We obtained permission from the student whose work is featured below. We show her responses to the selected questions highlighted earlier (the first blog post, a "mid-course" blog post, and the wrap-up final post.) We also include how we and our student handled a misconception discovered while reading a subsequent submission.

First blog question post:

Blog Questions for Unit 1:
1) In nature, where does your animal live? Describe the environment in which you found this animal including:
a) What is the climate?
b) Does the animal live in water (saltwater? freshwater? brackish water?) or is your animal terrestrial?
c) What depth or altitude does your animal live in?
d) Anything else you want to tell us about your animal's habitat?
2) What is the size of your animal? What are the advantages/disadvantages associated with this size? Be sure to keep in mind the unit 1 readings as you answer this question.

My animal was recently discovered in the Antarctic. In the Antarctic the conditions are very cold and icy with a yearly average of -49 to -56 degrees Fahrenheit. The animal can survive both in saltwater and on land. It has adapted to both conditions. In general, the Antarctic has a high altitude with an average of 8,200 feet. It was discovered in Western Antarctic near the MacAyeal ice stream and Mount Sidley the highest volcano in the Antarctic. So this animal is accustomed to high altitudes. The animal can also travel large depths (up to 10 ft.) in the ocean in search of food. This animal is 10 pounds with a height of 15 inches and length 20 inches. This smaller size is advantageous to this animal because it has a higher metabolic rate. It also has a larger surface area to volume ratio. This is more of a disadvantage because small animals lose heat at much higher rates than large animals, and therefore must produce more heat to offset the effects of thermal conductance.

Specific instructor feedback to Blog 1 Post:
"Excellent start, (Student's Name); concise yet covers all the questions posed."

EXAMPLE OF A MISCONCEPTION ADDRESSED:

This student revealed a misconception in her third and fourth blog posts, which were addressing her animal's cellular neurophysiology and central nervous system. Misconceptions are highlighted.

Unit 3 Blog Post:
When it is underwater in greater depths where there is more pressure it uses up its stored oxygen in its lungs much faster and also intakes more water to absorb more oxygen through its gills.

Specific Instructor Feedback to Blog 3 Post:
"I was surprised to read about gills! See more in next comment and in overall feedback comment."

Unit 4 Post:

The animal has a good brain to body ratio. Since it is not of great size its brain is about 2 inches all around. This animal is a hybrid between a fish and a furry animal maybe a fox because it has many features of a fish but it has feet that are not too big but allow it to walk on land, we are still trying to figure it out. When compared to fish, a fish has a smaller brain to body ratio as opposed to sharks or rays which have a good brain to body ratio. This "good" brain to body ratio is determined by an encephalization quotient. This animal has a 1/30 ratio of brain to body. Compared to an arctic fox which has a brain/body ratio or 1/13 the brain is smaller so it makes me question how this animal evolved to have a furry outer layer and feet. Could it have any relation to an arctic fox? We will have to run more tests and see. Arctic foxes have larger brain because they are of larger size than this animal. Fish on the other hand range in size but they have a very small brain compared to their body size. The reason for this is because they do not have to adapt to two environments they are only in the water. This animal has to have a more developed brain to be able to adjust to all its setting and to have such keen senses and receptors as it does.

Specific instructor feedback to Blog 4:

"I'm still giving you full credit due to the careful consideration of each question asked, and the proper association of adaptation w/ function in each case. I do hope this blog is helping you understand comparative physiology - you're certainly trying! But I draw the line at fish/mammal hybrid...that breaks many rules - including who can mate with whom. I think you need to do some further research to determine what class of animals your critter is most resembling - or did you discover a whole new class??? see main comment box."

Additional instructor feedback delivered to the main "comment box" following the first Blog submission (which consisted of the first four blog assignments):

Hi, it's Kristen - wow (Student's Name) you have put a lot of work and imagination into this blog. It's fun to read. RE: my comments on your "hybrid" idea - basically breaks a fundamental rule of evolutionary biology - ability to produce FERTILE young is a major part of the definition of species. Very few different mammal species can mate (horse and mule → donkey is one example, but donkey isn't a species since it can't reproduce; it's a true hybrid.) Fish and mammals are different CLASSES of animals - so on "first principal" you can't have a hybrid from a mammal and a fish. So I suggest that future posts reflect on this mystery - how your animal has gills AND lungs - or are they really lungs? really gills? (If so, your animal resembles an amphibian...and with fur?!) - let me know if you have more questions. I think you'll refine your animal into something very unique but still plausible! Keep it up. KHK"

Student addressed the misconception in subsequent posts:

Unit 6 (Respiratory System) Post:

My animal is an air and water breather. In the water it uses countercurrent* flow (as explained above).

