Interrogating the Brain

1. **DESCRIPTION:** Students will be tested on the physical and functional aspects of the human brain, as well as methods for investigating it, specifically **magnetic resonance imaging (MRI)** and **electroencephalography (EEG).**

   **A TEAM OF UP TO:** 2  
   **APPROXIMATE TIME:** 50 minutes

2. **EVENT PARAMETERS:** Each team may bring one 8.5”x11” sheet of paper that may contain information on both sides in any form from any source and up to two non-programmable, non-graphing calculators.

3. **THE COMPETITION:**
   (a) This event will include questions from the following three sections. Each section must comprise no less than 25% of the total points on the test.
   (b) Each question will be identified with a topic.
   (c) **Neuroanatomy**
      i. Surface anatomy: identify major gyri, sulci, and fissures.
      ii. Structure and function of cerebral arteries and veins; the blood-brain barrier.
      iii. Structure and function of the cortex, including cortical areas (e.g. precuneus, frontal pole), cerebellum, and brainstem.
      iv. Disorders and injuries of the brain (limited to: intracranial hemorrhage, stroke, hydrocephalus, aneurysm, multiple sclerosis) [Still under review.]
   (d) **Magnetic Resonance Imaging (MRI)**
      i. Basic physical principles of magnetism and nuclear magnetism.
      ii. Basic knowledge of use on person (e.g. patient comfort, contraindications).
      iii. Pulse sequences and imaging parameters.
      iv. Use of contrast agents.
      v. **Functional MRI:** fMRI vs. MRI; blood-oxygen-level dependent (BOLD) contrasts; study design; principles of interpretation.
   (e) **Electroencephalography (EEG)**
      i. Basic principles of operation: electrical function of neurons, generation of dipoles, surface distribution, the International 10-20 system.
      ii. EEG bands (delta, theta, alpha, beta, gamma, mu).
      iv. Limits of use: spatial resolution, artifacts, etc.
      v. The application of EEG to the study of sleep.
      vi. Questions will be limited to scalp-recorded EEG.

4. **SCORING:**
   (a) Each question will be assigned a number of points. Partial credit may be awarded.
   (b) Both the nature of the questions and scoring rubric should emphasize an understanding that is broad and basic rather than detailed and advanced.
   (c) Highest number of points will determine the winner.
   (d) **Tiebreakers:** Each category will have at least one question marked as a tiebreaker. These questions are scored normally and included in the overall score. The sum of points across all tiebreaker questions will be used to break ties. Secondary tie-breakers (in order): score on Neuroanatomy section, score on MRI section, score on EEG section.

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