Did you know that Alabama is the fifth most biodiverse state in the country – with more species of plants and animals than almost any other state! Reptiles and amphibians, or "herps", are large contributors to our title. We have over 50 kinds of snakes in our state, only 6 of which are venomous: the Cottonmouth, Copperhead, Eastern Coral Snake, Timber Rattlesnake, Eastern Diamondback Rattlesnake, and Pigmy Rattlesnake. When most people see or hear about snakes, they immediately think, "The only good snake is a dead snake!" That couldn't be farther from the truth.. All snakes play a beneficial role in our ecosystem.

Many people refer to venomous snakes as "poisonous". While both venom and poison are toxins, they differ dramatically. Venomous animals, snakes and others, inject their venom using fangs, stingers, or other specialized apparatuses. The venom is produced in a gland inside of the fangs and stingers. Poisonous animals produce poison in all or parts of their bodies and are harmful when touched or ingested. Poison is simple and used as a defense mechanism by plants and animals to avoid being eaten. Venom is complex and is used to harm, immobilize, and kill prey. So, while both venom and poison are toxins, their purpose and delivery method are distinctly different.

Cottonmouth
PHOTO BY RICK DOWLING

PHOTOS BY WIKIMEDIA

Humans have used toxins for medical purposes throughout history; Ancient Greece, traditional Chinese medicine, and on to modern-day. Most people think that the Caduceus is the medical symbol, but it's actually the Rod of Asclepius that is the true symbol of healthcare organizations and medical practice. The Greek God Asclepius is a deity associated with healing and medicine. The serpent in the symbol is said to symbolize rejuvenation through the shedding of skin or the dual nature of a physician's work in dealing with life and death. The ambiguity of the serpent as a symbol is representative of the ambiguity of drug use, which can heal or harm. More testament to this contradiction is the Ancient Greek word pharmakon, which meant "drug", "medicine", and "poison". While this article focuses on snake venom, venom from snails, scorpions, lizards, anemones, and others are also contributing to modern-day medicine.

Every snake produces its own specific venom and is made up of hundreds of different types of peptides, enzymes, and toxins. The toxins in venom can be divided into three main categories based on the system within the body that they affect; cytotoxins, hemotoxins, and neurotoxins. Some species of snakes use a combination of these different toxins.

- Hemotoxins target the circulatory system and affect blood and organs by destroying red blood cells, disrupting blood clotting, and causing organ degeneration and generalized tissue damage. A bite from a snake with hemotoxic venom is very painful and can cause nausea, disorientation, and headache in humans. In severe cases, envenomation can cause permanent damage, limb

PHOTO BY RICK DOWLING

SNAKES saving Lives

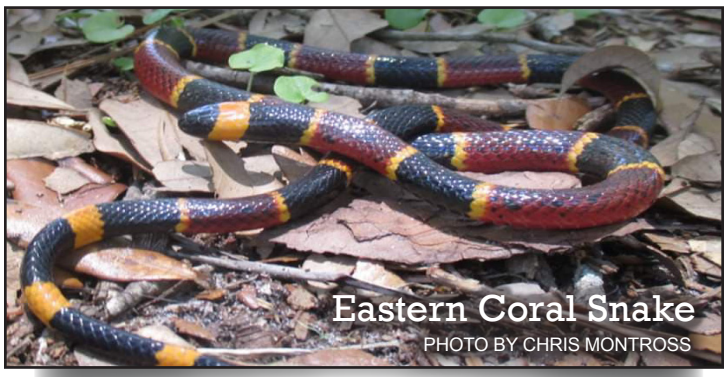
| Tyler Burgener, AWF Outdoor Classroom Specialist

loss, and even death. Snakes of the family Viperidae, including pit vipers and vipers, produce hemotoxic venom. This includes our native rattlesnakes, Cottonmouth, and Copperhead.

- Neurotoxins are the deadliest toxins. They target the brain and nervous system by disrupting chemical signals sent between neurons, meaning that the ability of nerves in the body to communicate with cells shuts off. An untreated bite from a snake with neurotoxic venom causes slurred speech, double vision, seizures, and muscular paralysis, eventually ending in respiratory or cardiac failure. Snakes in the family Elapidae typically produce neurotoxic venom. This includes our native Eastern Coral Snake.
- Cytotoxins target body cells by causing lysis, or the breakdown of the cell wall. A bite from a snake with cytotoxic venom can lead to the death of most of all the cells in a tissue or organ, a condition known as necrosis. Almost immediately after a bite, pain and swelling will begin and gradually become worse in the next few hours. Necrosis is usually confined to the skin and subcutaneous tissue and is visible after 48 hours. Sometimes the pain from cytotoxins can cause shock, kidney failure, severe allergic reactions and ultimately death. Some snakes that produce a cytotoxic venom include the Puff Adder, Gaboon Viper, and Mozambique Spitting Cobra.

