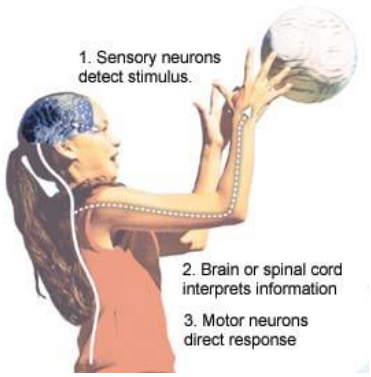
BIOL 1400/02 lab investigation
Designing a study of reaction time

Reaction time is in the spotlight during the 2018 Winter Olympics: picture a hockey goalie stopping a puck coming toward her faster than 100 miles an hour, or the fast start needed for a speed skater to excel. Winning a medal (or not) can hinge on athletes' reaction times.

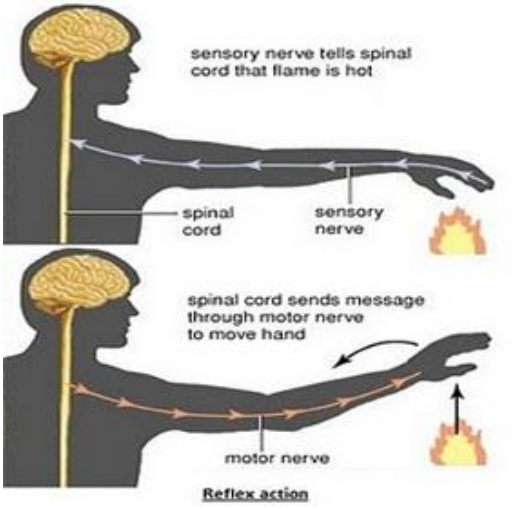
Although your reaction time may never have been the subject of so much attention, it does matter on a daily basis as you navigate through the world. For those of us who aren't Olympic athletes, driving is the one activity that places the greatest emphasis on our reaction times. Drivers must 1) perceive that a situation requires immediate action, 2) determine the appropriate action to take, and 3) act without delay. Every driver eventually needs to brake quickly or swerve to avoid an accident.

Whether the reaction is stopping a speeding puck or slamming on the brakes of a speeding car, **reactions** require the brain to receive information collected by the senses (and transmitted along sensory neurons), process that information, and send signals along nerves (via motor neurons) to produce a response by muscles.



Although this chain of events is complicated, the whole process (from detection to action) can be very fast, and that speed is measured as the reaction time. Reaction time is influenced by many factors, and one of those factors is age: in 2014, researchers tested the reaction times of more than 3,000 volunteers from ages 16 to 44 and found that, on average, reaction time peaks at age 24.

Reactions are complicated and voluntary, and those two features distinguish them from **reflexes**, which are involuntary and usually simple (and much faster than reactions). Consider the following diagram of someone who quickly withdraws a hand from above a flame. Pain receptors in the skin send a message to the spinal cord, and without any processing by the brain, a signal is sent to muscles that cause the hand to move away.



Other reflexes include pupil dilation and constriction, sneezing, the "startle" reflex exhibited by babies, and the patellar reflex (elicited by striking below the knee with a rubber hammer).

Reflexes do not vary much among healthy people. In fact, faulty reflexes usually indicate a medical problem, and that's why a doctor may check a patient's patellar reflex or shine a light in someone's eye to check for pupil constriction. **Reaction times**, on the other hand, vary widely among people, depend heavily on circumstances—such as distractions—and *can improve with practice*. And unlike the patellar reflex, which requires training to test correctly, reaction times can be tested quickly and easily without any training. This makes reaction time an interesting topic for a scientific investigation. In this lab, you'll participate in designing a study of human reaction time.

We'll begin by evaluating several different reaction timers to determine which one is the simplest to use and the most relevant for real-life reactions. Your instructor will explain how to access and use several online reaction timers. A low-tech, hands-on reaction timer will be also be available in lab.

After selecting a reaction timer from the ones we try out, we'll agree on an **independent variable** to study—something that may affect reaction time—and develop a testable **hypothesis**. Before lab, you should give some thought to factors that might affect reaction time and that we could investigate in the lab.

Then we'll conduct our study and analyze the results before making a conclusion about our hypothesis. Data sheets to turn in for a grade will be available next week in lab.

Reaction Time Investigation /Pre-lab Assignment

Name:_____ Lab day/time_____

Read the background information provided on pages 1-2, and complete the following questions BEFORE coming to lab. Pre-lab assignments will be due at the start of lab (as usual).

1. Suggest **two factors** (other than age, which was discussed in the introduction) that might cause two people to have different reaction times, or that might cause one person's reaction time to vary, depending on when the test is conducted. Explain why you think those factors might affect reaction time.

2. How do reflexes differ from reactions?

3. Describe a real-life situation, other than driving, in which your reaction time matters.

4. When researchers wanted to determine the peak age for reaction time, they tested more than 3,000 volunteers. Their results would not have been as convincing if they had tested only 30 volunteers. Why?