1. Answer: C. Of the cell types listed, in spite of their name, microglia are bone marrow-derived cells, which later migrate into the central nervous system to function as the representatives of the monocyte-macrophage system. Neurons and glial cells (astrocyte, oligodendrocyte and ependymocyte) are derived from neuroectoderm. *(Robbins pp. 1349-1350)*

2. Answer: A. Red neurons or eosinophilic neuronal necrosis (due to the microscopic appearance of the affected neurons), is the earliest light microscopic sign of acute neuronal injury. It can be identified in H&E-stained paraffin sections as early as 12-24 hours and indicate irreversible hypoxic-ischemic insult. *(Robbins p. 1350)*

3. Answer: C. This picture shows the typical facial features of anencephaly. It is a malformation of the anterior end of the neural tube and is thought to develop at about 28 days of gestation. Due to skull deficits, the brain cannot develop and remains as a disorganized remnants of component tissues, known as area cerebrovasculosa. Depending on the extent of the skull deficits, cerebellum, brain stem and pituitary gland may be unaffected. Due to the absence of descending tracts, spinal cord is abnormal. *(Robbins pp. 1353-1354)*

4. Answer: A. This picture shows a roughly triangular, cystic, remote infarct. It is cystic; therefore it is a remote process, at least a few months old, which means that it has not been caused by the recent trauma. It most likely is not a result of an old traumatic even, either, because there is a thin rim of intact pia-glial tissue overlying the lesion. In lesions secondary to external trauma, that rim of tissue also affected, whereas in infarcts, this membranous superficial pia-glial tissue survives through nutrition from the arachnoid space. At this stage, it is difficult to tell whether it actually is a resorbed hematoma or an infarct with secondary hemorrhage due to involvement of vessels by infarct; however, peripheral rusty areas most likely indicate hemosiderin pigment, indicating a hemorrhagic component. *(Robbins pp1357-1358, 1363-1365)*

5. Answer: A. This is Herpes virus encephalitis, which typically involves the inferior and medial aspects of the temporal lobes. Typical intranuclear inclusion bodies diagnostic of Herpes virus can be identified in a necroinflammatory background. Immunohistochemistry and PCR are also useful, but electron microscopy is rarely, if ever, needed for diagnosis. It is an acute to subacute process that leads to death or may have a more protracted course of 4-6 weeks. *(Robbins pp. 1373-1374)*

6. Answer: C. Three main differential diagnostic possibilities for multiple periventricular white matter lesions in the setting of immunosupression are malignant lymphoma, large B-cell type (as are most primary central nervous system lymphomas), toxoplasmosis and progressive multifocal leukoencephalopathy (PML). Excluding the typical radiological features for the sake of this theoretical discussion, primary brain tumors, including glioblastomas, can be multiple, but that is a rare occurrence and not typical for this setting. Multiple sclerosis also involves periventricular white matter , but is not specifically seen in this setting. Cryptococcosis, the most common fungal infection of the central nervous system, mainly involves meninges and Virchow-Robin spaces and rarely forms deep seated mass lesions. Chronic lymphocytic leukemia usually forms meningeal involvement. *(Robbins pp1378-1379)*

7. Answer: B. This picture shows spongiform encephalopathy, characterized by the microvacuolar ("spongiform") change in the neuropil. These vacuoles are actually intracytoplasmic neuronal vacuoles with membranous septa. The prototype disease, Creutzfeldt-Jacob Disease (CJD) presents with a typical, rapidly progressive dementia with average survival of 7 months. The "transmissible" agent is prion protein, not a virus. The transmission is very rare among medical personnel and iatrogenic transmission has been linked to corneal transplants, deep implanted electrodes and contaminated human growth hormone preparations. *(Robbins p. 1382)*

