

# Cutting Edge Research At Newtown High School

BY LAURIE BORST

High school science teacher Frank LaBanca is a research scientist himself who wants to see his students succeed at applied research. To that end, he offers a course that allows students to conduct research on a topic of their choosing. And NHS students are stepping up with projects involving gel electrophoresis to metamaterials to bioremediation.

"The applied research setting gives real world skills, like time management, creativity, researching," Mr LaBanca explained. "Authentic research provides information people want, like river study projects students have done in the past."

Scott Regnery, a senior, is studying "The Health of Local Streams and The Effect of Stocked Brook Trout On Native Populations." Scott has been engaged in soil and water sampling and testing.

Besides chemical analysis of environmental factors, Scott is studying which macroinvertebrates (insects) live in local streams. Some macroinvertebrates have zero tolerance for pollution, therefore, which insects are present is another indication of stream health.

"I found a stonefly, which has zero tolerance," Scott stated. "Therefore, water quality must be very good."

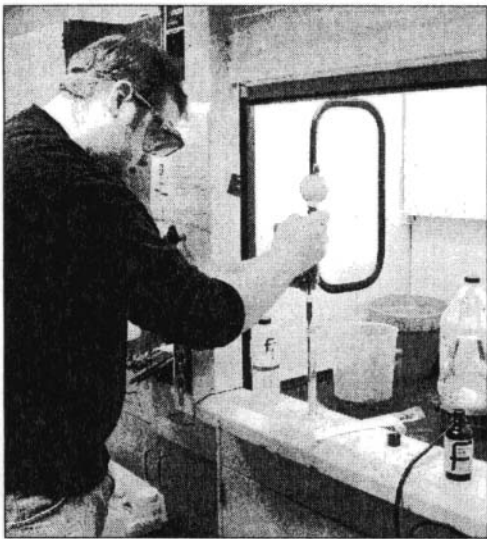
Another question he hopes to answer is, are the trout native or stocked, or a hybrid? He will use tail tissue to obtain DNA samples and run gels. Gel electrophoresis is a common procedure that separates DNA, creating patterns in the gel that are analyzed to determine what genes are present in the fish.

Sophomore Grant Kurtz has chosen to investigate "Integrating Facial Recognition Software For High Security Into Everyday Digital Cameras." While recognition software already exists, Grant would like to write a program that will simplify the process and compare retinal images through a connection to a digital camera.

To accomplish his goal, Grant has been learning Java, a computer programming language. He will test his software through a game he is developing. Grant is a member of the tech club and plans to study computers in college.

Senior Drew Taylor is no stranger to applied research. Last year, he attended the International Science and Engineering Fair in Indianapolis. This year, Drew is researching "The Simulation, Fabrication, and Testing of a Novel Metamaterial At a Near-Infrared Frequency."

"Metamaterials consist of three-dimensional arrays of hoops, rods, or other shapes



Senior Matt Berk performs a titration as part of his quest to refine Fryolator oil into biodiesel fuel. Many titrations use color change as the indicator of reaching the endpoint. Matt was pleased when he reached the expected color change.  
—Bee Photos, Borst

made of metal or other electrically conductive materials that are joined by electrical insulators, such as fiber-glass," is how these new materials are described in *Science News*, July 2006.

Drew tried to break it down into terms nonphysicists can understand. Basically, metamaterials bend waves around them, with the waves meeting up on the other side, essentially making whatever is placed inside the material, invisible.

"I'm trying to make a material that works within a narrow infrared zone," Drew explained.

Metamaterials intrigue scientists who dream of cloaking devices like those the Klingons have on Star Trek or an invisibility cloak a la Harry Potter, although it will be some time before you can buy one at the local wizard's shop. The more practical application of metamaterials is their ability to protect what might be placed inside them.

Maricate Colon, also a senior, is researching "The Bacterial Degradation Of Polychlorinated Biphenyls Using *Pseudomonas* Grown On BioSep Beads." Maricate has performed other water studies in the past.

This study looks at using *Pseudomonas*, a group of rod-shaped bacteria, to remediate PCBs, which are the byproducts of manufacturing done by General Electric. The Hudson and Housatonic Rivers have both been polluted by these PCBs.

With the help of Western Connecticut State University biology professor, Dr Ruth Gyure, Maricate was able to obtain BioSep beads. She will grow *Pseudomonas* on

biodegradable beads in different layers.

Maricate plans to place these beads into river mud, testing the water before and after treatment to establish PCB levels to determine how well the *Pseudomonas* clean up the contaminants. Maricate will also look at the length of time the beads are left to ascertain if longer periods in the water result in more remediation.

Senior Alex Albritton is researching the bottleneck, or Founder, effect in genetics. He is using *Drosophila melanogaster*, more commonly known as fruit flies, to study this.

The bottleneck effect refers to a population being altered by catastrophe, i.e., floods, famine, etc, that changes the gene frequency seen in that population. Founder effect refers to a few members of a population being separated from the group, again, altering gene frequency.

After several generations,



Scott Regnery, a senior at NHS in the applied research class of Frank LaBanca, is identifying macroinvertebrates, i.e., aquatic insects, crustaceans, mollusks, and worms, whose presence indicates the health of a stream. This will help Scott in study of native brook trout.

the original group will often have very different traits than the individuals that arise from the smaller population.

Alex has obtained flies from a biological supply house. He ordered wild type, which is the typical form observed in nature. Mutant strains can be selected, such as white or sepia eyes, or vestigial wings.

Alex's flies arrived on December 7. He hopes to produce a minimum of three generations in the next few months. He will select flies and segregate them, allowing them to mate. The offspring will be observed to determine the traits they have inherited and how inheritance was affected by the bottleneck effect.

Allison Conley is a senior interested in marine biology. Her research involves looking for a genetic link among invasive species. *Phragmites*, a species of grass, was brought in to improve marsh-

es and it took over.

Allison's question is, "Is there a gene that makes these species take over?" Not much research has been done in this area as yet. Among various scientists, there is the thought that invasive species that easily dominate native plants have a common gene that triggers their adaptive success.

Senior Matt Berk is investigating converting Fryolator oil from the cafeteria into biodiesel. Using titration to determine amounts of reagents, Matt then prepared a test batch. After mixing the reagents, Matt used a separation funnel to drain off the heavier byproducts leaving the biodiesel.

Matt plans to build a refinery and increase the amount of biodiesel he can produce. He hopes to acquire a diesel-powered motor in which to run his fuel. He will analyze emissions in exhaust from the engine to determine how "clean" the fuel is burning.

## Teaching The Teachers

With a grant from the Connecticut Department of Higher Education, professors at Western Connecticut State University and secondary science teachers from area schools developed the WestConn Institute for Science Teacher Research (WISTR), which held its first workshop last July.

The program's goal is to train secondary school science teachers to do research with their students. Newtown High School biology teacher Frank LaBanca introduced attendees to the topic of how to develop good questions, the subject of his doctoral research.

"This is a weeklong program with residency in a professor's lab for teachers," said Dr Theodora Pinou, assistant professor and secondary science education coordinator at Western Connecticut State University. "Teachers acquire inquiry, safety, and content experience not available in day-to-day classes."

After completing the weeklong class work, each participant developed a research project in conjunction with a mentor that are being carried out over the course of two semesters. In May, outcomes of the research will be presented at WCSU.

Those attending the workshop were 20 percent education students and 80 percent certified teachers. The workshop experience provides some idea of the reality of being a teacher in the classroom, Dr Pinou explained.

The state grant covers 18 months, and if the grant is renewed, the faculty hopes to offer the research program every other summer.