

## 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).
    - iii. Basics of evoked and event-related potentials (EP, ERP).
    - 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.