



## Research of alligator proteins may unlock new class of antibiotics

Louisiana is home to the highest population of alligators (*Alligator mississippiensis*) in the U.S. and their reputation for vicious bites is well known. Alligators are also notorious for inter-species fighting, leaving other alligators with large, jagged wounds, and sometimes lost limbs. Scientists have observed that injured alligators heal rapidly and rarely develop infections in these wounds, even in the most swampy, bacteria-laden environments. Research has shown that the first defense of the alligator immune system utilizes a unique antimicrobial peptide mechanism to combat bacteria, fungi and viruses.

Dr. Mark Merchant, biochemistry professor at McNeese State University, also known as “the alligator man,” is a leading researcher investigating these naturally occurring antibacterial peptides as a potential new class of antibiotic drugs for humans and animals.

Conventional antibiotics fight infection by targeting the enzymes needed for bacterial cell wall growth; however, subtle genetic mutations in these bacteria can quickly make them resistant to antibiotics. Antimicrobial peptides work by creating ionic interactions that cause bacterial cell membranes to rupture, which is not only very effective at preventing infection, it also makes it much more difficult for the bacteria to develop drug resistance.

In 2007, Dr. Merchant received a 4-year Research Competitiveness Subprogram (RCS) grant from the Louisiana Board of Regents to initiate his research on antimicrobial peptides from crocodilian species, which include alligators, caimans, and crocodiles.



*Dr. Merchant has traveled the swamps of the world collecting crocodilian blood samples for his research. 1.) American crocodile (*Crocodylus acutus*) on the Tempesque River in Costa Rica. 2.) African dwarf crocodile (*Osteolaemus tetraspis*) in Gabon, Africa. 3.) Caiman Yacare (*Caiman yacare*) in Corrientes, Argentina. 4.) Slender-snouted crocodile (*Mecistops cataphractus*) in Gabon, Africa. 5.) Broad-snouted caiman (*Caiman latirostris*) in Santa Fe, Argentina.*

Over the past five years, Dr. Merchant successfully leveraged EPSCoR travel grants to speak at five different national and international conferences where he met all of his current collaborating researchers.

Earlier this summer, Dr. Merchant received an EPSCoR Links with Industry and National Labs (LINK) grant to travel to Proyecto Yacaré, a 23-acre caiman research and farm facility in Santa Fe, Argentina that is owned and operated by the Argentinean provincial government. While there, he collected blood samples from caiman species to expand his field research and provide some insight into the evolution of crocodilian immunology.

Dr. Merchant and his team of collaborative Argentinean researchers collected and processed blood samples from both wild *Caiman latirostris* and *Caiman yacare*, and exported the samples back into the U.S. for further analysis. The lab work is currently progressing at McNeese State University in Lake Charles, Louisiana. The field research team, in conjunction with the Argentine National Scientific and Technical Research Council (CONICET) officials, successfully garnered a grant to allow co-collaborator Dr. Virginia Parachu to travel from Argentina to McNeese and assist with laboratory research for three months.

The research team is pleased to report that they have already successfully isolated a serum lectin protein from the caiman samples and is beginning to characterize these proteins and determine their structures.

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- LA EPSCoR Speaking of Science (SoS) Program teacher evaluation

They have also isolated two proteins that exhibit potent antibacterial activities from alligator white blood cells and are working to elucidate the structures of these proteins, so they can be synthesized to determine their antibacterial mechanisms. This would represent the first antimicrobial peptide isolated from crocodylians, and also the first from any reptilian species.

International collaborations such as these are not only vital for expanding research and resources, they also play an important role in laying the foundation for other post-doctoral fellows to visit Louisiana in the future.

Dr. Merchant's research is continuing to gain momentum, and he is currently leveraging a new National Geographic-funded grant to expand his fieldwork in Mexico, Belize, and Brazil.

With an eye on the future, Dr. Merchant is fostering additional collaborations, and has applied for a Special Programs Fulbright Scholarship to direct a 2½-week special course at the National University of Litoral in Esperanza, Argentina in 2012.

### Hands-On Alligator Experiences

McNeese State University has developed a three-week biochemistry summer internship program that provides excellent opportunities for students to gain hands-on experience in the field and in the laboratory.

High school students travel with Dr. Merchant to local marshes to catch



Photo courtesy of McNeese State University

*As part of a three-week biochemistry summer internship program at McNeese State University, high school students traveled to local marshes with Dr. Mark Merchant to catch wild alligators (*Alligator mississippiensis*) and collect blood samples for their research on the unique immune systems of these reptiles.*

wild alligators, collect blood samples, process the blood samples in the laboratory, and conduct experiments to determine the alligator's immunological capacity.

In the realm of classroom experiences, Dr. Merchant is an EPSCoR Speaking of Science (SoS) Program speaker, and he brings his alligator subjects with him for his presentations to student groups of all ages. Students hear about evolution of the immune system, wound healing mechanisms in alligators, and details about his research.

Children and adults alike can't help but become completely fascinated by the sight of, or, if not too squeamish, touching a living alligator. After the

presentations, students consistently rave about how memorable the guest alligators were.

An anonymous review from a Leesville High School teacher said, "The presentation was terrific because Dr. Merchant demonstrated to the students his passion for science and the students will never forget the presence of the alligator."

The teacher also forwarded a student comment: "I really enjoyed Dr. Merchant's presentation. His work was very interesting and getting to hold and see an alligator up close was spectacular. It was an unforgettable experience, and I'd like to thank him for coming."