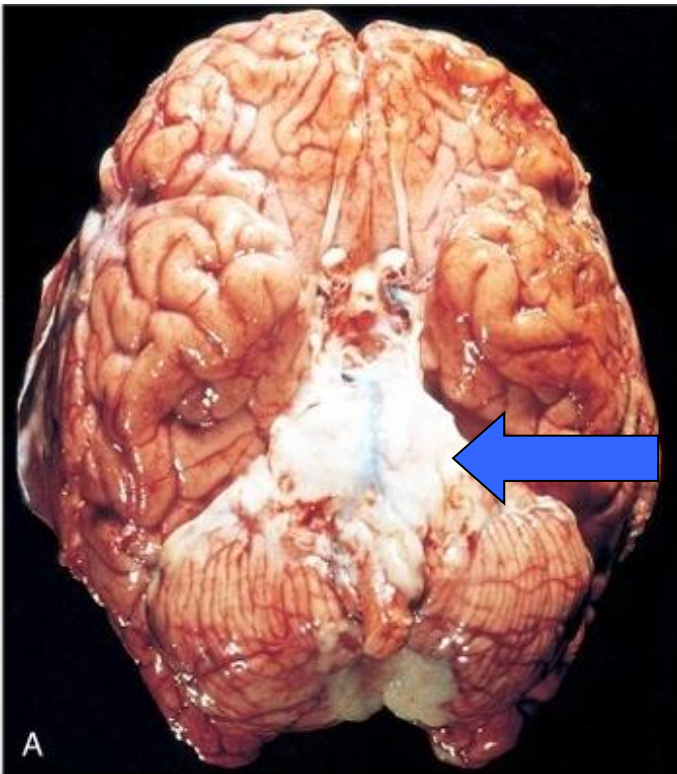
■ 4.15: **Tabes dorsalis: Spinal cord X11.** SC section through L4 segment, stained by the Loyez for myelin, showing an area of **pallor** in each of the **posterior columns** (thick arrows) in the middle root zone, caused by the **loss of the myelinated** fibers; causes **loss** of pain & deep sensations in the muscles & joints of the legs with **ataxia & absence of deep tendon reflexes**.



F23-16: CNS Bacterial infections.

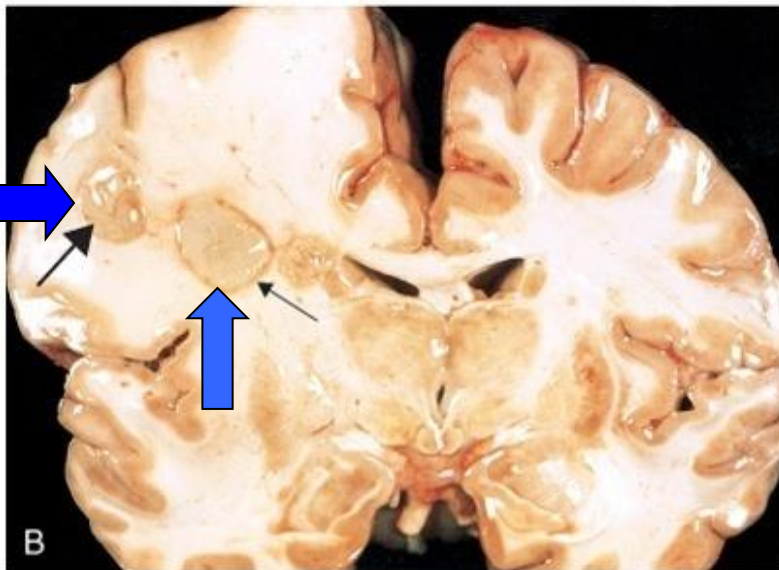
A, Pyogenic meningitis.

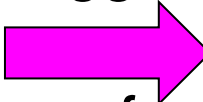
☹️ A thick layer of pus covers the brain stem & cerebellum.

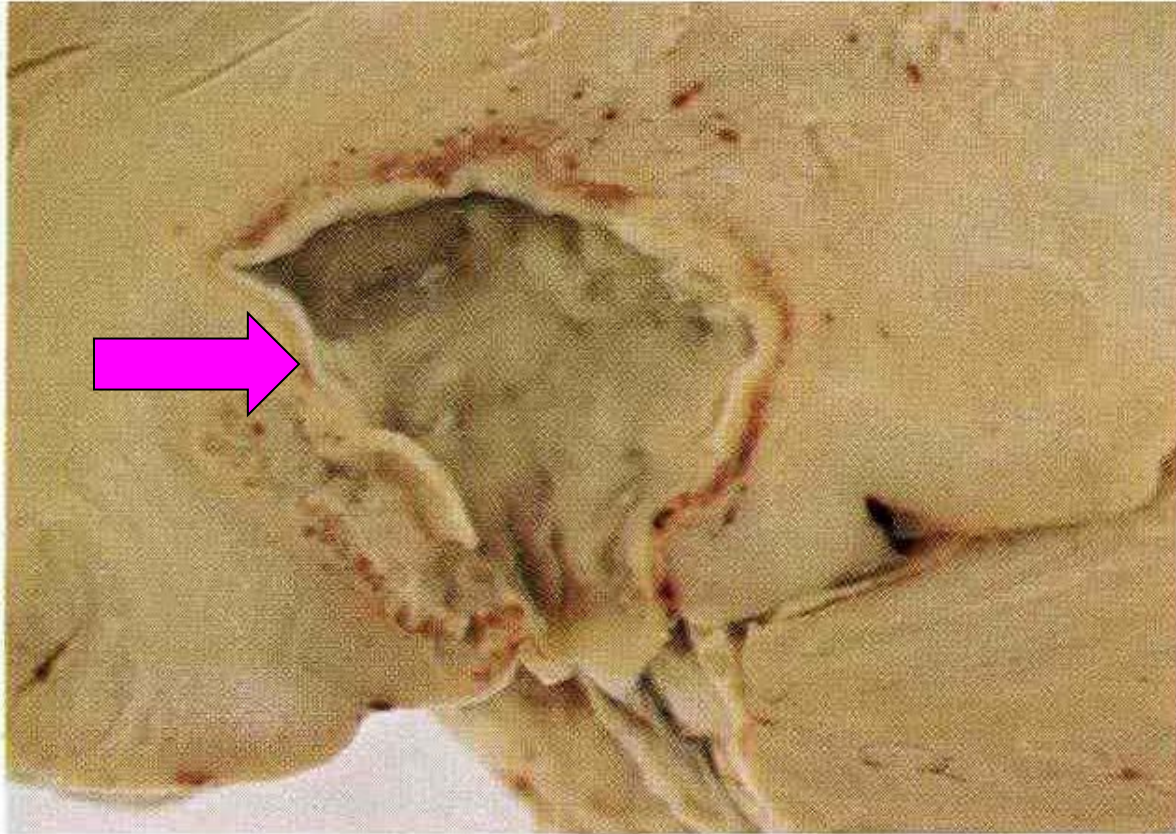


B, Two cerebral abscesses in the frontal white matter (arrows) .

