

Scientific Literacy 1: Background Essay

Intestinal plasticity is when an animal is able to spontaneously stretch their bodies to intake food (Esbaugh et al., 2015). This is how many reptiles are able to eat other animals much bigger than their mouth sizes. This is relevant to creatures that "sit and wait" because they do not need very many meals, so when they do eat, it is typically something large enough to withstand their appetites. These animals can live in harsh conditions, and they must savor what they have.

The Burmese python is one of these reptiles that use this feeding strategy when hunting. Plasticity is in regard to the muscles when skeletal muscles can easily adapt to the environment that they put themselves into, i.e., eating a large animal (Esbaugh et al., 2015). This is possible by the muscle fibers being able to switch back and forth in their plasticity. It is important because plasticity is very complex and varies by species. Reptiles have more plasticity than humans because they have different feeding requirements. Humans require multiple feedings a day in comparison to reptiles. Metabolic rates play a role in this as they have a lower metabolism, requiring a more consistent feeding schedule (Esbaugh et al., 2015). Overall, reptiles have smaller food intake due to their size.

The parathyroid hormone, or PTH, is produced by the neck gland to stimulate calcium release into the body from bones (NIH, 2023). Calcitonin is another hormone made from the thyroid gland that inhibits the spread of osteoclasts which break down bones (NIH, 2023). These two work together to regulate calcium and phosphorous levels in vertebrates by having opposite effects, which, in turn, work together. One who studies this must recognize that calcium and phosphorus go hand-in-hand in regulation in the endocrine system.

PTH can be broken down by liver and kidney enzymes that contribute to hyperparathyroidism and Chronic kidney disease (CKD) (NIH, 2023). Hyperparathyroidism is when too much parathyroid hormone is released, and CKD is Chronic Kidney Disease. Chronic Kidney Disease is when the kidneys lose their function of filtering waste from the human body. This allows for blood pollution, blood in the urine, and overall malaise.

Electron microscopy is a technique used to find the structure of a sample in high quality. It uses electrons to provide more resolution than a typical light. Energy Dispersive X-Ray, or EDX, is used to find the composition of a sample from X-Ray emissions (OI, 1). They are used to find the mental composition of biological samples by using electron based techniques to provide high quality structure, allowing for a deep analysis, and creating a visual spread of components (OI, 1). A sample can be radiated with electron beams to produce this light. Those signals create a microstructure that is then analyzed into a bigger picture (OI, 1).

References

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Scientific Literacy 2: Data Analysis

Burmese pythons have been researched on their calcium intake, and it was questioned on how the high amounts of calcium were not detrimental to the snakes' health. Research suggests that these reptiles have a cell type that is able to contain the high calcium intake (Lignot, et al., 2025). While this study was quite small, and ethically limited, there was a large correlation between diet and calcium production.

Intestinal crypts are glands in the large intestine that can be magnified to study digestion patterns. Intestinal crypts in fasting snakes appear empty due to their lack of food in their system (Lignot, et al., 2025). When fed normally, the crypts are high in calcium nutrients (Lignot, et al., 2025). When fed boneless, they appear lightly filled due to the lack of heavy calcium nutrients (Lignot, et al., 2025). When fed rich in calcium, these snakes present with full crypts which can be compared in similarity to a normal diet (Lignot, et al., 2025). These samples are not only looked at histologically, but also through TEM micrographs and x-rays.

Crypt particles are compaction of calcium and phosphorus that are found in intestinal cells (Lignot, et al., 2025). They occur when a snake has had a diet rich in calcium. Crypt particles are made of epithelial tissue, the outer layer of tissue. The histological slides presented with samples of epithelial tissue highlighted the existence of said crypt particles. The tissues sampled from snakes with different diets showed crypt particles containing more or less calcium traces based on their intake.

Snakes regulate blood calcium levels via calcitonin and parathyroid hormone (PTH). Blood analyses were collected and studied based on calcitonin, parathyroid hormone, and calcium presence. The parathyroid hormone from the parathyroid gland raises the blood calcium

by bone stimulation, just as calcitonin lowers blood calcium by preventing unnecessary loss of nutrients. This is because of their diet. When there are high rates of calcium, calcitonin comes into play to balance and lower levels, and vice versa for low rates of calcium and parathyroid hormones. Without the balancing of calcitonin, snakes could experience hypercalcemia (too much calcium) or hypocalcemia (too little calcium). The study appeared to show that snakes who had fasted, or snakes with a regular diet portrayed consistency with hormonal changes compared to those with differing diets (Lignot, et al., 2025).

The authors made a strong case in favor of the new cell research within these reptiles by having a solid research question. The researchers were efficient in collecting histology samples between different reptiles with different diets to assess their differences. In regard to studying cells, the researchers were able to recognize patterns between snakes of differing diets, and why their samples looked different. The researcher could physically see the calcium build up, or lack there of, just by examining tissue samples. While calcitonin and parathyroid hormones are natural to living beings, they affect every living being differently. Living beings in general can have too much or too little of nutrients, and in snakes, this can be seen through the crypt cells.

This relates to cell biology because these hormones bind to receptors to carry out their function. Hormones are meant for biological balance, and to do this they have to have a lipid soluble cell in order to pass through membranes to partake in homeostasis. The ligand, or the molecule signaling others, must bind to a protein receptor to stimulate a cellular response. In this case, the parathyroid hormone or calcitonin would be the ligand to the calcium receptor protein. Digestion also plays a big role in homeostasis. When they expel the digested material, the excess comes out too. Throughout the internal digestion, calcitonin, and parathyroid hormone crack down on balancing the correct amount of calcium.

References

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'spheroids' along the intestine of Burmese pythons: identification of a new cell type?.

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