



Animal behavior: An Independent Research Project

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Animal Behavior: An Independent Research Project

This project is modeled after the way animal research is done by research scientists, in an attempt to make the investigation more authentic. A typical research scientist is employed by a university or a teaching hospital, which is usually affiliated with a medical school. The employer pays the scientist for any clinical or teaching duties, but not for research itself. All research money, including supplies and salaries, is provided by grants. Therefore, research scientists must continually apply for grants to ensure continued funding of their work. A typical grant might take months to write, and has only about a 30% chance of being funded, so perseverance is a must!

Meanwhile, if the research involves the use of animals, the study must be approved by the research institution's Animal Care Committee (ACC). The researcher must prove to the ACC that their protocol requires the use of live animals, complies with animal welfare laws, involves minimal distress to the animals, and is not unnecessarily duplicative.

Once a study has ACC approval and a funding source, the researcher begins his/her investigation. At the completion of the investigation, the researcher writes a paper reporting his/her findings. Scientific posters are often presented at conferences.

The researcher may also submit his/her report to an appropriate journal for publication. Publication standards are rigorous, and few papers get published. Yet this is an important part of research. It is a way of sharing your research information with your peers, and the more a researcher publishes, the more likely s/he is able to acquire funding for future research.

Purpose:

This is an independent research project intended for second semester high school biology students. It could easily be modified for any age life science students.

The purpose of the project is to allow students to conduct their own animal behavior research investigation, from beginning to end. The process models the way animal research is conducted by research scientists.

The project will take 10-12 weeks. Though most of the work will be done by the students at home, some class time will be needed to explain the different tasks, and monitor progress.

Objectives:

Students will be able to:

- identify a testable question about animal behavior, and make a hypothesis about its answer.

- design and carry out an experiment to test their hypothesis.
- collect and organize their data.
- draw valid conclusions.
- present their study at a scientific poster session.
- model the process of animal research, as conducted by research scientists.
- learn the significance of grants and publishing in the scientific community.

Materials:

Students will work individually, or in pairs. Students must supply their own materials. Equipment will vary depending on the design of each experiment. You may wish to make the following equipment available:

- thermometers
- stopwatches
- aquaria
- rulers
- animal identification guides
- science project books for ideas

Safety:

Make sure that students' experimental designs include proper safety precautions. Do not allow students to conduct unsafe or unapproved experiments. Make sure students take proper precautions when working with live animals, to avoid animal bites or scratches. Students should not be in contact with animals that might carry infectious diseases. Do not allow students to use flammable, corrosive, explosive or highly poisonous substances.

Preparation and Procedure:

Photocopy the handouts found at the links below. Use a different color for each handout. You will need one copy of each of the following per student, except where noted.

1. Animal Behavior: An Independent Research Project (Student instructions)
2. Animal Info Sheet
3. Animal Care Committee Project Application
4. Animal Care Committee Project Review (1 per research team)
5. National Institutes of Health (NIH) Grant Proposal
6. NIH Grant Proposal Review (one per research team)
7. Scientific Poster Guidelines
8. Animal Behavior Study Poster Grading Sheet (one per student + optional laminated class set)

This project is broken down into a series of tasks, in an attempt to make it more manageable for both students and teacher. Begin by giving students an overall picture of the project, but do not go into detail about each task until the previous task has been completed.

Task 1: (Class time needed: 15 minutes to introduce project; Recommended due date: one day)

Students are given a choice of working independently or with a partner. Encourage partnerships, as little scientific research is done alone. Also, there will be fewer projects to grade! A maximum of two students per research team is recommended to facilitate equal workloads, and fewer scheduling conflicts. Working independently is permissible, as some students prefer this, and have limited time to meet with a partner.

Task 2: (ten minutes to introduce task. Homework: 30 minutes to complete book research, 30+ minutes to complete observational research. Recommended due date: three days)

Animals easily found around students' homes include earthworms, pill bugs, bees, fish, ducks, birds, spiders, squirrels, cats, dogs, crickets, or even humans. If available, zoo animals are also appropriate. However, this will limit the experiment to an observational study, as the student will be unable to manipulate the animals' environment.

You may wish to use class time to complete the book research on the "Animal Info Sheet," but students will need to complete the observational research for homework.