**Instructor note: Here she is relating a concept learned in an earlier learning unit/organ system*

However reviewing countercurrent exchange in more detail it is an example of simple diffusion. Countercurrent exchange is the flow of adjacent fluids in opposite directions that maximizes the rate of simple diffusion. Blood flows toward the head in the gills, while water flows over the gills in the opposite direction. Countercurrent exchange occurs in the lamellae, plate like structures that aid in respiration, which are found in gills so when the blood moves through the lamellae it comes in contact with water whose 02 content is higher than in the capillaries. So, this flow enhances diffusion by maintaining a concentration gradient of oxygen between the water (which is relatively high in oxygen) and the blood (lower in oxygen). In this case oxygen will move down its concentration gradient from the water into the blood.

On land this animal is able to breathe because it has modified gills. These modified gills have pouches attached to them (which were mistaken originally for lungs). While on land these modified gills trap oxygen in these pouches to keep resupplying the blood all the oxygen it needs.

From unit 8 (blog post:

An interesting thing we finally figured out was that the "fur" that surrounds the outside of the fish actually turned out to be a mucous outer layer. This mucous outer layer is what allows the fish to spend longer amounts of time out of water. What the mucous layer does is it holds onto water and keeps the animal moist sustaining it on land. Even though the animal spends up to 80-90% in the water there are times where it must spend a longer period of time on land.

MID-COURSE BLOG POST: DIGESTIVE SYSTEM

Student is posting far more detailed and sophisticated responses to blog questions

1. *What factors related to the environment and physiology determine survivability for your animal? Be specific, I am looking for something that pertains to your animal, not to animals in general.*

This animal is able to reach great depths in the ocean. This is important for its survivability because the deeper they can go the more food they can find to eat. This animal can survive off a large variety of foods. This may range from small particles to small animals, particularly smaller fish. This animal has a variety of options given the fact it does not just eat plants or just eat meat. This allows the animal to consume a variety of things and have a high survivability rate because of this. This animal is good at avoiding predators that may try to harm or eat it. As I mentioned in a previous section this animal has chemoreceptors that detect harmful toxins that can be found either in the environment or set off by other animals. This ability to recognize these toxins keep the animal from getting killed. Lastly, the animal does not have too much competition unless it is a penguin or a larger mammal. Because the animal is a larger fish and lives off smaller animals and particles it does not really have to compete for food. As mentioned

before it has a lot of options, is not picky, and can survive up to about a month without food if need be. If it were to go without food for a longer period of time this would however be in hibernation mode (known as estivation), so the animal would not require a lot of energy.

2. *Which of the three major mechanisms that we discussed in class does your animal use to collect food. Describe whether your animal is an herbivore, carnivore, omnivore, detrivitore, or filter-feeder. Also describe one special, specific adaptation that your animal uses.*

This animal uses suspension feeding to collect food and is a filter feeder as well. Filter feeders trap organic material that is suspended in the water which may include dead particles, bacteria, algae, protozoa, and small animals. One special adaptation that my animal uses is it superior mouth structure. This mouth structure is beneficial to my animal in eating because it is useful in fishes that wait for animals and/or particles to come near them before they attempt to eat it. Once the food approaches them they have little teeth like structures composed of keratin that allow water to be filtered through and leave behind the more substantial items such as little animals, algae, and other particles found in the ocean.

3. *Describe the foregut, midgut, and hindgut of your animal-- describe both the anatomy and the physiology. Not just what the structures are, but what is going on in those structures.*

In the foregut of the animal one will find a pharynx and an esophagus. The pharynx is a cavity at the rear of the oral cavity. In the pharynx you can see teeth which allow for mastication of the food without the loss of fine particles through the gills (which are located after the pharynx). The pharynx also plays an important role in controlling and directing the water that enters the animal's mouth and goes through the gills for respiratory purposes. The esophagus is a fairly straight and muscular tube that extends from the pharynx to the stomach. In this animal it is not very long like in a human so the food (bolus), via peristalsis, gets pushed down into the stomach very quickly. In the stomach there is a constant supply of gastric juices that aid in the chemical breakdown of the bolus. In more detail, the chemicals that are found in the stomach include hydrochloric acid (HCL), pepsin, gastric lipase and gastrin. The secretion of HCL is stimulated by the segmentation of the stomach as food enters as well as gastrin stimulating parietal cells to secrete HCL. This acid partially denatures proteins found in the food, activates pepsinogen and stimulates flow of bile and pancreatic juices. Pepsinogen which is secreted by chief cells, which are stimulated by gastrin, is converted to active pepsin and continues to further break down protein in the gut. Gastric lipase breaks down triglycerides into fatty acids and monoglycerides. After these chemicals work their magic the bolus is moved to the pyloric caeca. The pyloric caeca is located at the hind end of the stomach and has finger like projections between the stomach and the intestines. The role of this structure in the animal is to further digest the food by secreting enzymes and to absorb some of the digested food. After, the chyme, which was once the bolus, enters the intestines. The intestines of this animal receive more enzymes from the pancreas and liver to further aid in the digestion of the food in the intestines (this animal does not have a hepatopancreas). These hydrolytic enzymes include amylase, lipase and

