Chapter highlights: Injury and Illness (Ch 14)

The purpose of “chapter highlights” is to offer a framework in which to think about the specific information discussed in each *Brain Facts* chapter. These highlights draw upon information in the chapter and on the new Brain Facts web site (http://www.brainfacts.org) and occasionally, on our own knowledge of neuroscience that may not be discussed in *Brain Facts*. Questions for Brain Bee will come from *Brain Facts* (new 2012 publication) and entries from the new Brain Facts web site that have “brainfacts.org” in the URL. Some but not all relevant entries are cited below.


There are different ways to classify brain tumors:

- **Malignant vs. benign**
  - Brain tumors that are cancerous are called *malignant*
  - Non-cancerous brain tumors are called *benign*
  - A benign brain tumor can still be dangerous because it can interfere with normal brain activity

- **Primary vs. Metastatic**
  - Brain tumors that arise within the brain are *primary*
  - Brain tumors that spread from other parts of the body are called *metastatic*

**Gliomas** are kind of malignant brain tumors that release the neurotransmitter glutamate. Even though glutamate is the most common neurotransmitter in the central nervous system, gliomas release so much glutamate that it kills off nearby neurons and can cause seizures. For more information on glioma brain tumors, go to: http://www.brainfacts.org/diseases-disorders/cancer/articles/2008/glioma-brain-tumors/.

How are brain tumors diagnosed? What are the treatment options?

- Tumors in the brain are usually diagnosed using MRI and CT scanning
- People with brain tumors will sometimes have seizures, headaches, visual disturbances, and possibly impaired mental functioning
- Surgery is an option, depending on the location of the tumor
- Targeted therapies are the focus of many new therapies to stop brain tumors, and include:
  - Monoclonal antibodies (component of the immune system that recognizes the surface of tumor cells)
  - Anti-angiogenic therapy (deprives the brain tumor of blood)
  - Immunotherapy (uses the body’s own immune system to fight the brain tumor)
Gene therapy (delivers bioengineered genes to kill the tumor)

And many others!

**Chemo brain** is a condition that affects those who have undergone chemotherapy. It refers to the cognitive deficits that occur after chemotherapy, which include: short-term memory loss, difficulty retrieving information, problems switching from one task to another, and problems with attention. For more information on the vulnerable brain cells and understanding the full impact of this condition, go to: [http://www.brainfacts.org/diseases-disorders/cancer/articles/2012/chemo-brain-the-fallout-from-cancer-treatment/](http://www.brainfacts.org/diseases-disorders/cancer/articles/2012/chemo-brain-the-fallout-from-cancer-treatment/).

**Multiple sclerosis (MS)** is an autoimmune disease where the body’s own immune system attacks the myelin sheath covering the axons of the central nervous system. If you think back to how important the myelin sheath is to transmitting electrical impulses down axons, you’ll realize that without the myelin sheath, the transmission of signals between cells of the nervous system can be destroyed. (For information about myelination in the brain, go to: [http://www.brainfacts.org/brain-basics/brain-development/articles/2012/myelination-and-paring-back/](http://www.brainfacts.org/brain-basics/brain-development/articles/2012/myelination-and-paring-back/))

- Symptoms can include: numbness, clumsiness, blurred vision, slurred speech, cognitive problems such as memory loss, depression, fatigue, etc
- There is currently no cure for MS, but for more information about MS and possible new treatments, go to: [http://www.brainfacts.org/Diseases-Disorders/Immune-System-Disorders/Articles/2011/Multiple-Sclerosis-Making-a-Difference-Today](http://www.brainfacts.org/Diseases-Disorders/Immune-System-Disorders/Articles/2011/Multiple-Sclerosis-Making-a-Difference-Today)


- Includes **HIV-associated neurocognitive disorder (HAND)**, which includes mental problems ranging from mild difficulty with concentration, memory, complex decision-making or coordination to progressive, fatal dementia
- **Peripheral neuropathy**, a type of nerve injury in extremities that causes discomfort ranging from tingling and burning to severe pain, also affects individuals with AIDS

