



How I Set Up My Own Body Farm

By Jennifer Dean

To prepare for a new forensic science elective at Camas High School, and determined to make this new course an exciting application of biology and chemistry principles, I began by collecting forensic science resources, ordering books and enrolling in the local community college course on forensic science. I spent every extra hour soaking up as much as I could about this field during the “time off” teachers get in the summer.

I was particularly fascinated by the fields of forensic entomology and anthropology. From books such as *Stiff: The Curious Lives of Human Cadavers* by Mary Roach and Dr. Bill Bass’s work around the creation of a human body farm at the University of Tennessee Forensic Anthropology Center, I decided to create something similar for our new high school forensic science program.

As we met for dinner after a day of revitalizing workshops in Seattle at an NSTA conference, I shared my thoughts about the creation of an animal body farm with my talented and dedicated colleagues. These teachers have a passion for their students and their work. I felt free to share these ideas with them and know I’d be supported in making it a reality. As the Science Department, we formally agreed to dedicate ourselves to submitting grants to make it a reality. Back at work, I sent copies of the farm proposal to my immediate supervisors, and they responded with letters of support.

The next step was getting the farm started—with or without grant money—because the first class of forensic science would be starting in the fall. I began a collection of animals in my extra chest freezer at home. (We *do* keep our food in a separate freezer.) I started with storing away our farm ducks that died, raccoons killed by neighbors, and other readily available road kill. I thank my husband for this stage in the creation of the farm. He was the one who wrapped the carcasses in plastic and deposited the corpses in the freezer for me. He also finds bones on his elk hunting adventures, and points out dead animals on the side of the road. I am thankful to have such supportive home and work partners in my educational visions.

Students are naturally curious, and this project allowed them to ask their own questions, design experiments, and collect and analyze real data. In addition, I don’t know very many high school students who will turn down an opportunity to be outside instead of in the classroom. Different parts of this project appeal to different students. Some love to dig in the dirt, sort out insects or cut up beef liver. Others take a less hands-on approach, keeping a distance but being involved by using photography. Some students are put off with larger animals like a goat or duck, so I modified some protocols to use only chicken legs or chickens that did not hatch from their eggs.

This semester I have a group of students working on the impacts of different molarities of sulfuric acid on the skeletonization of chicken legs. They are keeping an almost daily log of the physical changes in their samples. Other groups are attempting to inject vitamin C into the tissue of chicken legs, hypothesizing that the larvae that feed on these tissues will ingest measurable amounts of vitamin C. Another team is using our soil testing kits to analyze the changes in soil characteristics around and under a decomposing goat. We have tried, with less success, to map and analyze the distance larvae will travel from the corpse to pupate. This takes especially strong observational skills and detailed measurements.

The students and I have both learned a lot about the importance of experimental design. Scavengers have been a significant problem. In one of our early experiments, we would find our ducks moved twenty yards from their original location. Eventually the duck body disappeared entirely. We have learned to make adjustments for the rainy Washington weather. In our practice labs using beef liver, we flooded many of our experimental plates, quickly finding creative ways to allow rain water to drain. This project

has given students the chance to develop skills in critical and creative thinking, trouble-shooting and overcoming problems—all great skills for real life work in any field.

I think it is critical that students develop an appreciation and respect for the animals donated to the Camas body farm. My deceased pet goat is approaching a later stage of skeletonization, yet still wears its collar. The collar encourages students to reflect on the history of these animals, an appreciation of life's stages, and the contributions these animals provided to others in their life and death. Our shop teachers have allowed students to carve signs in memory of these great pets to place at the farm during the experiments.

Students research safety precautions for their lab and put up a typed copy at their station. I keep on hand a large supply of gloves and disposable aprons. Some students prefer to have face masks as well.

If other teachers are interested in starting a body farm with animals, I suggest they find a location that can be fenced, not only for the scavenger problem mentioned above, but also to deter students who are not involved in the class. Invite in a local forensic entomologist and anthropologist to be guest speakers. Organize your animal donations, and have a good method for storing animals as they arrive. If one of your students or parents has a contact with a local veterinarian, they are a safer source of disease-free animals. Hunters and their abandoned camps are a great source of bones. Our local humane society declined to donate bodies for research, but others may.