8. Answer: D. This periaqueductal midbrain lesion represents an acute multiple sclerosis plaque with its edematous, soft, tan and bright appearance. Therefore, is a demyelinating process, where myelin has formed and later damaged, as opposed to dysmyelination, where there is a problem with the initial formation of myelin. Its onset is rare in childhood and after the age of 50. Clinical signs and symptoms cannot be attributed to certain anatomical structures and are random and variable, not typical, with different lesions arising at different times in different areas. Gray matter involvement is possible, but white matter is typically involved. *(Robbins pp. 1382-1384)*

9. Answer: B. A neurofibrillary tangle is shown in this picture. Although neurofibrillary tangles can be seen in various degenerative conditions in various parts of the brain, they are commonly present in the entorhinal cortex in Alzheimer's disease, a slowly progressive dementing disorder, the definitive diagnosis of which is by autopsy. Grossly, the brain shows extensive atrophy with widening of the sulci and knive-edge atrophy of the gyri. *(Robbins pp. 1386-1389)*

10. Answer: B. Cerebellar vermal atrophy is typically associated with chronic alcoholism. It is due to an irreversible loss of internal granule cells due to toxic effect of ethanol and secondary nutritional deficits, leading to cerebellar dysfunction in about 1% of chronic alcoholics. *(Robbins p. 1400)*

11. Answer: B. Infratentorial tumors are common in children, while supratentorial tumors are common in adults. Biologic behavior of central nervous system tumors does not necessarily correlate with histologic appearance. Biologic behavior may be malignant in spite of benign histology due to highly infiltrative nature of glial tumors, or location in a critical area, precluding surgical resection. They tend to spread through direct invasion of the surrounding tissues and leptomeningeal spread and drop metastases. Incidence of intracranial tumors range from 10 to 17 per 100,000 persons, with glioma being the most common tumor. *(Robbins p. 1401)*

12. Answer: B. This is a pilocytic astrocytoma, which typically is a cystic, well-circumscribedd tumor, commonly located in the cerebellum in children. It is considered WHO Grade I and is amenable to gross total resection with good prognosis. *(Robbins p. 1403)*

13. Answer: E. This is an oligodendroglioma, WHO Grade II, also referred to as "low grade oligodendroglioma". Anaplastic oligodendrogliomas are WHO Grade III and according to WHO classification, no Grade IV oligodendrogliomas are recognized. It is common in the white matter of cerebral hemispheres, where oligodendroglial cells are most frequent, not in the cortex; however, it has a propensity to infiltrate the leptomeninges. Present in almost 90% of these tumors, microcalcifications are not pathognomonic, but are helpful to the diagnosis. The clear cytoplasm creating the "fried egg" appearance is due to hydropic degeneration secondary to delayed fixation, and is not seen in frozen sections or in rapidly fixed tumors. Loss of heterozygosity in 1p and 19q is a standard test as it indicates a better response to treatment, and hence, better prognosis. *(Robbins p. 1404)*

14. Answer: A. This is a medulloblastoma composed of undifferentiated cells, which may show neuronal and glial differentiation in parts of the tumor and may express their respective markers. It most commonly arises in the cerebellar vermis in children. The most common genetic alteration is the losses of 17q. Even though this is a highly malignant tumor, with total resection and radiation, 5-year survival rate approaches 75%. It is relatively well-circumscribed, but results in drop metastases through 4th. ventricle and leptomeningeal infiltration. *(Robbins pp. 1407-1408)*

15. Answer: D. Among many histologic types of meningiomas, chrodoid and clear cell types are considered WHO Grade II (atypical meningioma), while rhabdoid and papillary are WHO Grade III (malignant or anaplastic), regardless of any other features. Aside from these, for a diagnosis of atypical meningioma, four or more mitotic figures in 10 high power fileds OR three or more of necrosis, small cells with high nucleus to cytoplasm ratios, sheeting, cytologic atypia are required. For a diagnosis of malignant meningioma, a mitotic rate of 20 or more per 10 high power fields OR a tumor that looks like a carcinoma or sarcoma, i.e., an obviously malignant appearance, is required. *(WHO p. 176)*

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