



Combining strengths of five premier community colleges from around the nation for new learning models to build our biotech workforce

NCBW Supports Innovative New Research Project -Teaching Tool

Forsyth Tech Biotech Students Gain New Skills With Hands-On, Real World Results

The National Center for the Biotechnology Workforce (NCBW) formulates responses to current biotech workforce demands with programs and curricula for easy access at community colleges. NCBW responses are rolled out in classrooms and equipped training laboratories, then disseminated and replicated at community colleges in other locations.

Results of these initiatives produce hundreds of new, skilled workers around the country.

A new project supported by the NCBW - launched at Forsyth Tech - takes the experience and skills of Lucien J. Houenou, Ph.D., an accomplished expert in neurobiology and experimental neurology formerly with Wake Forest University Medical Center, and translates them into an exciting new teaching tool that might also contribute to fighting several degenerative diseases that affect the nervous system.

"We are doing this to make an in-house research model that is replicable for the rest of the nation at the community college level," says Russ Read, executive director of the NCBW. "Dr. Houenou's project is a great model. He can conduct some needed basic research and at the same time offer students new skills in hands-on learning that produces meaningful and tangible results."



Lucien J. Houenou, Ph.D., brings his expertise and experiences in neurobiology into an exciting new teaching tool that could help fight disease



individuals to become highly-skilled technicians needed to support growing medical, life science, and pharmaceutical research and development. Students emerge from the two-year associate in applied science degree program ready for career opportunities in biotechnology.

"Neuron degeneration contributes to diseases, including Alzheimer's, Parkinson and amyotrophic lateral sclerosis (ALS) - also called Lou Gehrig disease," says Dr. Houenou. "Although these diseases are believed to have a genetic component, the exact mechanisms involved are still unknown."

The challenge is to identify the effects and mechanisms of neurotoxins on the development of spinal cord

The primary use of biotechnology in North Carolina is in production of pharmaceuticals, medical research and diagnostics. Forsyth Tech's biotechnology program prepares

neurons. The scale of experimentation and data collection in this challenge is enormous. The work, which at times seems like emptying the ocean with a tea cup, takes place using strict protocols in a specialized research laboratory.

Despite massive investments by pharmaceutical companies in research, there are still many unexplored areas and missing data. "Big companies are focused on production and sales, they don't always have the manpower to spare in pursuing all these questions on neuron degeneration," says Dr. Houenou. "Or they don't have particular skills, ones which may be more advanced or different than their areas of concentration."

The result is that Dr. Houenou's new project at Forsyth Tech, called "Mechanisms and Prevention of Spinal Neuron Degeneration in Animal Models," has significance within the industry and has the potential to produce breakthrough results.

"This is a real research project that builds on work I have been doing at Wake Forest University. It was thoughtfully considered and discussed with my partners and is important," says Dr. Houenou. "This real world aspect motivates students and complements our theoretical courses with hands-on work in the nitty-gritty of actual scientific discovery." *(continued on next page)*

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To harness the power of biotechnology industry potential – with a skilled, ready workforce – the U.S. Department of Labor Employment and Training Administration created the National Center for the Biotechnology Workforce in 2004.

Because community colleges are actively involved in meeting the needs of workers and industries in their communities, the National Center focuses energy and investments on five community colleges with different but congruent strengths in the biotechnology industry to create new curricula and infrastructure models that can easily be shared and replicated.

Learning Biotech Hands-On

Motor neurons reach from the brain to the spinal cord and from the spinal cord to the muscles throughout the body. ALS is a progressive neurodegenerative disease that affects such nerve cells in the brain and the spinal cord. When muscles no longer receive messages from the motor neurons that they require to function, the muscles begin to atrophy (become smaller). Limbs begin to look “thinner” as muscle tissue atrophies. Early symptoms of ALS often include increasing muscle weakness, especially involving the arms and legs, speech, swallowing or breathing.