My students' expressed surprise that cremation was acceptable but not donations to science. And with that, I have a great subject for an ethics discussion in some future forensic science class.

Steps to Starting a Body Farm Project at your School

- *Find and get approval for a location on or off school property for the farm*
- *Write out your specific learning goals- what content/context will this be used in?*
 - ❖ Insect metamorphosis i.e. life stages, gene regulation
 - ❖ Ecological principles i.e. biotic and abiotic factors and their interactions
 - ❖ Forensic anthropology i.e. what can bones tell us – comparative anatomy
 - ❖ Forensic entomology i.e. what can bugs tell us
 - ❖ Physical Science application -Soil Changes around and beneath corpse
 - ❖ Scientific Inquiry - investigative design and research practice
- *Collect your resources*
 - ❖ Find, call, and invite in your local experts (police officers, local physicians, medical examiners, forensic scientists, local entomologists and anthropologists)

 - ❖ Find, contact and/or order your corpses (aka dead animals)
 - ✓ Some potential sources (that cost little)
Fish and Wildlife, Local Veterinarians, Humane Society, Road Kill
- *Students begin a literature search and study of the fields of forensic entomology, forensic anthropology and the University of Tennessee Forensic Anthropology Facility. I use a jigsaw activity with articles from the websites and print resources listed on the page *my favorites.*
- *Teacher Led Practice Labs in both Forensic Entomology and Anthropology*
*See separate section of notebook or resources listed on other side of this sheet
- *Students choose investigative questions and begin their experimental design*
*Please refer to specific scoring rubric for details for assessment ideas
*A separate sheet lists some of the investigative questions my students explored
- *Begin investigations-* placing bodies at the site, collect data as often as possible
- *Assessment*
 - ❖ Student Presentations and/or lab reports
 - ❖ Invite in local experts to ask questions and watch presentations
 - ❖ Skeletal Analyses
 - ❖ Metamorphosis Mentoring

Troubleshooting

Scavengers- either fence your farm or place wire cage over animal (secure cage)

Weather - what will and wind do to your experimental set-up

Safety - goggles, gloves, lab coats, boots, face masks!

Find a spot to clean up

Camas Body Farm Investigation Rubric

Investigation Components	Description of Required Investigation Components	Points Possible	Points Earned
Question	The scientific question your team is investigating.	1	
Prediction and Reason	The hypothesis is expected to include a cause-effect reason. We will use the if, then, because format for our lab write-ups. IF manipulated (independent variable), THEN responding (dependent variable), BECAUSE a specific reason (based on your life experiences and RESEARCH).	3	
Materials	A list of the minimum materials needed to perform the procedure must be listed in this section. <i>Include specific quantities within this section OR your logical steps section.</i>	8	
Procedure	The written or diagrammed procedure is evaluated as follows.		
Controlled (kept the same) Variables	At least two controlled (kept the same) variables must be identified or implied in the procedure or the materials list (e.g. same type of seeds or plants, same amount of soil, water, and light, same temperature).	2	
Manipulated (changed) Variable	Only one manipulated (changed) variable is identified or implied in the procedure or data table, if given (e.g. size of space above or below ground).	1	
Responding (dependent) Variable	The responding (dependent) variable identified or implied in the procedure or data table, if given (e.g. health of plants as measured by height and number of leaves).	1	
Record Measurements	The procedure states or implies measurements are recorded periodically or gives a data table. If artificial data for the responding variable is given, no value point may be awarded. The phrase 'take measurement' cannot be used to mean record.	20	
Trials are Repeated	More than one trial is planned, or implied in a data table, to measure the responding (dependent) variable. Including more than one plant for each condition is comparable to repeated trials.	1	
Experimental Control Condition	An experimental control condition should be identified or implied in the procedure. An experimental control condition is an unchanged condition that is used to insure the manipulated variable caused the changes in the responding variable when investigating complex systems.	1	
Extra Validity Measures	Additional validity measures that were not included in the scenario investigation should be included in the procedure (e.g. plant seeds at the same depth).	2	

Logical Steps	The steps of the procedure are detailed enough to repeat the procedure effectively	10	
Conclusions	<p>A. Explicitly state whether your hypothesis was ¹ Supported, ² Not Supported or ³ Inconclusive AND how you know (include both Quantitative and Qualitative Data)</p> <p>B. Explain your results using graphs, tables and charts where appropriate. <i>X-axis (manipulated/independent variable), Y-axis (responding/dependent variable).</i></p> <p>C. Make suggestions for future investigations</p> <p>D. Explain any problems that <u>COULD</u> have occurred during the experimental procedure and how this may have impacted your results.</p>	25	
Teacher Comments:			
Total Points Earned			

Research Topics for Body Farm Project:

How do the species of blowfly differ that visit a corpse left in the full sun compared to the full shade?