While these toxins can clearly be harmful they can be extremely helpful for treating some medical problems with minimal side effects when used pharmaceutically. There are now around 20 different medications originating from animal venoms and a number of them are derived from snake venom in particular.

Hemotoxic venoms affect the circulatory system, so naturally hemotoxic venom-derived drugs treat blood pressure-related illnesses. The first venom-based drug approved by the US Food and Drug Administration was Captopril, in 1981. The Brazilian Lancehead Viper's hemotoxic venom is the source of this drug; a snake that has arguably saved more lives than any other animal in the world. Captopril was the first angiotensin-converting enzyme (ACE) inhibitor. This class of medication, which is used to prevent vessel dilation, is used to treat more than 40 million people worldwide. Since Captopril, two more drugs have been approved to prevent heart attacks and strokes; Eptifibatide from the Dusky Pigmy Rattlesnake,



Eastern Coral Snake
PHOTO BY CHRIS MONTROSS

Copperhead
PHOTO BY ADAM COONER

Dusky Pigmy Rattlesnake
PHOTO BY ADAM COONER

an Alabama native, and Tirofiban from the Saw-scaled Viper.

Scientists are also studying the use of neurotoxic snake venom to treat everything from pain, brain injuries, strokes, cancer, and HIV to diseases such as Alzheimer's, Parkinson's, and multiple sclerosis. Research has shown that two molecules from Black Mamba venom are as effective as morphine for treating pain but are not yet ready for human trials. A protein in the venom of another species native to Alabama, the Copperhead, is being used in studies for a medication to treat breast cancer. Cancer cells work by spreading through the bloodstream, attaching to new sites in the body, and causing the growth of blood vessels that supply cancer tumors with nutrients. Copperhead venom proteins, called contortrostatins, prevent cancer cells from attaching to other cells and signaling new blood vessel growth, effectively preventing the spread of cancer cells.

Venom-derived medicine isn't the only way snakes are beneficial to humans; rodent and secondarily, tick, control is another service they provide to us. Alabama is home to a host of tick species, including both the Lone Star Tick and Black-legged Tick. The Lone Star tick can transmit several incurable diseases, particularly southern tick-associated rash illnesses (STARI) which causes an allergy to red meat and a rash similar to that of Lyme disease. Black-legged Ticks, or Deer Ticks, are mainly responsible for the transmission of Lyme disease. Lyme disease affects over 300,000 people in the US annually and causes some or all of the above-mentioned symptoms plus cognitive decline, heart problems, and unexplained pain. Because symptoms aren't always present, diagnosis isn't always easy and many cases go untreated. Lyme disease is treatable with antibiotics but 10% of patients never see improvement.

Black-legged tick
PHOTO BY WIKIMEDIA

Lone Star tick
PHOTO BY SCOTT CLEM

Rodents are a part of most snakes' diets, venomous and non-venomous. An Alabama native, the Timber Rattlesnake, eats primarily small rodents like rats and chipmunks, which are preferred hosts for disease-carrying ticks. According to a study from the University of Maryland, an individual Timber Rattlesnake secondarily consumes a minimum of 2,500-4,500 ticks each year. Not only do rodents host ticks, they also carry over 50 other diseases that are transmittable to humans like Leptospirosis and Salmonellosis. They are also responsible for millions of dollars in damages to field crops, stored grain, and farm equipment each year. Snakes are one of the primary predators helping us naturally maintain rodent populations.

While all of this information may have changed your mind about whether or not snakes have a place in our community, you still may not exactly feel comfortable with the thought of them being around. What would you do if you encountered a snake – venomous or not? The safest, most responsible thing you could do it just leave the snake alone and distance yourself from it. Snakes only bite to kill and eat prey or to defend themselves. Since humans aren't on the menu for our native species, the only reason they would have to bite you is in defense. If you keep your distance and leave the snake alone, it won't need to defend itself. By getting close enough to kill the snake, you are close enough to be bitten by the snake. Accidents happen and sometimes snakes are stepped on before they are seen. In that case, seek medical attention immediately. While there is certainly some risk involved with being around a snake, their presence is overwhelmingly beneficial to humans and their lives should be valued for the services they perform.

Timber Rattlesnake
PHOTO BY ADAM COONER