Section 4

- the four regions of the cerebral cortex:

1. **frontal lobe.** controls movement of voluntary muscles (ex. walking and speech), association areas are linked to intellectual activities and personality.
2. **temporal lobe.** sensory areas are associated with vision and hearing. association areas are linked to memory and interpretation of sensory information.
3. **parietal lobe.** sensory areas are associated with touch and temperature awareness. association areas have been linked to emotions and interpreting speech.
4. **occipital lobe.** sensory areas are associated with vision. association areas interpret visual information.

- some terms to know and love.

  - **meninges.** protective membranes surrounding the brain and spinal cord.
  - **cerebrospinal fluid.** cushioning fluid circulating between the innermost and middle meanings of the brain.
  - **olfactory lobes.** areas of the brain that process smell information
  - **cerebrum.** largest and most developed portion of the human brain. stores sensory information, initiates voluntary motor activities, etc.
  - **cerebellum.** part of the hindbrain that controls limb movements, balance, etc.
  - **cerebral cortex.** the outermost lining of the cerebrum
  - **corpus callosum.** nerve tract connecting the two cerebral hemispheres
  - **thalamus.** area of brain that coordinates and interprets sensory information and directs it to the cerebrum
  - **pons.** region of the brain that acts as a relay station by sending nerve messages between the cerebellum and the medulla
  - **medulla oblongata.** region of the hindbrain that joins the spinal cord to the cerebellum; one of the most important sites of autonomic nerve control
- brain stuff:

- average mass of an adult human male brain is approximately 1380g. the average mass of an adult human female brain is approximately 1250g

- the human brain grows rapidly up to the fifth year of life, but stops around the 20th year

- during old age, the mass of the brain decreases

- grey matter expands during growth faster than white matter, so the outer layer is folded and rolled upon itself

- the brain consists of two hemispheres, the right and left hemisphere. the left hemisphere controls the right side of the brain and vice versa

- if an area is damaged, the other hemisphere can often develop control over the functions of the damaged area

- synaptic transmission.

- **synapse**. a region between neurons or between neurons and effectors

- **neurotransmitter**. a chemical released from a neuron into a synapse

- when an impulse reaches the end of the presynaptic neuron, neurotransmitters, such as acetylcholine are released from vesicles in the end plates of the presynaptic neuron. the neurotransmitters diffuse across the synaptic cleft, and open the sodium channels in the
post-synaptic neuron, causing depolarization. The enzyme cholinesterase breaks down acetylcholine, allowing the post-synaptic neuron to recover and return to resting potential. In this example, acetylcholine worked as an excitatory neurotransmitter.

Inhibitory neurotransmitters cause the post-synaptic neuron’s membrane to become more permeable to potassium. This makes the post-synaptic neuron ‘hyperpolarized’, because the resting membrane is even more negative. Even more sodium channels have to be opened before depolarization and an action potential can occur.

Inhibitory impulses help to prioritize incoming information

- The autonomic nervous system

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<thead>
<tr>
<th>System</th>
<th>Function</th>
<th>Components</th>
<th>Importance</th>
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<tbody>
<tr>
<td>Sympathetic nervous system</td>
<td>- Prepares body for stress</td>
<td>- Nerves from thoracic nerves and lumbar nerves (see p.436)</td>
<td>- Works together with the endocrine system, adjusting to environment changes</td>
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<td>- Increases heart rate</td>
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<td>- Decreases digestion</td>
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<td>- Increases bld. glucose</td>
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<td>- Increases epinephrine</td>
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<tr>
<td>Parasympathetic nervous system</td>
<td>- Restores normal balance</td>
<td>- Nerves from cervical and caudal areas</td>
<td>- Messages sent to heart, eyes, bladder, skin, etc. restore normal balance</td>
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<tr>
<td></td>
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<td>- Stores glucose</td>
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- The immune system

- The body’s three front lines of defense:

1. The skin, which acts as a physical barrier. The skin also produces acidic (pH 3 to 5) secretions which help to inhibit the growth of microbes

2. The respiratory passage, whose mucus traps microbes and whose cilia move the mucus and trapped microbes toward the entrance where they can be expelled by coughing.

3. The stomach contains corrosive acids and enzymes which will destroy most invading microbes that are ingested.
- **immune system terms to know and love.**

  - **lymphocytes.** specialized white blood cells which produce antibodies.
  
  - **antibodies.** protein molecules that protect the body from invaders by killing antigens.
  
  - **antigens.** chemical markers found on the surface of bacteria and viruses.
  
  - **T-cells.** lymphocytes made in the bone marrow that identify and attack foreign invaders
  
  - **B-cells.** lymphocytes made in bone marrow that produce antibodies

  - **antibodies.**

  - antibodies are specific to the antigens they attach to
  
  - the size of the complex is larger, making phagocytosis easier for lymphocytes
  
  - change in shape of toxins or invader prevents further bonding to receptor sites.
  
  - the four steps the body uses to recognize harmful antigens are:

  1. bacterium enters body
  
  2. macrophage engulfs the bacterium and pushes antigen markers to outer membrane of macrophage
  
  3. helper T-cell identifies the antigen present on the cell membrane of the macrophage
  
  4. the B-cell identifies the ‘blueprint’ of the antigen marker and begins to produce antibodies
- malfunctions of the immune system.

- there are two problems an abnormally functioning immune system can encounter:

1. immune deficiency diseases.

immune deficiency diseases may be caused by a foreign agent, such as the HIV virus, which attacks T cells or a hereditary condition, such as severe combined immunodeficiency (SCID), where a gene mutation causes an inability to produce T or B cells. cancer treatment or prolonged exposure to cortisol can also reduce the effectiveness of the immune system.

2. autoimmune diseases.

it is possible for the immune system to go awry and attack the cells and tissues of its own body. the bad lymphocytes treat the body’s cells as foreign invaders and make antibodies to attach to them.

- ex. multiple sclerosis (MS)

- allergies.

- an allergy occurs when one’s immune system mistakes a harmless cell for a harmful invader. while the harmless foreign particles may not be dangerous, the body’s immune response to the foreign particle may be very severe, even life-threatening.
- *anaphylactic reactions.*

  - anaphylactic reactions are severe food allergies
  - often accompanied by swelling, hives and itching
  - cells that believe they are in danger release bradykinin, which stimulates the release of histamine
  - histamine increases the permeability of the cells of the capillaries, causing it to redden.
  - the movement of proteins out of the capillaries causes less water to be absorbed, and therefore, swelling
  - adrenaline is often administered to treat severe anaphylactic shock because it increases the heart rate, and increases the body’s ability to deal with stress.