Q: What is the possible route of infection in this case?

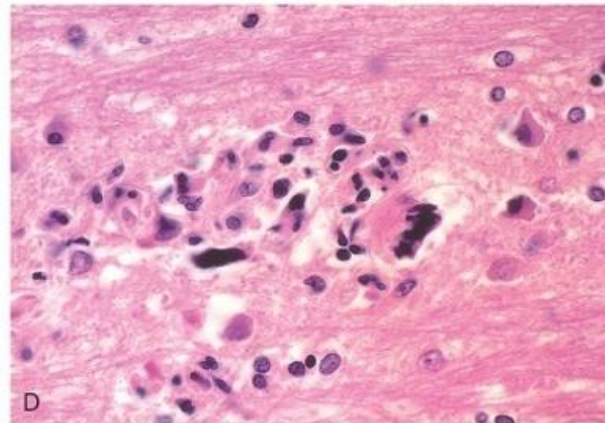
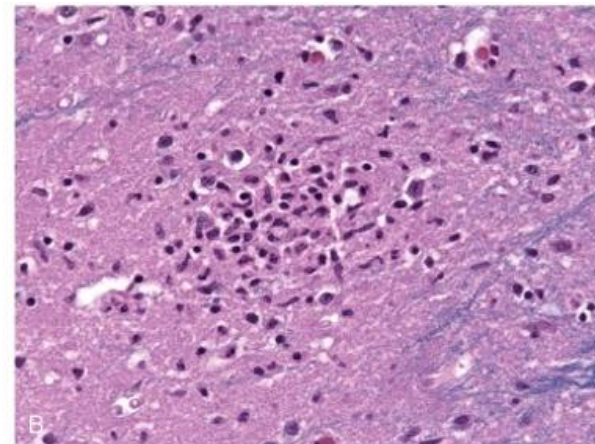
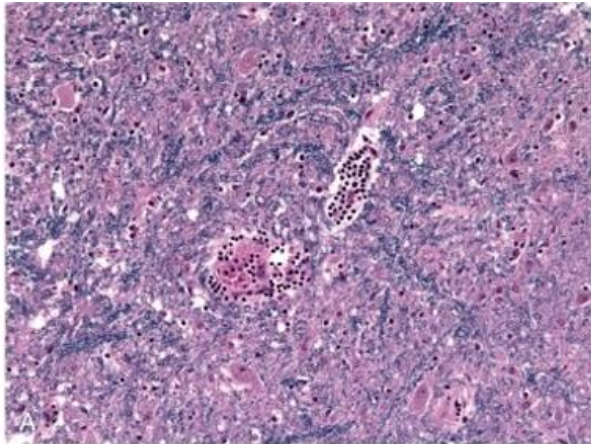


F 9-11: **Chronic brain abscess** in the inferior part of the temporal lobe, with an irregular ragged cavity, the inner wall of which is lined by greyish-green  **pus**. The abscess is enclosed by a **capsule** consisting of granulation tissue & fibrosis. ☠ This abscess results from extension of infection from chronic suppurative otitis media (CSOM) & chronic mastoiditis.