How does preservation method affect the length of blowfly maggots?

How far will a blowfly maggot go to pupate?

What is the effect of burning on invertebrate colonization of a dead body?

What is the effect of competition on the growth characteristics of blowfly maggots?

- A. competition with food
- B. competition with numbers of maggots
- C. competition with different species of blowfly maggots

How long can a blowfly maggot live underground?

What is the quickest method to skeletonize a corpse?

- A. sulfuric acid
- B. dermestid beetles
- C. hydrogen peroxide
- D. lemon juice

Can we detect a toxin/chemical in the body of a corpse?

Method 1- injections of vitamin C Control- injections with distilled water

What changes does the soil beneath a corpse undergo?

Method 1- monitor pH changes beneath corpse
Control- monitor pH on substrates around corpse

Method 2- monitor temperature changes, photograph, record and research daily weather information

Method 3- monitor chemical changes- such as phosphates/nitrates

Method 4- monitor microbial changes- culture and identify

What changes to vegetation occur above a buried corpse? (planted radish seeds)

Method 1- identify, photograph vegetation changes before and after corpse
Control- identify, photograph vegetation around burial site

What changes in insect communities exist on a corpse?

Method 1- identify, culture, photograph insects

What changes in insect communities exist beneath a corpse?

What changes occur in the decomposition of the corpse itself?

****these questions were modified from the textbook “Essential Biology” by Alan Gunn**

**My Favorite Resources
used in the creation and inspiration for this Project**

Websites

http://web.utk.edu/~anthrop/index.htm	Forensic
Anthropology Center- UT	
http://www.deathonline.net/decomposition/corpse_fauna/flies/life_cycle.htm	
Decomposition: The Life Cycle of a Fly	
http://www.tolweb.org/treehouses/?treehouse_id=4197	Bugs,
Bodies and CSI (by Michelle Chambers)	
http://www.nhm.ac.uk/nature-online/life/insects-spiders/webcast-forensicentomology/forensic-entomology.html	Natural History Museum- Forensic Entomology Page
http://www.deathonline.net/decomposition/index.htm	Decomposition_
what happens after death	
http://www.ent.iastate.edu/list/directory/121/vid/4	Iowa State
Entomology videos	
http://www.ento.vt.edu/~sharov/3d/3dinsect.html	3-D
Insects	
http://www.tolweb.org/treehouses/?treehouse_id=4197	Bugs and the
Body	
http://www.forensicentomology.com/flies.htm#flypics	Insects in Legal
Investigations	
http://www.research.missouri.edu/entomology/	American Board of
Forensic Entomology	
http://everest.ento.vt.edu/~carroll/insect_video_home.html	Insects in
Motion	

Print Resources

- “Essential Forensic Biology” by **Alan Gunn**
- “Trail of Bones: More Cases from the Files of a Forensic Anthropologist” by **Mary H. Manheim**
- “Bone Detective: The Story of a Forensic Anthropologist” by **Diane France**
- “Silent Witness: How Forensic Anthropology is Used to Solve the World’s Toughest Crimes” by **Roxana Ferllini**
- “The Bone Detective: How Forensic Anthropologists Solve Crimes and Uncover Mysteries of the Dead” by **Donna M. Jackson**

“Bones: A forensic Detective’s Casebook” by Dr. Douglas Ubelaker and Henry Scammell

“Forensic Science: An Introduction to Scientific and Investigative Techniques” by Stuart H. James and Jon J. Nordby

“Make No Bones” by Aaron Elkins

“The Body Farm” by Patricia Cornwell

“Forensic Detective” by Robert Mann and Miryam Ehrlich Williams