

# Neuroimaging of sleep deprivation effects on brain

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A decorative graphic consisting of several horizontal lines of varying lengths and colors (teal, white, and light blue) extending from the right side of the slide.

# Sleep

- Certain stages of sleep are needed for the regeneration of neurons within the cerebral cortex
- Other stages seem to be related to forming new memories and generating new synaptic connections





# Sleep deprivation

- Extended periods of wakefulness or a decrease of sleep over an extended period of time
- Common among students
- People believe they can train their bodies to require less sleep → **FALSE**

# Objectives

- To study the effects of sleep deprivation on healthy brain in terms of reaction time, decision making, short and long-term memory, mental arithmetic and emotional response
- To identify areas of brain most affected by sleep deprivation
- To focus study on students as a risk group

# Hypothesis

Sleep deprivation has significant consequences on brain, reducing the speed as well as the efficiency of one's actions

# Materials and Methods

- Subjects: 2 different groups
  - Control group:
    - 25 healthy students (no sleep disorders)
    - Age: between 18 and 30
    - 8h/night of continuous sleep
  - Sleep-deprived group:
    - 25 healthy students (no sleep disorders)
    - Age: between 18 and 30
    - Less than 5h/night of sleep during long period of time (more than a month)

# Materials and Methods

- Subjects of both groups are asked to do the next tasks:
  - **Reaction time:** Press a button when light appears
  - **Decision making:** Play game that requires quick but logical decisions
  - **Memory:** Remember difference words with no semantic or syntactic relation
  - **Mental arithmetic:** Solve easy math operations
  - **Emotional response:** Look at aversive images

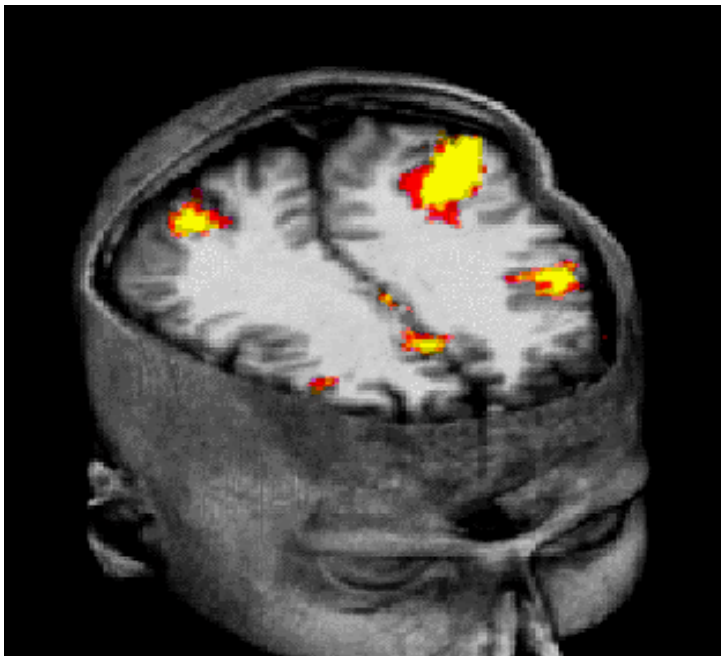
# Materials and Methods

- Neuroimaging technique used: fMRI
  - Contrast injected to subjects: BOLD
  - Frequency of images taking: 1-4 seconds
  - Size of voxels: 2-4 millimeters each side

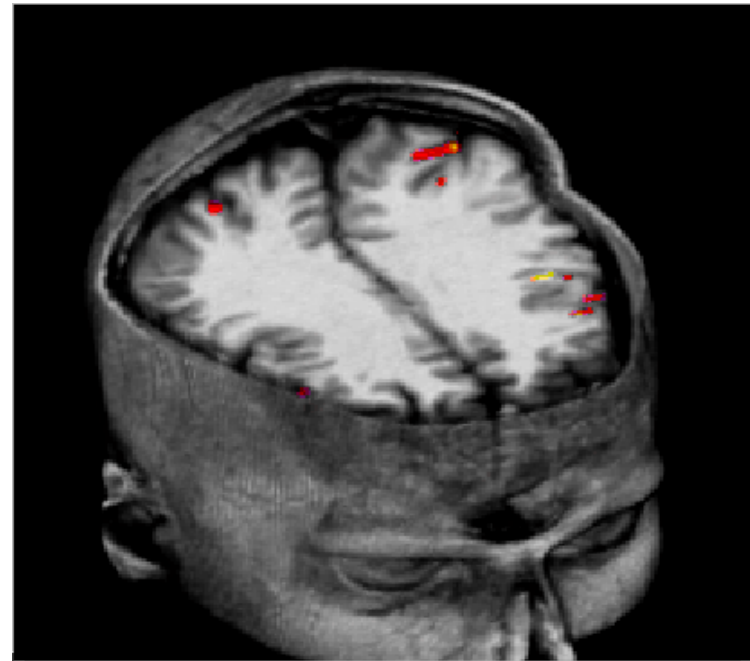
# Materials and Methods

- Example of fMRI results: *mental arithmetic*

Rested subject



Sleep-deprived subject



# Problems

- BOLD signal is an indirect measure of brain activity: it could be influenced by non-neural changes in the body
- Neuroimaging technique fMRI is very expensive
- Subjects must remain completely motionless
- Subjects with any ferromagnetic objects are not suitable for the study
- Reliability of subjects about their sleep habits