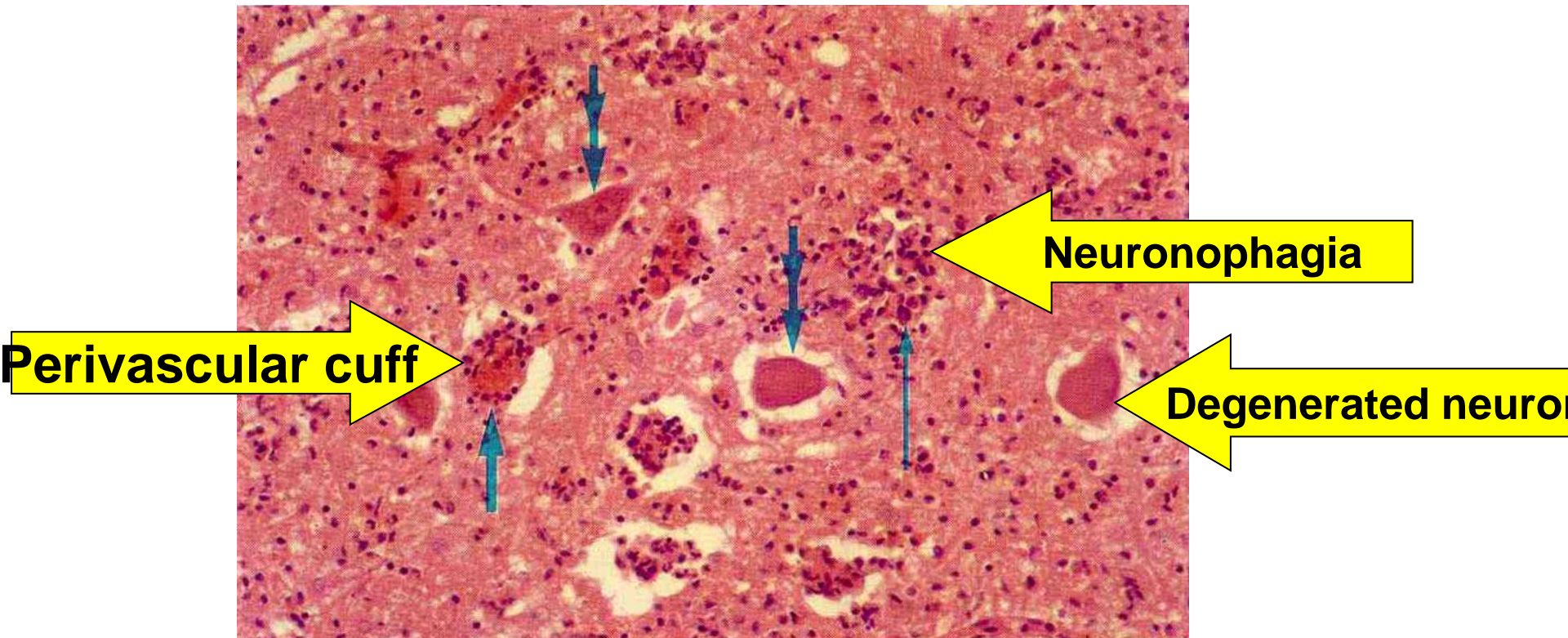


9.11 Chronic abscess: brain

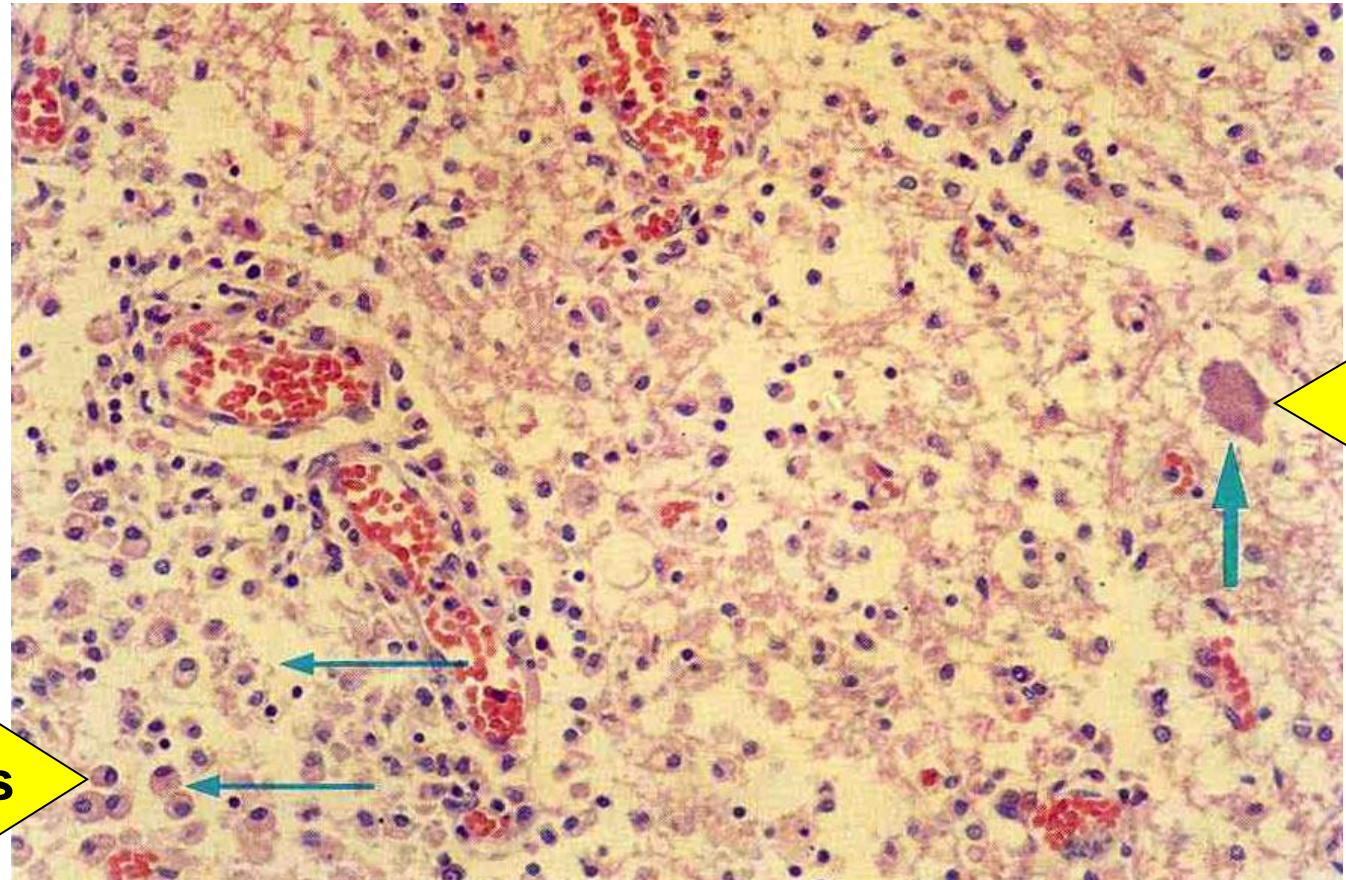
F23-17: CNS Viral infections. Characteristic findings of viral meningo-encephalitis include **(A)** perivascular cuffs of lymphocytes & **(B)** microglial nodules. **(C) Herpes encephalitis** showing extensive destruction of inferior frontal & anterior temporal lobes. **(D) HIV encephalitis.** Note the microglial nodule & multinucleated giant cell.