Evaluate each research team's "Animal Info Sheet" to make sure the animal is available and appropriate for study, and that the researchers have an adequate understanding of how to care for the animal.

Task 3: (ten minutes to introduce task + homework. 60 minutes for guest speaker. Recommended due date: two days)

Local universities, medical schools and/or hospitals are good places to look for speakers. Many states have biomedical research associations, with free speakers bureaus. Contact the Foundation for Biomedical Research to locate associations in your area. (See References and Resources section.)

Contact the speaker several weeks in advance of the date you wish him/her to come. Explain the project, and ask him/her to prepare information about animal research policies and practices. Encourage him/her to bring an animal, and give a sample animal handling training session. Collect copies of the students' questions, and send selected questions to the speaker so he/she can adequately prepare, particularly if students have ethical questions.

Task 4: (ten minutes to introduce task + homework. Recommended due date: two days)

The intent of this task is to encourage students to brainstorm many possibilities before they choose a final question for their study. Evaluate their final questions, making sure they are specific, and testable with available time and equipment.

Task 5: (30 minutes to introduce task + homework. 60 minutes for Animal Care Committee review activity. Recommended due date for Project Review Application: one week)

Review the elements of a well-written procedure. Choose selected students' final questions from Task 4, and brainstorm experimental designs. Encourage students to use a word processor or computer from this point on, as they will need to make several revisions.

Students will turn in this first draft of their experiment to an Animal Care Committee (ACC) for approval. To form ACCs, divide students into teams of four (it is not necessary for them to be on the same team as their research partner). Each team will represent an Animal Care Committee. Emphasize that the role of the ACC is to make sure the animals in the study will be treated humanely, and that the study is worthwhile. Since the focus of the study is on animal behavior, the animals are expected to survive the experiment.

Give each ACC one researcher's "Animal Care Committee Project Application" to review. (They should not review the applications of any member of their team.) Team members should discuss the application, and fill out an "Animal Care Committee Project Review" form. They may ask the researcher for more information, if necessary. When finished, they should attach the "ACC Project Application" to the now complete "ACC Project Review," and turn it in to the teacher. They should then pick up another application form for review. Continue until all applications have been reviewed.

If a research team's application is denied, or approved with conditions, the team must revise their procedure and resubmit it until it has ACC approval.

Keep a record of which students have received ACC approval, and which students have not. Consider making a chart showing student names and tasks. Mark off each task as students complete it.

Note: There is no standard rule for the number of animals necessary for a statistically significant experiment. As a general rule, the number of animals can be minimized by using the same animal for the control and the experiment, if possible, and conducting several trials for each animal. Research scientists often consult statisticians to help determine the number of animals necessary for complicated studies. For the purposes of this project, six to ten animals are reasonable.

Task 6: (20 minutes to introduce task + homework. Recommended due date for NIH Grant Proposal: one week)

Review the "NIH Grant Proposal" form with students. Students can modify their "Animal Care Committee Project Review Applications" for many of the sections. Proposals must be approved by the teacher before students can begin their research.

The "Budget" section is an attempt to make the grant more authentic. Since no money will be awarded, the student is, in a sense, contracting for a grade. Make sure the quality of the proposal merits the number of points the student requests. For example, if the

student budgets 200 points, yet has an unsupported hypothesis, or a vague procedure, suggest that this proposal is worth 150 points, but not 200. Give the student an opportunity to revise their proposal to increase the likelihood of earning the grade they desire.

Use the “NIH Grant Proposal Review” to record your evaluation of each proposal. Check the appropriate boxes. Be sure to write comments for any “inadequate” or “satisfactory” marks, so students know how to improve their application, if necessary.

Keep track of which students have received “funding,” and which have not.

Task 7: (Homework. Optional peer review: 30 minutes. Recommended due date to conduct experiment and write conclusion: five weeks).

Once approved, have students carry out their investigations at home. Periodically ask about their progress. Encourage students to begin their experiments as soon as possible. They need to give themselves time to make mistakes and repeat procedures, because something nearly always goes wrong!

Students may find that they need to modify their procedures. Any significant changes must be approved by the teacher.

You may or may not wish to have students hand in their data and conclusions. If you want to give students an opportunity for feedback, you could organize a time for peer review, or collect their work and offer feedback yourself. Have them attach data and conclusions to their NIH Grant Proposal, so you will have access to their purpose, hypothesis and procedure.

