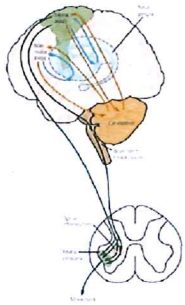
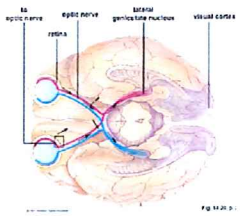
Testing Sensory-Motor Plasticity with Prism Goggles!



Glossary:

Motor System- Parts of the central nervous system involved in movement, including the primary motor cortex, basal ganglia, cerebellum, and spinal cord.



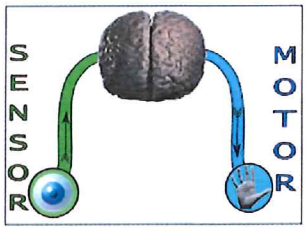
Visual System- The part of the central nervous system which gives organisms the ability to process visual detail. It detects and interprets information from visible light to build a representation of the surrounding environment.

Plasticity- The ability of the neural pathways and synapses in the living brain and nervous system to change in response to experience or injury.

Visuomotor Plasticity- A reversible process where a motor behavior dependent on sight is altered by visual input.

Prism Adaptation- A visuomotor adaptation that occurs after the visual field has been artificially shifted.

Background



- An important feature of the brain is its ability to **adapt** and **change**, depending on the incoming signals it is receiving or previous experience. This is called "plasticity" or "neural plasticity," for the neurons (cells) that make up our brain. This plasticity is particularly obvious when we study sensory and motor (movement) systems.

- For example, we use our sense of vision to guide the movements required to pick up a basketball and shoot it into the net. If you have never done this before, it can be difficult. However, with practice our brain adapts and our chances of getting the ball in the hoop increase. If we practice enough, we can even become excellent basketball players. However, once we master this skill, if we stop practicing we perform the task more poorly. This is called "visuomotor plasticity" and it is reversible, meaning the changes in our brain that occur to learn the task can also be undone.

- Visuomotor plasticity involves specific regions of the brain, such as the **primary visual cortex** and the **cerebellum**.

- Though all of us have experienced "visuo-motor plasticity" throughout are lives, today we will have the opportunity to experience it in few a minutes! We will make some **quantitative observations** as to how quickly our motor movements undergo plasticity in response to changes in our vision.

The Experiment:

Student roles:

1) Student 1 will be the "experimentee" or bean bag thrower.
2) Students 2 and 3 will be the observers and count the number of tosses required to get a bean bag in the bucket and the number of successful tosses out of 10.
3) Student 4 will be the note taker, and write down the values collected by students 2 and 3.
4) Student 5 will be the bean bag retriever.

Phases of the experiment:

Pre-adaptation: Student 1 will attempt to through bean bags into a bucket. She will have 10 throws. Students 2 and 3 will count how many throws it takes to land a bean bag in the bucket and how many successful throws are made. Student 4 will write these values down in the data table handout and make additional observations. Student 5 will retrieve the bean bags from the bucket for Student 1.

Adaptation: Same as Preadaptation, except student 1 will wear prism goggles, which will shift her visual field by approximately 30 degrees. In addition to throw counts, notes will be taken on how the goggles impacted student 1's throwing ability. Students will initially have a difficult time throwing the bean bag in the bucket, but usually improve after 5-7 tosses.

Post-adaptation: Same as adaptation, except student 1 will remove prism goggles. In addition to throw counts, notes will be taken on how removing the goggles impacted student 1's throwing ability. Due to adaptation and consequent overcompensation for their altered visual field, students usually overthrow in the wrong direction. Again, this usually takes 5-7 tosses to correct.