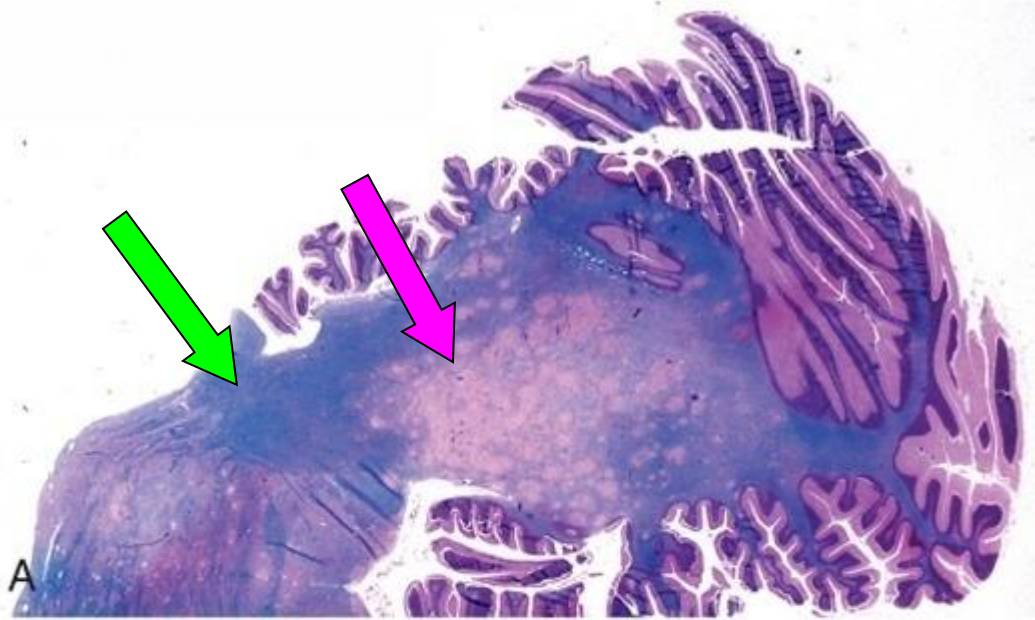
■ 4.19: **Poliomyelitis: X235 Spinal cord** anterior horn in a patient who die 6 days {Cause?} after the onset of illness. There is neutrophils, lymphocytes & macrophages cell infiltration, some as a **perivascular cuff** (thick A). **All neurons are degenerated**, having no nucleus & contain little or no Nissl substance & some are shrunken & occupy large **vacuoles** (double thick A). Several necrotic neurons are being phagocytosed (**neuronophagia** (thin A)).



■ 4.20: **Poliomyelitis: x235. Spinal cord** anterior horn in a patient who die 7 days after the onset of illness {**Cause?**}. There is extensive destruction of all neurons, except a degenerating & shrunken **single neuron** (thick arrow). There is infiltration by lymphocytes, plasma cells ,& macrophages which are swollen with pale granular lipid [foamy macrophages, thin arrow] pushing the nucleus to one side of the cell



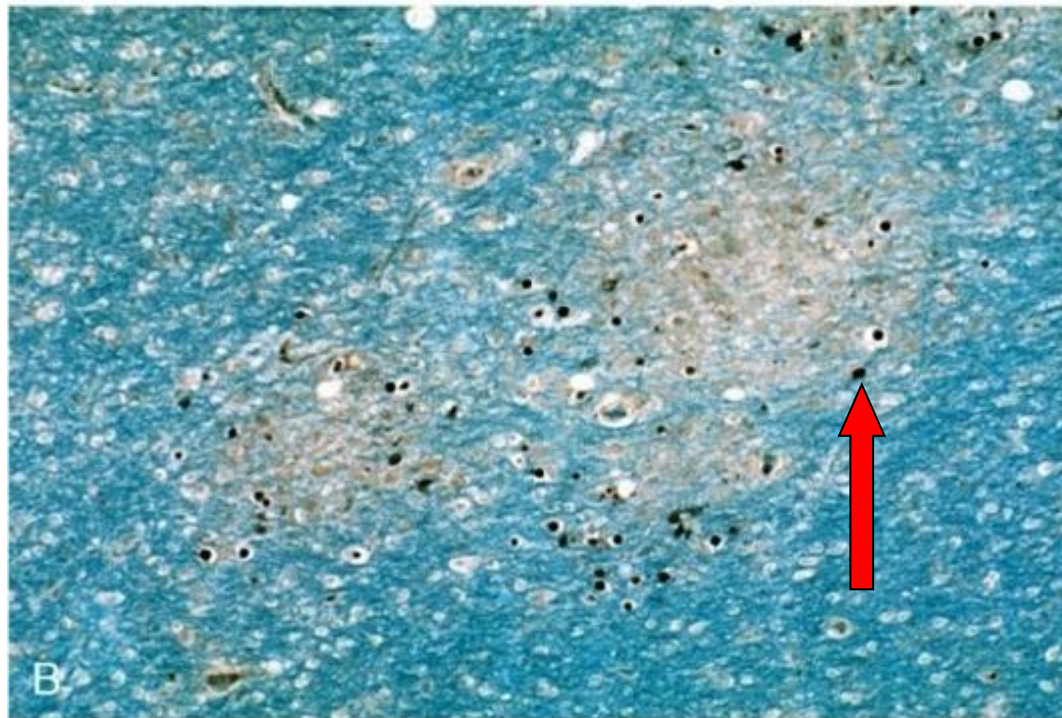
Foamy macrophages



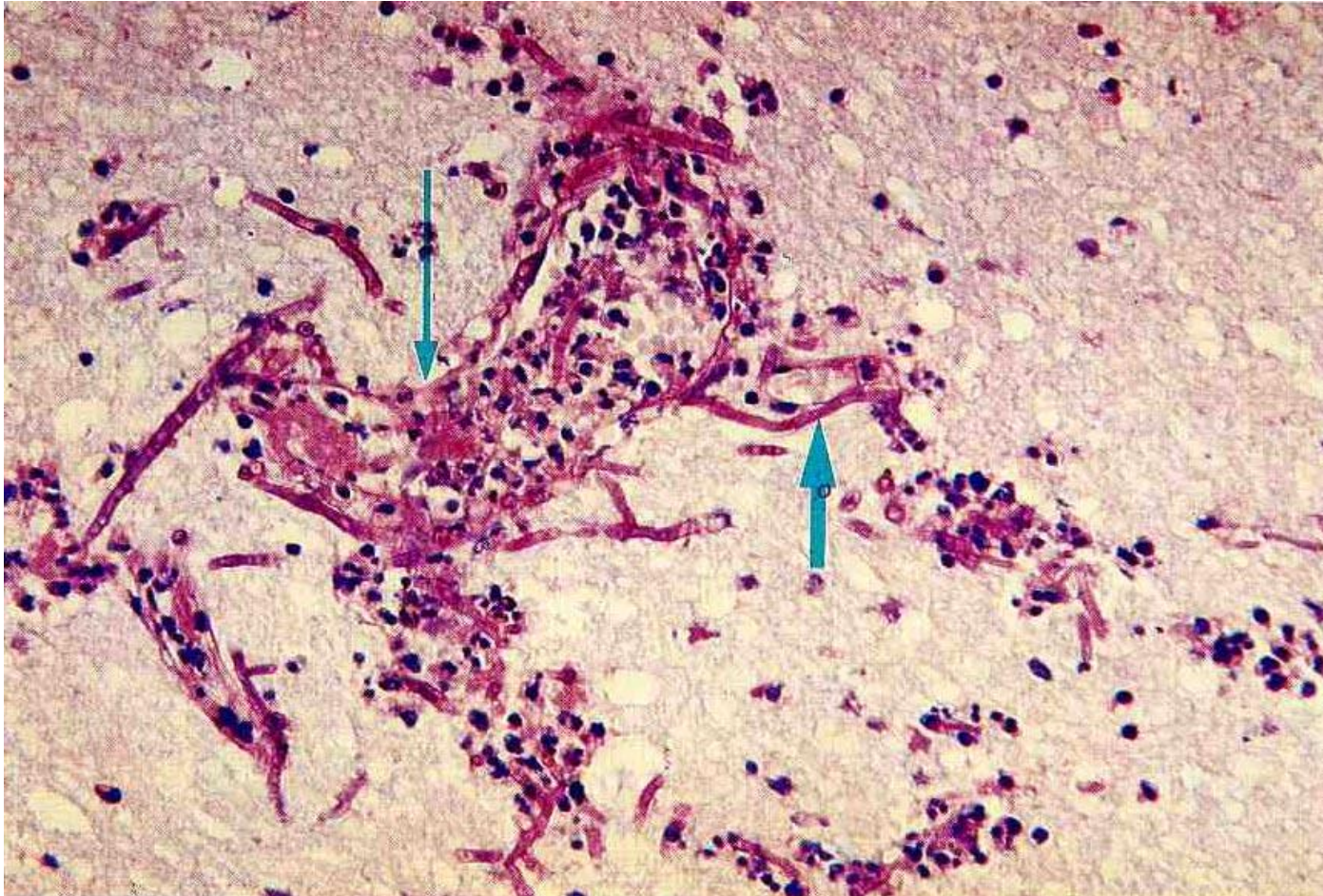
F23-18: Progressive multifocal leukoencephalopathy (PML).