Task 8: (15 minutes to introduce task; five-seven minutes per student for poster presentations. Recommended due date for making poster: one week)

Students should follow “Scientific Poster Guidelines” as they prepare their posters. If you have done this project before, have sample posters from previous years available. Requiring students to provide physical evidence of project completion discourages students from making up data, or turning in projects from previous years.

It is recommended that you spread the poster presentations out over several class periods. Five to ten presentations per day is reasonable. Establish a sign-up sheet to record which students will present each day.

Review the “Animal Behavior Study Poster Session Grading Sheet” with students, as they will be grading their classmates’ work. Make sure the grading criteria are clear.

Arrange for several bulletin boards to be set up around your classroom, library, gymnasium, or other suitable location. Have students attach their poster to a bulletin board, and stand next to their poster.

The remaining students (and yourself) will serve as evaluators. Consider asking parents, administrators or older students, as well. Have the evaluators spread out among the presenters, in small groups. Each small group should spend five to seven minutes with each presenter, reading their poster, listening to their presentation, and asking appropriate questions. Each evaluator should fill out an “Animal Behavior Study Poster Session Grading Sheet” for each researcher. To minimize paper use, you may wish to laminate a class set of grading sheets, and provide students with transparency pens or grease pencils. Each evaluator could then record the total points on a grading sheet left with each presenter. Or each small group of evaluators could average their final grades for each presenter and record.

The teacher’s evaluation should be permanent, and include comments. Average all evaluators’ grades to calculate each presenter’s final grade. You may wish to give more weight to the teacher’s evaluation.

Task 9: To simulate the “publishing” of research, arrange to display exceptional research in a public place. Consider the hallway, library, administration building, pet store, hospital, etc. Ask the students where they would like their work displayed, and arrange it, if possible.

Where to Go From Here:

Have interested students conduct additional research projects. Bring students to a local research facility to observe animal research. Help students arrange internships with local research scientists. Have students research and report on ethical issues in animal research, or medical advances made possible by animal research.

References and Resources :

1. Cain, Nancy Woodard. (1995). *Animal Behavior Science Projects*. New York: John Wiley & Sons.
2. Farmer, Mike. (1986). *Science Projects - A Modular Approach* (4th ed.). Travelers Rest, SC: Applied Educational Technology.
3. Foundation For Biomedical Research, 818 Connecticut Avenue, NW, Suite 303, Washington, D.C. 20006, (202) 457-0654 FAX (202) 457-0659, <http://www.fbresearch.org/>.
4. Kneidel, Sally Stenhouse. (1993). *Creepy Crawlies and the Scientific Method*. Golden, CO: Fulcrum Publishing.
5. Smith, Stan C. (1997). *Classroom Animals: Beyond Observation*. Warrensburg, MO: Stan C. Smith, E-mail: ssmith@idir.net.
6. Washington Association for Biomedical Research, 200 Broadway, Seattle, WA 98122-5323, (206) 621-8556, FAX (206) 621-0328, <http://www.son.washington.edu/makcon/index.html>. (To schedule a free speaker, call 1-800-213-WABR).

Suggestions for Assessment:

This activity can be used as a tool for assessing a student's ability to "do" science. It can be used in addition to, or as an alternative to, a semester final. You can give as much or as little feedback during the project as you wish.

Animal Behavior: An Independent Research Project

Student Instructions

Purpose:

You have been learning how to conduct biologically valid experiments, and how to interpret your data into meaningful conclusions. The purpose of this project is to allow you to apply what you've learned in an animal behavior study of your choice. You will model your study after the way animal research is conducted by research scientists.

Objectives:

Students will be able to:

- identify a testable question about animal behavior, and make a hypothesis about its answer.
- design and carry out an experiment to test the hypothesis.
- collect and organize data.
- draw valid conclusions.
- present your study at a scientific poster session.
- model the process of animal research, as conducted by research scientists.
- understand the significance of grants and publishing in the scientific community.

Your mission, should you choose to accept it:

You are a research scientist in the Comparative Medicine department at the local university. You are paid 10% of your salary by the university for your teaching duties, but all of your money for research (including the other 90% of your salary) comes from grants (money provided by a separate agency for a specific research project). It is time to begin thinking about the next experiment you'd like to do. You will need to write a grant, submit it for approval, carry out your experiment, and report your results to the scientific community.