chitinase which are secreted by acinar cells in the pancreas. These enzymes aid in the breakdown of carbohydrates, fats and chitin. The liver secretes bile from its hepatocytes which further aid in the emulsification of fats as well as many other things. Most of these enzymatic secretions take place in the small intestine which have a large surface area for absorption. Within the small intestine we have villi, finger like projections, and microvilli, smaller hair like projections, which increase the surface area immensely to make digestion and absorption easier. Absorption of carbohydrates, proteins, and fats mostly occurs in the parts of the small intestine, where its large surface area comes in handy. In the hindgut, which is hard to distinguish from the midgut, we will find the colon (large intestine) and the rectum. The colon is made up of three regions, the ascending, transverse and descending colon, however this is not noticeable in this animal like in a human. Its main role is to store fecal matter meanwhile, absorbing water, salts, and nutrients. This fecal matter is then passed down to the rectum, the final section of the colon, where the animal disposes of this matter through its anus, a muscle bearing sphincter.

4. *Describe the symbiotic bacteria in your animal. In which part of the digestive system do they reside, and what functions do they carry out?*

Bacteria from the order Vibrionales reside in this animals intestines. In the intestines this bacteria ferments and utilizes a lot of complex carbohydrates. So, in the intestines, particularly the small intestine, it aids with the break up and absorption of carbohydrates by fermenting them and even utilizing them for their own purposes. Another bacteria that the animal has a symbiotic relationship with is Roseobacter which is found in the animal's stomach. Its main role is to be an antibacterial microbe. So its defensive role in the stomach protects the animal from pathogens that may make it sick or worse, kill it.

Specific Instructor Feedback to Blog 9 Post:

Very nice and complete blog post. Good job!

FINAL BLOG POST - THERMOREGULATION:

Unit 11 Questions:

1. *Your mission is ending because you need to get back to UCONN to present your scientific findings at the beginning of the semester in January. It's the middle of the winter, and it's cold and snowy back in Storrs.* ***At this time of the year*** *(meaning in January, and not at other times of the year), what is the temperature range in your animal's natural habitat? Is it significantly different during the day vs. night?*

January is the second warmest month in the Antarctic so the temperatures range from -18 to -21 degrees Fahrenheit on average. In the Antarctic the sun is always low on the horizon that sometimes it doesn't come up for months at a time. As a result, there really is no major distinction between temperatures during the day and during the night.

2. *Which of the following terms describes your animal? Endothermic, Ectothermic, Poikilothermic? Homeothermic?*

Heterothermic? You can answer with one term (or more than one term if applicable). ***BRIEFLY*** *define the terms you use. Should not be a long explanation, but each term can be defined in a sentence. Points will be take off if you add information beyond the terms and definition.*

My animal is heterothermic; this means that the animal has some degree of endothermy but it is not fully homeothermic. (An endotherm is an animal that uses internal heat to regulate their temperature. A homeotherm is an animal that maintains a consistent internal core temperature.)

3. *Two zoos are very interested in acquiring your incredible newly-discovered animal! You must send the animal to the zoo before you end your mission, so the animal will be arriving at the zoo in mid-January. You only have permission to send one animal, so you must choose one of these two zoos: The Bronx Zoo, which has an average temperature in January of 4°C/39°F, or; The Tampa Busch Gardens Zoo, which is averaging 29°C/85°F this January. Which zoo have you chosen to send your animal to? (your choice is not being evaluated in your grade-- you can chose either zoo at random, I'm just giving you two options for your animals "new" temperature).*
   *Assume your animal will be kept in an outdoor enclosure, how will arrival at the zoo affect your animals internal body temperature (or not)? What physiological mechanisms will your animal use to regulate it's heat in this new habitat (**remember:** gain, retain, generate, lose)*

I would choose the Bronx Zoo for my animal. Since my animal is from the Antarctic it is used to low temperatures. In January when the temperature in the zoo averages around 39 degrees F this is still a very high temperature for the animal since the average in the Antarctic is around -20 degrees Fahrenheit in January. However in Western Antarctic, where this animal is from, tends to be a little warmer so this animal is able to adapt. As temperatures rise this animal is able to adapt by losing heat. This animal tends to maintain a pretty steady internal temperature given the fact it is heterothermic. It is a regional heterotherm so it only heats certain areas of the body that need to be heated. Since the animal likes to swim a lot, and swimming generates heat, the animal will have to lose the excess heat especially in a warmer climate. The animal will adapt by vasodilation of its blood vessels and allowing an increased flow of blood to the integument to disperse of the excess heat as well as panting while on land. The zoo should accommodate the animal by providing it with a seawater swimming area with water that is maintained at a very cold temperature so at least the animal could stay in a similar environment as in the Antarctic and have another means of cooling off.