

MAKING CONNECTIONS

ZOOLOGY

Name _____

The Effect of Gravity on Snakes

Gravity is a force that pulls on everything. This includes the blood of animals. When you stand up gravity pulls downward on your blood. But all your blood does not run down to your feet. Our circulatory systems have mechanisms that help us maintain a constant supply of blood to our brains.

To help us understand how the human circulatory system works to offset gravity, Dr. Harvey B. Lillywhite studies snakes. Dr. Lillywhite is a professor of zoology at the University of Florida at Gainesville.

We normally think of snakes as always being horizontal. In a horizontal position, the force of gravity pulling on a snake is the same along its body. Blood flow from its heart to its head and tail without having to overcome the effects of gravity.

However, some snakes live in trees. They move up and down trees in a vertical position without passing out from a loss of blood to their brains. Sea snakes dive and return to the surface in vertical positions with no trouble.

Dr. Lillywhite began his study by hypothesizing that tree snakes and sea snakes have developed adaptations to offset the force of gravity on their blood. He tested this by first observing snakes that live mostly a horizontal life-style. Dr. Lillywhite found that when he placed horizontal snakes in a vertical position, their blood drained down to their tails. This caused them to lose blood flow to their head and lungs. They would not have survived if they had been left in a vertical position.

Dr. Lillywhite then tested sea snakes, and found that the same reactions occurred in sea snakes when he placed them in a vertical position. However, Dr. Lillywhite had taken these snakes out of the water to conduct his tests. In the water, sea snakes do not need mechanisms to offset the force of gravity. While gravity pulls downward on their blood the water pushes upward and balances the force of gravity.

Dr. Lillywhite found that tree snakes on the other hand, had indeed developed adaptations to keep gravity from pulling blood downward to their tails. The heart of a tree snake is closer to its head, so the heart doesn't have to work as hard to get blood to work as hard to get blood to the brain. The muscles of its blood vessels tighten up as it climbs a tree. This won't let blood drain into its tail.

Tree snakes have sensors, called baroreceptors, around their hearts. When gravity pulls downward on the snake's blood, the baroreceptors tell the muscles of the blood vessels in the tail to tighten. They also tell the muscles in the brain to loosen so more blood can get to the brain. When the tree snake climbs head first down a tree, the baroreceptors act in reverse. The skin of a tree snake fits much tighter than the skin of a horizontal snake. This helps to keep blood from filling up its tail.

Essential questions:

1. How does this article relate to gravity as a force?
2. List some similar connections with this article and the human circulatory system.