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| **iLearn BI 101**  **Procedures** | **Scientific Inquiry Assessment:**  **Sex and the Single Guppy** |

Now is your opportunity to demonstrate what you have learned about the process of scientific inquiry. After completing this activity and question set you will be submitting this document for grading through the course website. Upon completion of this assignment with the minimum required score, you will have completed the Scientific Inquiry module. The details on the grading and submission process can be found on the course website. You will need one additional document, which can be found in the course module:

* **Scientific Inquiry Report**: Record your answers to the questions below in this document. This report is to be submitted through the submission page on the course’s website.

**Introduction:**

Guppies are a popular freshwater aquarium fish*.* They are native to Caribbean islands and Venezuela.Female guppies measure 4–6 cm (1.6–2.4 in) long, males 2.5–3.5 cm (1.0–1.4 in) long. Their scientific name is *Poecilia reticulata*: the genus name *Poecilia* is derived from the Greek“poikilo ” meaning variable or variegated ; the species name *reticulata* is Latin for “netted” or “marked with a network”. The common name “Guppy” derives from the surname of the British scientist who first classified them.

Female guppies, which are dull colored, prefer colorful males for mating. This biological phenomenon is called ***sexual selection****.* Guppy predators also prefer colorful males, since they are easier to locate. Spots are varied in color –– black, red, blue, yellow, green, and iridescent –– and vary in size, shape, hue, and combinations. Each guppy has a unique array of spots.

Aside from attracting females, spots on male guppy also serve as ***camouflage*** against the background of the colored sands and pebbles lining the streambeds in the mountain streams they inhabit. Guppies make use of the camouflage by staying close to the streambed for protection during daylight hours. Their fish predators hunt them from dawn to dusk.

Male and female guppies

courtesy of“Marrabbio2”

Wikimedia Commons

Biologist John Engler was intrigued by the variability in coloration among the make guppies in the freshwater streams of Trinidad. Because the fish that prey on guppies are visual predators, he expected that most guppies would be drab and camouflaged. Females are in fact drab, but the males were often brightly colored. Engler noted that obstacles like waterfalls often created isolated pools within a stream and that each pool could have a unique combination of colors.

Waterfalls along some of the mountain streams form barriers to upstream movement. In these streams, different guppy populations are confined to different stream sections. However, during flood season, guppies can move upstream to invade pools above the waterfalls. They can do this when water levels rise high enough for them to jump a much reduced barrier waterfall. The farther upstream guppies reach, the farther away they are from the larger predator fish that cannot jump the waterfalls. Thus, the farther downstream a guppy population is located, the greater the number of predators.

Three fish species prey on guppies in Trinidad, each exhibiting a different degree of predatory aggressiveness.

1. **Rivulus (*Rivulus hartii*) –** Not aggressive, rarely preys on guppies.
2. **Blue Acara (*Aequidens pulcher*) –** Medium sized, with a **s**omewhat aggressive strategy.
3. **Pike Cichlid (*Crenicichla alta*) –** Large, highly aggressive predator.

**Procedures:**

Your task is to recreate Engler’s journey of discovery by designing and running a simulated experiment to discover the cause of such vast variety in guppy colors. Go to the following website:

<http://www.pbs.org/wgbh/evolution/sex/guppy/>

Familiarize yourself with the interactive activity by clicking on the “I’m ready to find out” link. Read through the introductory information and click on each of the pools to learn about the different populations that live in the virtual stream. You may also learn about the different types of guppies by clicking on the link to the Guppy Gallery at the lower left corner of the simulator. As you explore each pool on the website and examine the species in the guppy gallery, observe the color trends in the guppies and the presence and relative number of guppy predators among pools in the same stream.

1. Write down any and all **observations** you feel might be important in your report.

Once you have finished exploring the pools, click on the link at the bottom of the screen “What causes guppy coloration?” Read over the possible hypotheses, and then click on the link below the text to set up your simulation pool. Click on each of the pull down menus to familiarize yourself with the options you have to set up your experiment. Compare the options given to the hypotheses presented in the previous screen. You should notice that most of the hypotheses presented are not testable within the constraints of this simulation (I.e there is no way to investigate mating habits and female behavior). The **question** you are now tasked with answering is this:

**What causes such dramatic variation in guppy coloration within the same stream?**

1. Develop a **hypothesis**. Based on the observations you made, develop an appropriate hypothesis that you would like to test. Be sure it answers the question stated above, is testable within the constraints of the simulation, and is properly phrased based on what you learned in lecture.
2. Next, formulate your properly phrased **prediction statement**. As with your hypothesis, be sure that it is properly phrased.

Design your Experiment. Determine the test groups that you want to include in your experiment, including a control group and as many experimental groups you feel appropriate to address your hypothesis. In your lab report, record the following aspects of your experiments:

1. Based on your prediction statement, identify your **dependent variable.**
2. Based on your prediction statement, identify your **independent variable**
3. Based on your question, hypothesis, and prediction statement Identify the settings that are needed for your **control group**. (Remember, this is what would be considered “normal conditions” without any manipulation to the environment.)Report the settings you chose in your report and explain why these settings represent your control group.
4. Now determine the most appropriate settings for your **experimental group**(s). Based on the independent variable you identified above, identify how many variations are needed to test your hypothesis and record the settings for each group in the **Experimental Data Tables** found in your report. Follow the directions in the report to record each group properly in the data tables. Be sure these settings will give you data that reflects your hypothesis.

**Perform** your experiment. Run the simulation at least one time for every group you created below. As soon as you start each simulation, be sure to record the starting population sizes. Each simulation should run for ~6 minutes, or approximately 12 generations. Don’t worry if you run over 12 generations, just don’t let it run too long. Once all of your data tables are completed analyze your **results.** Answer questions 8 – 12 found in the report. Once all questions have been answered, submit your report through the course website.