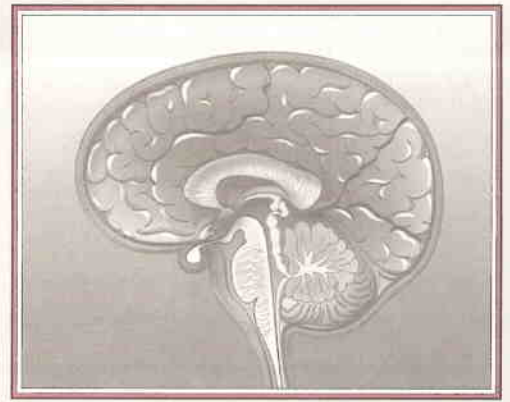


# *Brain Imaging: Understanding the Basics Frequently Asked Questions*



---

Written by:

Dr. Judy Illes and Patricia Lau, The University of British Columbia, Vancouver, British Columbia

Dr. Joseph T. Giacino, JFK Johnson Rehabilitation Institute, New Jersey

Acknowledgements:

The Greenwall Foundation, Dr. Joseph J. Fins (Weill Cornell Medical College), Dr. Emily Murphy (Stanford University), and members of the Ethics, Neuroimaging, and Limited States of Consciousness Workshop, Stanford University June 2007.

---

## **1 – What is brain imaging?**

Brain imaging allows scientists and doctors to view and monitor the areas of the brain. Brain images can be produced using structural imaging techniques, commonly MRI (Magnetic Resonance Imaging) and CAT (Computed Axial Tomography), or functional imaging strategies like PET (Positron Emission Tomography) and functional MRI (fMRI). Structural imaging is designed to identify abnormalities such as strokes, bleeding, and tumors, while functional imaging procedures evaluate how the brain is working. Functional imaging techniques can be used to study the brain at rest, or during an activity such as when a person is hearing, seeing, feeling, moving, talking and thinking. These measurements are based on the flow of blood in the brain, and changing levels of oxygen in specific brain regions depending on that flow.

## **2 – How is brain imaging used for understanding brain injury?**

In addition to studying the anatomy or structure of injury, studies during the past few years have shown that fMRI and PET scans may be able to capture an image of activity in the brain of an injured patient that is not possible to know or see otherwise. This is particularly important as some brain injuries result in loss of speech and movement.

