Ying Jia, Ph.D., a research scientist with 20 publications to his name, has been working at the Natural Toxins Research Center since 2007. Dr. Jia received his education at Nanjing Agricultural University in Nanjing, China, where he studied plant breeding and cytogenetics for his Master of Science, and plant molecular biology for his doctorate. His previous research experience includes post-doctoral work as a research associate at USDA in North Dakota and Texas A&M University-Kingsville, a Visiting Scholar at Rothamsted International in England, and a research associate in the Institute of Genetics at the Chinese Academy of Sciences.

His research at the Natural Toxins Research Center focuses on the molecular biology of snake venom. Dr. Jia is assisted by Bruno Cantu, an undergraduate biology student. Specifically, Dr. Jia and the NTRC research team are interested in identifying genes encoding proteins which can be of biomedical application. For example, some components in snake venom show very promising anti-cancer effects and may prevent the growth of cancerous tumors. Snake venoms are rich resources for searching for these types of molecules. In order to assist with this, Dr. Jia and the NTRC research team has constructed a complementary DNA (cDNA) library using the venomous gland of *Agkistrodon piscivorus leucostoma* (western cottonmouth), as well as randomly sequencing 2,112 independent clones and constructed small Expressed Sequence Tags (ESTs) for 1,309 databases. The three most highly expressed genes in this venom are phospholipase (35%), metalloproteinase (2.8%) and serine proteinase (2.2%).

In addition, clones showing sequence identity to disintegrins, thrombin-like enzymes, hemorrhagic toxins, fibrinogen clotting inhibitors and plasminogen activators were also identified in the EST database. Currently, Dr. Jia is focusing on massive production of recombinant proteins of Parvalbumin (an abundantly expressed gene in fast contracting/relaxing muscle fibers) in the prokaryotic expression system and its possible function analysis. The development of a eukaryotic expression system for phospholipases, disintegrins and lectins is in progress.
One of the most successful examples of drug discovery from venom research is captopril, which is a peptide prototype found in Bothrops jararaca venoms. The peptide has an angiotensin-converting enzyme inhibitory activity. This means it decreases arterial pressure - or in other words lowers blood pressure.

Based on this information, several drugs have been developed and are now used internationally.

Each year, more and more venomous snakes become endangered due to habitat destruction, hunting, and the natural fear of people working and living in the same habitat snakes occupy. Yet, the full potential of these snakes’ contributions to medicine is not known. Also, their populations are usually not managed to best benefit their countries of origin. As snakes become endangered, it will become more difficult to make drug discoveries from their venoms.

Venoms found in the Viperidae family in South America are rich sources of proteinases, which render fibrinogen incoagulable and solubilize fibrin. Many of these compounds have profound effects (stimulating or inhibiting) on the hemostatic mechanism, including blood coagulation cascade, fibrinolysis, hypotension, vascular integrity and platelet function. Many snake venoms are not available for research because of habitat destruction. One solution to habitat destruction is to raise snakes in captivity.
but many species of snakes do not breed well or even survive in captivity. For example, the Bushmaster, *Lachesis muta muta*, (*L. m. muta*) is a large venomous snake with extremely complex venom, but it does not do well in captivity.

The Aguaruna Indians of Peru live in dispersed settlements at elevations of 200 - 1,000 meters along the Marañon Nieve, Potro, Mayo, Cahuapanas, Cenepa and Santiago rivers and their tributaries. They support themselves through horticulture, although they also hunt and fish. More recently, they have become involved in snake farming in order to sell their venoms for biomedical applications. They have a large snake farm in an Aguaruna Indian village at Rio Cenepa, located in an untouched forest.

The Director of the NTRC, Dr. John C. Perez was asked to visit the Aguaruna village in the summer of 2007 to make recommendations on potential applications for the medical use of snake venoms.

The snake farm of the Aguaruna Indians is incredible. It is on a 1,345 hectare piece of land with 550 hectares surrounded by a wire mesh fence that is 6 ft. high. Adult snakes are too large to penetrate this fence. Rodent feed is placed inside the fence to attract rodents small enough to pass through the fence so they can then act as food for the captive snakes. This setup keeps the snakes in their natural environment. In operation for two years, this snake farm is primarily used to house the Bushmaster, but will be expanded to include other snakes. The accomplishment of raising the Bushmaster snake is a task that few serpentariums in the world have been able to accomplish. Since the Bushmaster’s venom is important to biomedical research, it is very important that the Aguaruna Indians have found a way to allow the snakes’ survival in captivity. Their facility lacks the necessary equipment for processing the venom.

The NTRC is in the process of signing agreements with the Aguaruna Indians in Peru to analyze the Bushmaster (*L. m. muta*) venom by HPLC, mass spectrometry and various biological assays. The venom is one of the most complex to be tested at the NTRC. Preliminary results suggest the venom has gelatinase, hemorrhagic, fibrinolytic and disintegrin activities. The fibrinolytic and disintegrin activity is important in the treatment of strokes and heart attacks since the disintegrins prevent platelet binding, and fibrinolytic activity can digest blood clots. The Aguaruna Indians’ system of snake farming allows a large quantity of Bushmaster venom to be extracted for biomedical research without destroying natural resources. It is hopeful that agreements can be signed with the NTRC to provide quality Bushmaster (*L. m. muta*) venom or venom fractions for biomedical research, while at the same  providing additional income for the Aguaruna Indians in Peru.

Currently working on this project for the NTRC are Yvette Guerra, an undergraduate student at Texas A&M University-Kingsville, and Juan Carlos Lopez-Johnston, a research associate at the NTRC. Yvette is working towards a double major in chemistry and biology. Research on the Bushmaster venom involves testing T24 tumor cells to see the disintegrin’s ability to inhibit metastasis. This adhesion is how cancer cells join to healthy tissue. By testing the concentrations of the disintegrins, it may be possible to learn to stop malignant cells from adhering to the body and prevent tumors from growing.
To receive a free copy of the Natural Toxins Research Center newsletter, contact Nora Diaz DeLeon at (361) 593-3082 or by email at kanmd00@tamuk.edu.

Viper Day 2008

Each year, the Natural Toxins Research Center invites junior and senior high school students from local school districts to come experience a sample of the biomedical research being conducted at our facilities. This is also a good opportunity to demonstrate some of the advantages and benefits that can be found through pursuit of a degree in a field of science. This year's keynote speaker will be Dr. Ed Neas, the Director and founder of Chata Biosystems, Inc. Dr. Neas is a former graduate student of the NTRC. He received both his bachelors and masters Degree from Texas A&M Kingsville.

Dr. Edwin Neas, Sr. Vice President Research and Development.

Texas in Biology and his Ph.D. from Utah State University in Microbiology.

The day will also include presentations explaining the research conducted at the NTRC, games, prizes, souvenirs and tours of the serpentarium and the laboratory. There may also be opportunities to tour other biology facilities on campus upon request. In addition to all of this, seniors who will attend Texas A&M University-Kingsville will receive a chance to win a scholarship!

If you would like to bring a group of your biology students, contact us as soon as possible to reserve your group, as this year's registration will be limited.

We look forward to hosting your school on Friday, February 22, 2008 for this exciting event!

Donations for the Natural Toxins Research Center may be forwarded to:

Natural Toxins Research Center - Texas A&M University-Kingsville
975 West Avenue B, MSC 158, Kingsville, Texas 78363-8202

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