“The possibility of a genetic component in this disease process, and determining its exact mechanisms, are crucial to finding a cure or preventing it and other diseases,” says Dr. Houenou. Drawing on his extensive research experience, he devised a plan to try and determine these links. The resulting project employs observed effects of a plant on a remote population’s diet.

The cycad palm is known to contain neurotoxins, including one used to produce cyanide. It’s been shown that people who live on the island of Guam whose diets include cycad palm nuts have a very high incidence of a fatal, degenerative nerve disease similar to amyotrophic lateral sclerosis and parkinsonism-dementia (ALS-PD). This disorder is up to 100 times more common in the Chamorro people of Guam than in the continental U.S. and other developed countries.

Dr. Houenou’s plan for the project at Forsyth Tech is to examine the effects and mechanisms of specific neurotoxins derived from cycad palm nuts on development of spinal cord neurons in embryonic chickens.

“The Guam people process the nuts to remove toxins, but they may not do it completely - some residual toxins may remain,” says Dr. Houenou. “The point is, it has not been determined if these toxins really kill neurons. We suspect the nuts, but no one’s really tested it scientifically.”

Basically, this research will provide significant insights into the mechanisms of the degeneration and death of neurons associated with ALS-PD in humans induced by certain plant or food toxins.

In addition to the prospect of making a real discovery that could possibly help save lives, the new project will serve as a teaching tool with hands-on experience for students. Gearing up for the

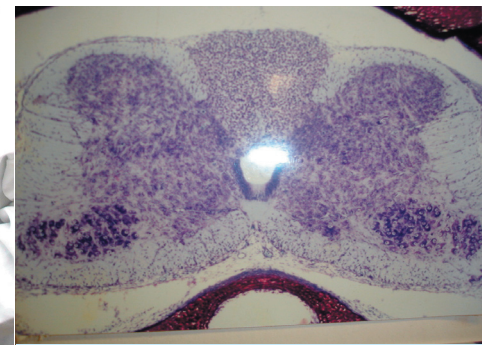
project Dr. Houenou has three advanced students working with him on it. The plan also required purchasing and installing new, specialized equipment. “This equipment is versatile and it can be used for different purposes; we can set it up to test anything on nerve degeneration,” says Dr. Houenou.

The focus is to develop protocols for testing particular compounds and their effects on nerve degeneration “I did this at Wake Forest so I have the boilerplate to do it, an actual research project here, in-house, using compounds that are a staple in most research,” says Dr. Houenou.

Emphasis will be placed by student participants on common and standard procedures of experimental research, including project scope selection, hypothesis development, experimental design and procedures, use of appropriate controls, record keeping, data collection, analysis, and reporting. “We’ve developed the course outline and how it fits in with the overall biotech learning program. This material will also be prepared

for dissemination to other institutions seeking to set up similar projects,” says Dr. Houenou.

In describing more details of the work being done, Dr. Houenou points out that approximately fifty percent of all neurons degenerate and die. “This is part of the normal sculpting of the



A microscopic view of a histological section of a chicken embryo. The dark cells on each side are motor neurons that control muscle movements.

body. Our hands are not webbed, for example, even though they start out that way, with webs, as embryos. These cells selectively die to sculpt the digits.

“Biotech uses this research - we study developing chicken embryos and ask, ‘in what period do these cells die?’ or ‘how many die in the spinal cord?’ We’re interested in motor neurons - those that connect to muscles. We can identify compounds to prevent these cells from dying - ones that have a positive effect on neuron survival. Or we can study the reverse - those that kill neurons and what concentration ranges are toxic. If we kill the neurons, then we can figure out how to prevent killing them.”

Dr. Houenou is excited about the new term: “This project, if successful, can help us better understand and prevent neurodegenerative disease!”

Thanks to a grant from the NCBW, Dr. Houenou is guiding the development of this research project that will serve not only as a teaching tool for students in the Biotechnology program at Forsyth Technical Community College, but as a model for future productive research at community colleges facing similar challenges in meeting biotech workforce demands.



Student assistant Sadie Gaskins tests effects of different compounds on chicken embryos.

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