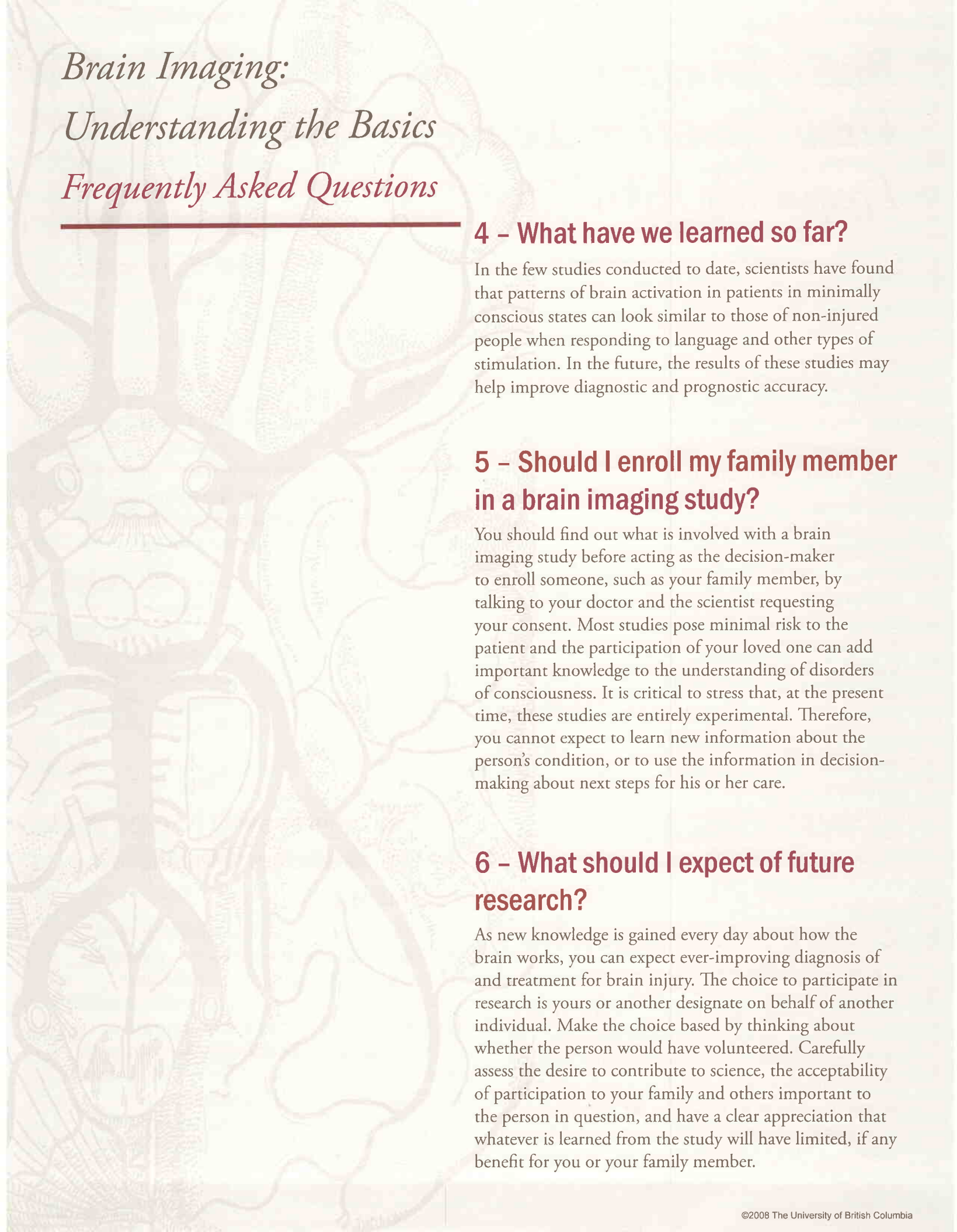
---

**During a scan, the patient may be asked to listen to familiar voices, or to imagine themselves in different scenes like being at home or playing tennis.**

Learning about the parts of the brain that are activated in such cases may help scientists and doctors have a better understanding of disorders of consciousness that can occur after brain injury, such as the vegetative and minimally conscious states. Repeated brain scans over time may help scientists and doctors better understand the process of recovery and the effectiveness of different rehabilitation techniques.

## **3 – Can brain imaging be used to determine whether someone is conscious?**

At present, there are no diagnostic tests capable of detecting whether someone is conscious. Conversely, there are no imaging tests that can determine if someone is unconscious. Specialized rating scales and brain imaging techniques have been developed to investigate the likelihood that someone is consciously processing information, but neither of these approaches provides definitive evidence of consciousness or unconsciousness. Despite their limitations, doctors currently rely on bedside examination findings to diagnose disorders of consciousness.



*Brain Imaging:  
Understanding the Basics  
Frequently Asked Questions*

---

#### **4 – What have we learned so far?**

In the few studies conducted to date, scientists have found that patterns of brain activation in patients in minimally conscious states can look similar to those of non-injured people when responding to language and other types of stimulation. In the future, the results of these studies may help improve diagnostic and prognostic accuracy.

#### **5 – Should I enroll my family member in a brain imaging study?**

You should find out what is involved with a brain imaging study before acting as the decision-maker to enroll someone, such as your family member, by talking to your doctor and the scientist requesting your consent. Most studies pose minimal risk to the patient and the participation of your loved one can add important knowledge to the understanding of disorders of consciousness. It is critical to stress that, at the present time, these studies are entirely experimental. Therefore, you cannot expect to learn new information about the person's condition, or to use the information in decision-making about next steps for his or her care.

#### **6 – What should I expect of future research?**

As new knowledge is gained every day about how the brain works, you can expect ever-improving diagnosis of and treatment for brain injury. The choice to participate in research is yours or another designate on behalf of another individual. Make the choice based by thinking about whether the person would have volunteered. Carefully assess the desire to contribute to science, the acceptability of participation to your family and others important to the person in question, and have a clear appreciation that whatever is learned from the study will have limited, if any benefit for you or your family member.