A, Section stained for myelin, showing irregular poorly defined areas of **demyelination**, which become confluent in places.

B, Enlarged oligodendrocyte nuclei stained for viral antigens surround an area of early myelin loss.

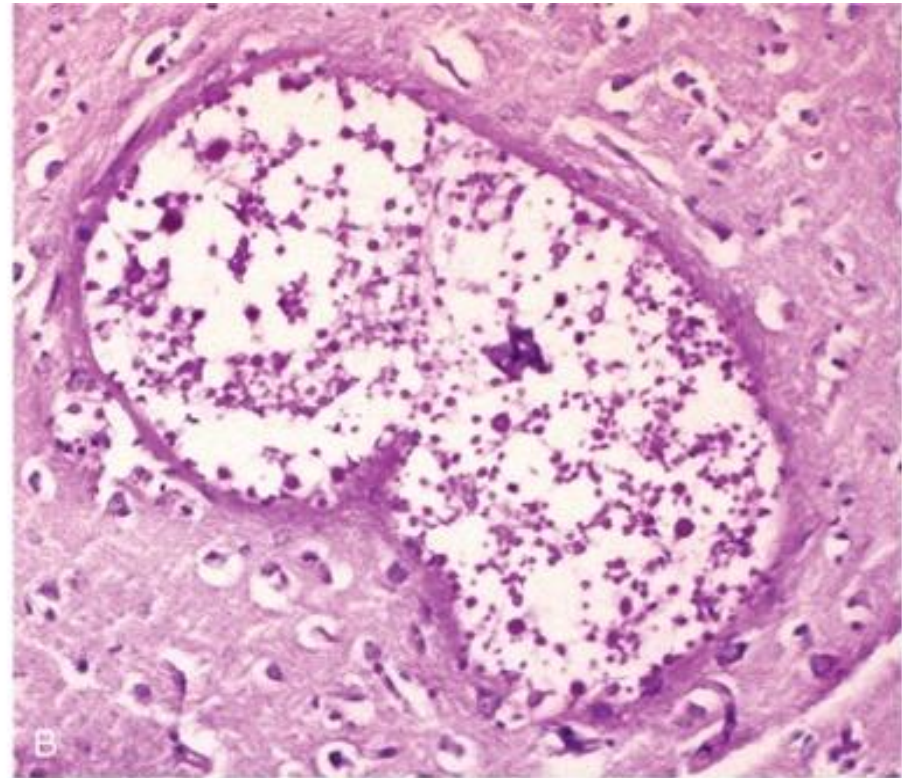
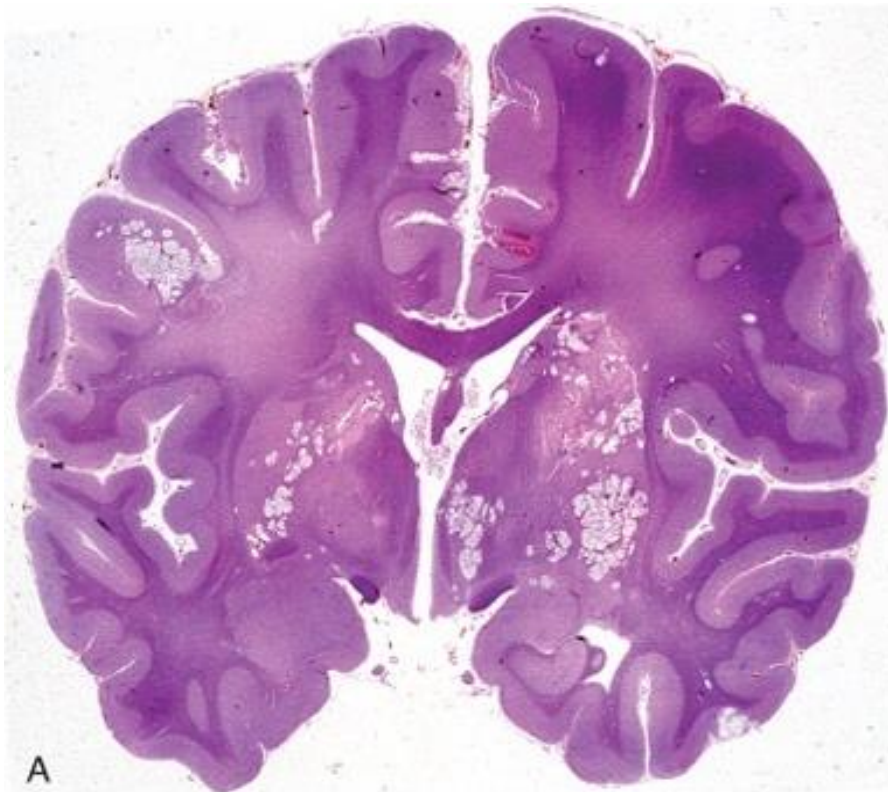


■ **4.10: Aspergillosis: Brain.** A 13 years old girl on chemotherapy for Hodgkin's lymphoma. The branching filamentous *Aspergillus* fungi, with many transverse septa in the hyphae (thick arrow) are growing alongside & penetrating the small venule lumen & the adjacent white matter. Parts of the hyphae are surrounded by a moderate neutrophils infiltrate.