**Neurological trauma** includes both **traumatic brain injury** and **spinal cord injury**.

- One of the concerns with traumatic brain injury are increased intracranial pressure caused by **cerebral edema**, which can be treated by removing **cerebral spinal fluid**, moderate hyperventilation, or administration of drugs to reduce cellular metabolism or to remove water from the injured tissue
- While there isn’t a cure for traumatic brain injury, the hormone **progesterone** has recently been shown to reduce the number of deaths from severe closed-head injury by 50%
- **Neurogenesis**, or the addition of new neurons in the brain, occurs even in adulthood (contrary to what you’ve probably been taught!) Studies are underway to help determine how to increase neurogenesis to help the injured brain regenerate.
For breakthroughs regarding spinal cord injury treatments, visit:

**NeuroMyth: Brain damage is always permanent**

**Truth:** In some instances, the brain can repair itself. Whether a person recovers from a brain injury depends on the location and severity of the damage. A concussion, a typically mild and common type of brain injury, usually results in only temporary disruption of brain functions as long as there is adequate recovery time and no repeated injury. Even after more serious brain injury, such as stroke, research indicates that — especially with the help of therapy — the brain may be capable of developing new connections and “reroute” function through healthy areas.

**NeuroMyth: Your brain can’t make new cells**

**Truth:** Your brain constantly generates new cells and remains adaptable — or “plastic” — as you age. Most brain cells, or neurons, are created before you’re born. However, throughout adulthood new neurons are born in a few regions of the brain, including the hippocampus, where new memories are formed, and the olfactory bulb, where smells are processed. After the cells are created they integrate into existing brain regions.

**Stroke** occurs when a blood vessel carrying oxygen and nutrients to the brain bursts or becomes clogged by a blood clot or other particle. This causes the brain to be deprived of blood and oxygen, which can cause neurons to die almost immediately.

- **Tissue plasminogen activator (tPA)** is a clot-dissolving drug used to help people that have experienced a stroke
  - tPA must be given within 3 hours of the stroke
- Following a stroke, the brain is capable of rewiring itself in ways that can help with functional recovery, although much of this is done through physical therapy (see http://www.brainfacts.org/diseases-disorders/injury/articles/2011/stroke-restructuring-the-brain/ for more info)

**Seizures** are episodes of disturbed brain activity that cause changes in attention or behavior, and are associated with epilepsy

- Epilepsy can be **partial** or **generalized**
  - Partial epilepsy is characterized by partial seizures, or when a person remains conscious during the seizure, and are caused by excessive electrical activity in one area of the brain
  - General epilepsy is characterized by general seizures, or when a person loses consciousness during the seizure, and are caused by simultaneous excessive electrical activity over a wide area of the brain
- A new form of epilepsy treatment is **electrical stimulation therapy**, which involves an implanted device that delivers small bursts of electrical activity to the brain, which reduces the frequency

You have already learned a little bit about how pain is transmitted in Chapter 3 of Brain Facts. For a review, see: http://www.brainfacts.org/sensing-thinking-behaving/senses-and-perception/articles/2012/sending-and-receiving-pain-and-messages/

In this chapter, we learn ways of treating pain, and how the body controls pain.

- **Local anesthesia** temporarily interrupts the action of all nerve fibers, including pain-carrying ones, by interfering with actions of sodium channels. If you’ve ever had to have a filling, you’ve probably been given a local anesthetic!

- **Analgesia** refers to the loss of pain sensation. The 4 main types of analgesics (aka painkillers) include:
  - Nonsteroidal anti-inflammatory drugs (NSAIDS), which include ibuprofen and naproxen, and work by inhibiting the cyclo-oxygenase (COX) enzymes that make the inflammatory and pain-producing chemical prostaglandin
  - Opioids, which include morphine and codeine
  - Antiepileptic agents
  - Antidepressants

- **Endorphins** are opioids that naturally occur in the body. If you’ve ever hurt yourself playing a sport, you may have experience an “endorphin rush” that temporarily prevented pain sensation.