This project will take 10-12 weeks to complete. To keep it manageable, it has been broken down into a series of tasks.

Task 1: Decide whether you would like to work independently on this project, or with a research partner. Choose your partner carefully, as you will need to work together closely, meeting regularly outside of school hours to conduct your research.

DUE DATE:

Task 2: Choose an animal you are interested in researching. The animal must be easily available, and supplied by you. Research the animal, using the "Animal Info Sheet" to record your findings. Consider possible questions you are interested in answering about its behavior. You will be writing these down later.

DUE DATE: (one per research team)

Task 3: It's been awhile since you've used animals in your research. You need to refresh your memory about how animal research is conducted in the research community. A guest speaker will be teaching you how to comply with the laws protecting research animals, typical animal research practices, etc. Prepare a list of at least ten questions you would like to ask the speaker.

These could be general questions you have about animal research, or specific questions about the experiment you have in mind.

DUE DATE: (one per researcher)

Task 4: Look back at your "Animal Info Sheet." You should now be familiar with the animal, and hopefully curious about some of its behavior. Make a list of at least 20 testable, clearly written questions you have about the animal's behavior. Put a line through any questions that are not testable with the equipment and/or time you have available. Of the remaining questions, circle the one you wish to focus on for your study. Show your question to a classmate (not your research partner), and have them evaluate your question for its clearness and testability. Rewrite (and reword, if necessary) your question on the back of your paper.

DUE DATE: (one per research team)

Task 5: Design a procedure for how you will experimentally find the answer to your question. Make sure your experiment is controlled and thorough. Since you will be using animals in your research, you will need to gain approval from the university's Animal Care Committee (ACC). Complete the "Animal Care Committee Project Application." Be sure to review the criteria by which the Animal Care Committee will review your application listed on the "Animal Care Committee Review Form."

DUE DATE: (one per research team)

Task 6: Now that your study has been approved by the ACC, you have decided to seek funding from the National Institutes of Health (NIH), a federal agency that funds many biomedical research projects. Complete the "NIH Grant Proposal" form. Submit your proposal to the teacher, who will represent NIH. Be sure to review the criteria by which your NIH proposal will be reviewed, listed on the "NIH Grant Proposal Review Form."

DUE DATE: (one per research team)

Task 7: Once your study has been funded, you're set to go! Carry out your experiment over the next five weeks. Record your data carefully. Write a conclusion/discussion explaining your results.

DUE DATE: (one per research team)

Task 8: It's time to share your results with the rest of the scientific community. You will be presenting your study at the regional Animal Behavior Poster Session. Use the "Scientific Poster Guidelines" as you prepare your poster. Your presentation will be graded according to the "Animal Behavior Study Poster Session Grading Sheet."

DUE DATE: (one per research team)

Task 9: Congratulations! You have just completed your very own animal behavior study. As a scientist, your chance of getting future research grants depends on how many papers you have had published in scientific journals. Only exceptional research will be published. If your work was exceptional, it will be "published" at a public location of your choice. Nice work!

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Animal Info Sheet

Name of Researcher(s):

Genus, species and common name of animal to be used:

Book Research:

The purpose of this research is to familiarize you with the needs of the animal so that you can adequately care for it during your experiment. Use general books on animal behavior, magazines such as *National Geographic*, *Scientific American*, and *Field and Stream*, and/or the Internet to gather the following information about the animal you wish to research.

Answer the following questions on an attached sheet of paper, under the heading “Book Research.”

1. Describe the habitat of the animal (preferred environment, temperature, moisture level, light, etc.)
2. Describe the animal’s feeding habits (What does it eat? What time? How often? How much?)
3. Provide any other interesting information you find.

Observational Research:

The purpose of observational research is to get to know the animal you wish to study in its natural habitat. Careful observation will help you formulate interesting questions you may wish to research.

Observe several animals in their natural habitat for a minimum of 30 minutes. It is a good idea to observe the animals at different times of the day, if possible. A better knowledge of your animal will lead to a better and more meaningful experiment.

Answer the following questions on an attached sheet, under the heading “Observational Research.”

1. List several physical differences between individual animals.
2. List several behavioral differences between individual animals.
3. Describe how the animal moves.
4. List any interesting behaviors you observe.