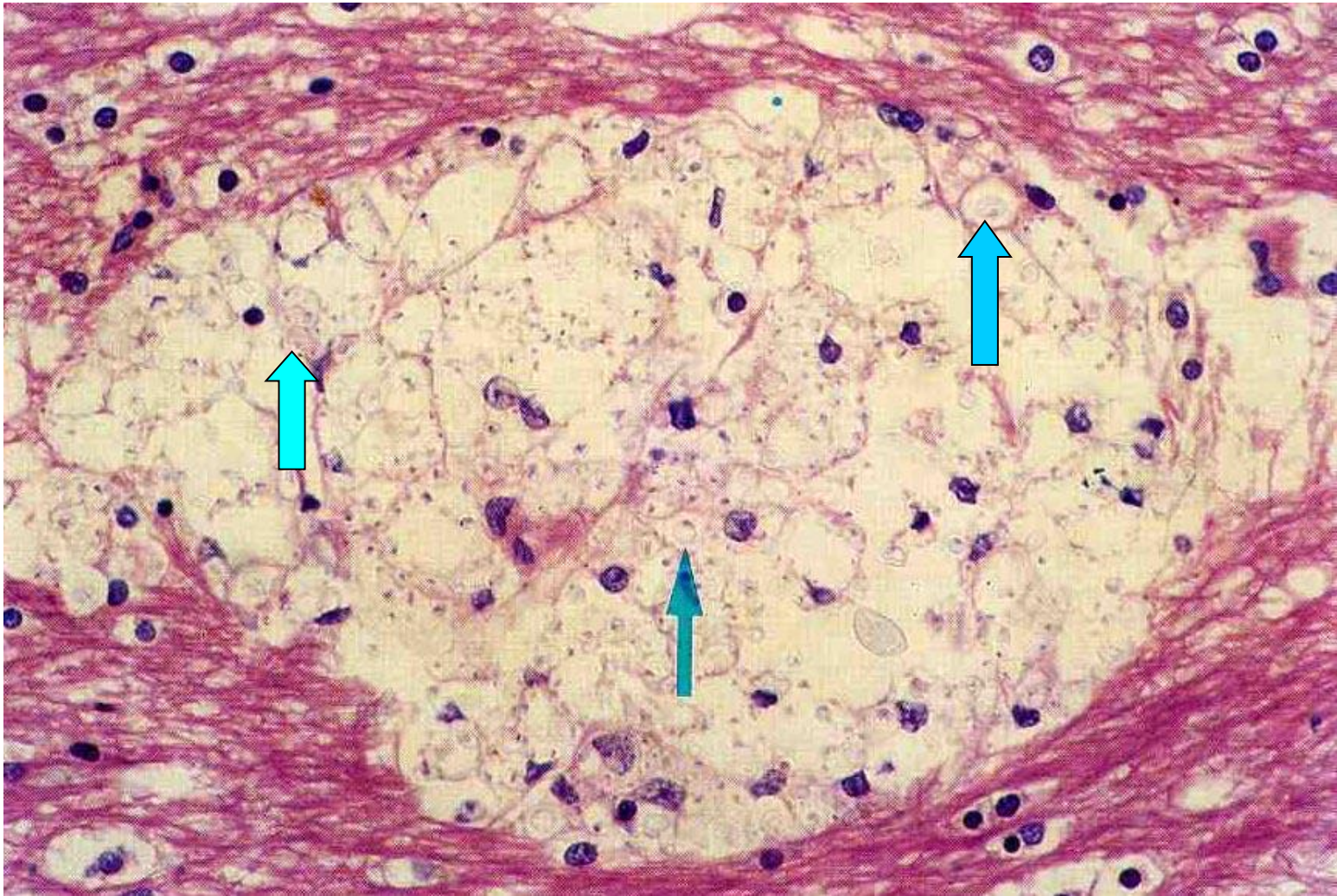
F23-19: Cryptococcal infection. Inhalation of the yeast from the environment (pigeon droppings) may produce lesions in the lung, which in immune depressed patient may spread to the CNS, causing meningo-encephalitis.

A, Brain section showing many areas of tissue destruction associated with the spread of organisms in the perivascular spaces. **B, Cryptococci** in the lesions at higher magnification.

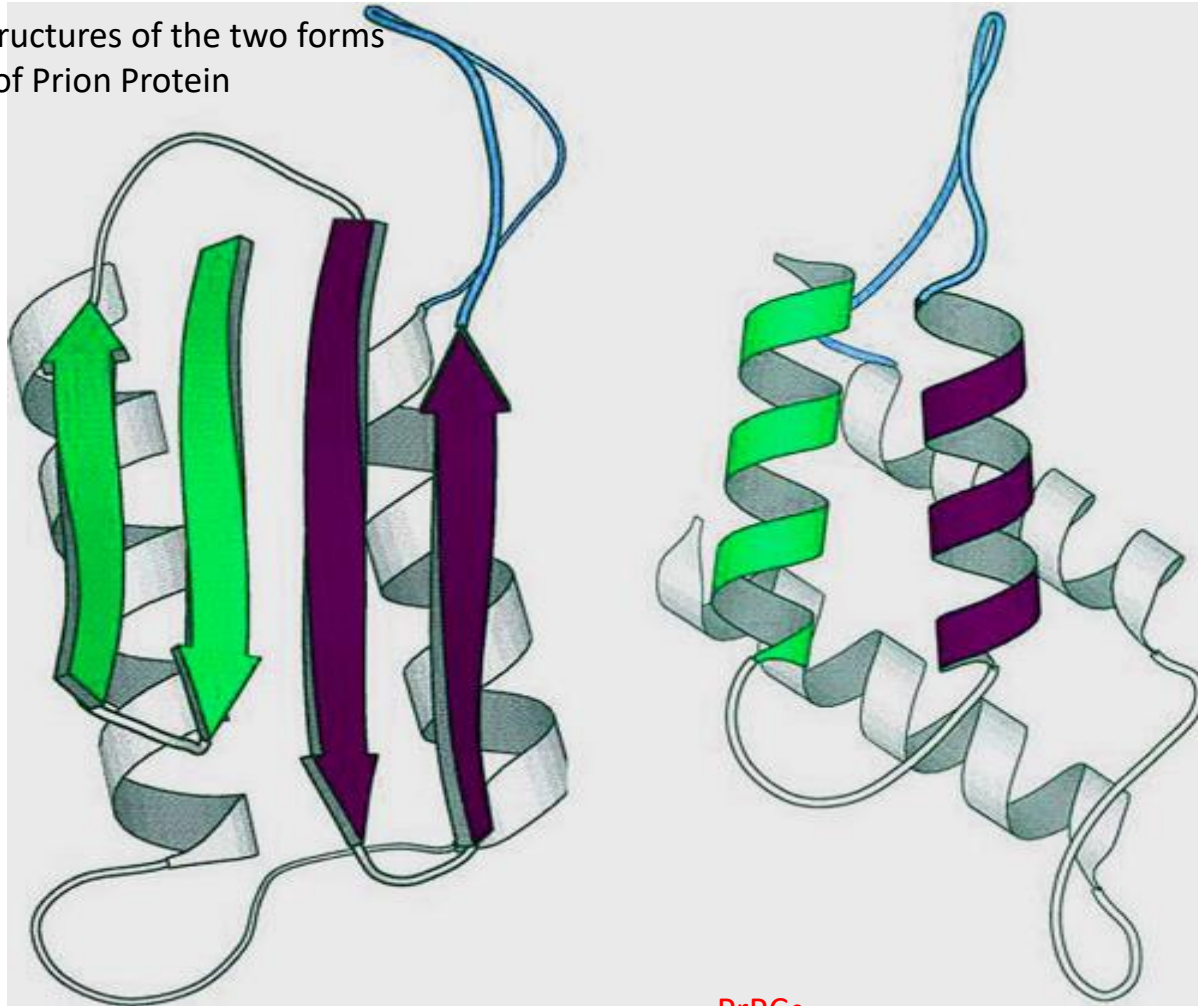


■ 4.11: **Cryptococcosis (neoformans) : brain X360.**

Typical cyst in the cerebral cortex, contains large number of **Cryptococci**, each is 5-20 microns in \emptyset , is dark-colored & enclosed within a thick pale grey mucoid capsule (thick arrow) with little, if any, inflammatory reaction!



Protein Structures of the two forms
of Prion Protein



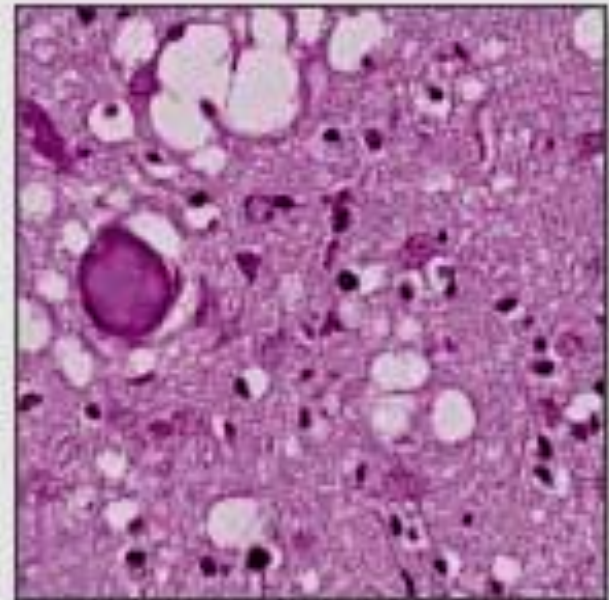
PrPSc

Infectious form(normal form of protein folded incorrectly)..
Sc= scrapie

PrPC•

The normal form of the protein. •
C= 'cellular' or 'common' •

Brain shrinkage and deterioration occurs rapidly



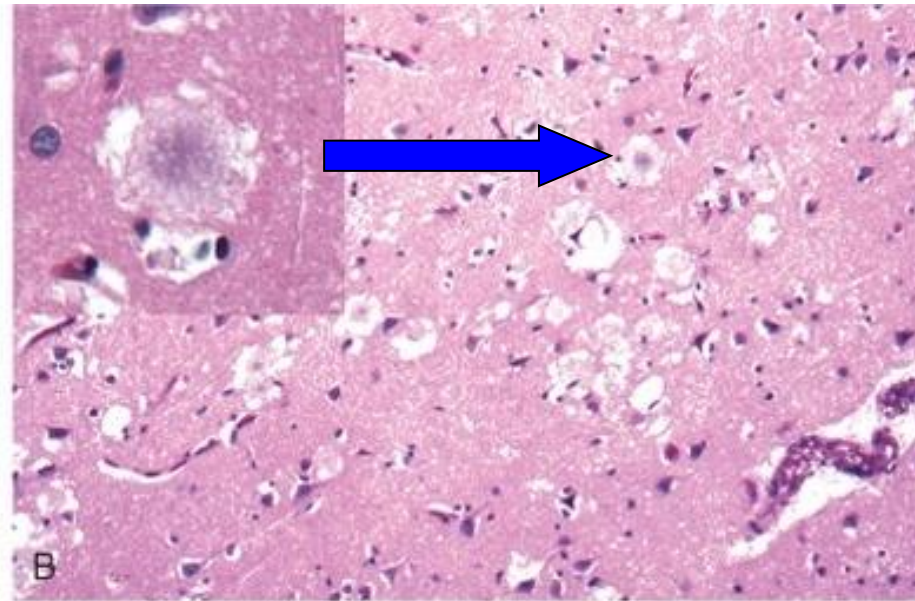
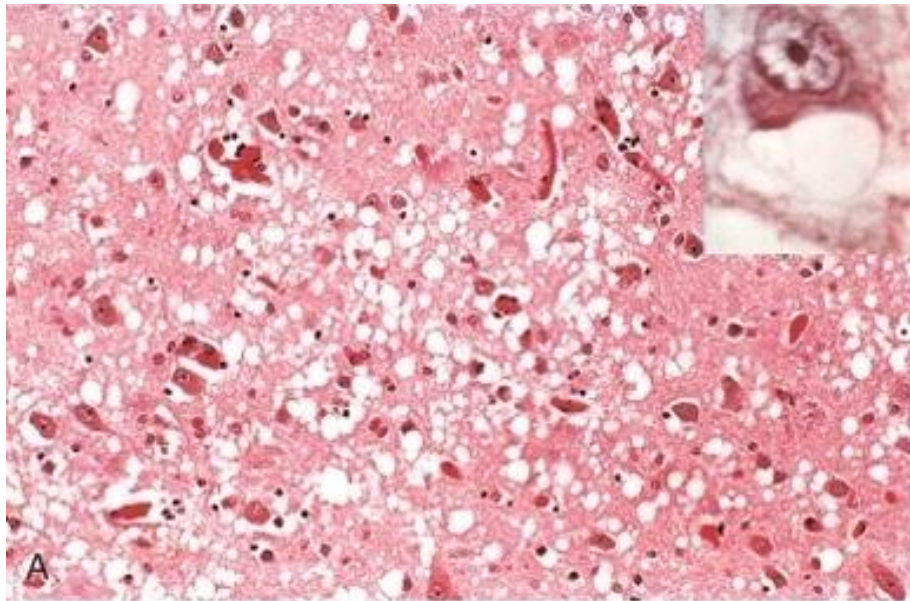
Brain section showing spongiform pathology characteristic of Creutzfeldt-Jakob

F 23-21: Prion disease.

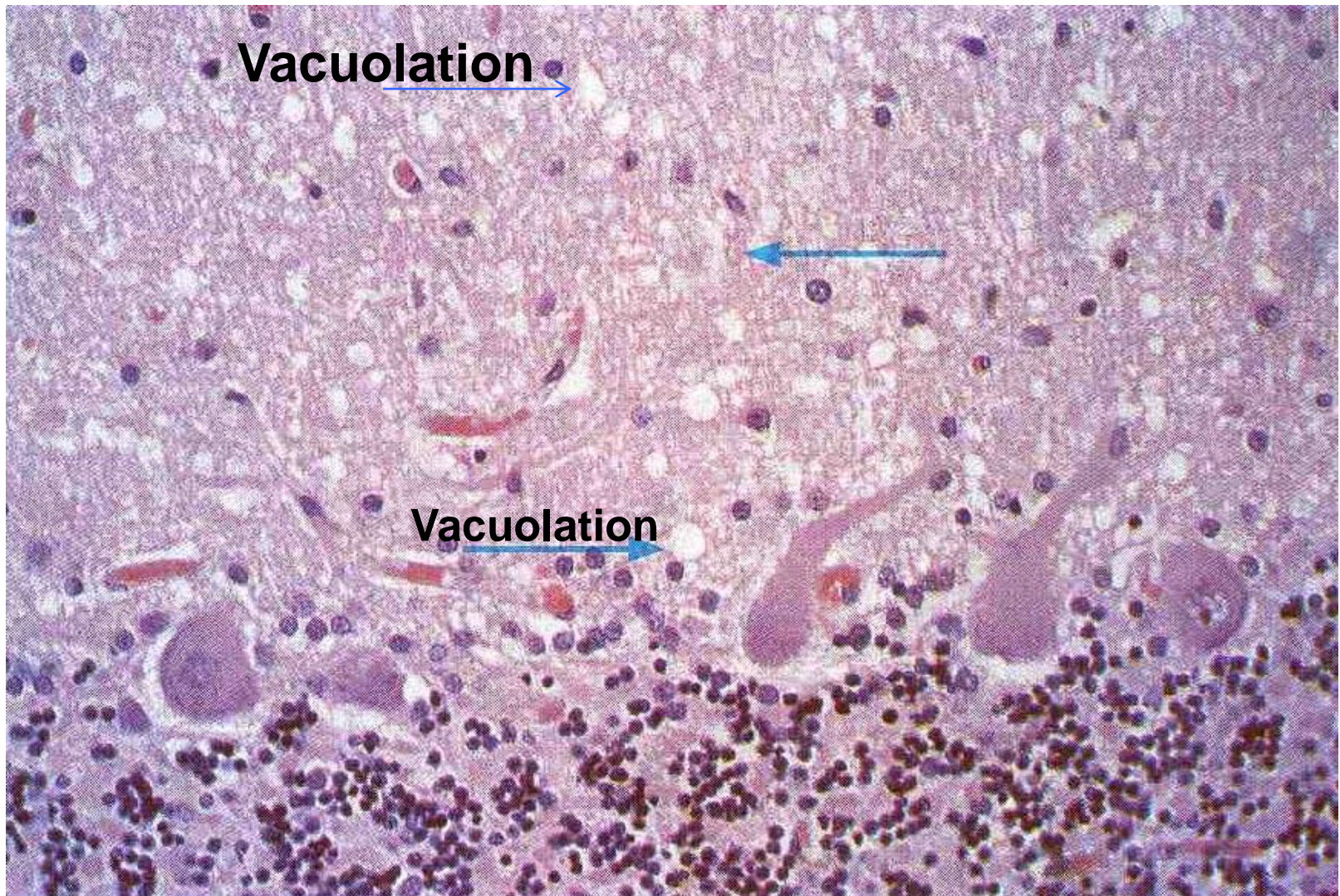
A, Histology of CJD showing spongiform change in the cerebral cortex.

Inset, High magnification of neuron with vacuoles.

B, Variant CJD (vCJD) is characterized by abundant cortical amyloid plaques (see inset), surrounded by spongiform change.



■ 4.17: **Creutzfeldt-Jakob disease: Brain.** The main features are **loss of neurons, demyelination** & spongiform change (confluent **vacuolation** {thin arrow} of the cerebral white matter “neuropil”). However there is **no inflammatory reaction!**



■ 4.16: Creutzfeldt-Jakob disease: Brain.

Immunohistochemical stain demonstrating the presence of proteinase K-resistant Prion Protein (**PrP^{sc}**) in tissue {arrows}.

