



Applied Research & Technology Program NEWSLETTER



*Program of Distinction
Ogden College of
Science and Engineering*

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*A
Program of Distinction*

Western Kentucky University

**Ogden College of
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Sygen Chair in Biotechnology

The Biotechnology Center looks forward with excitement to finding the scientist who will soon fill the Sygen Chair in Biotechnology. This is a new position for a senior scientist on the WKU faculty in biology, funded by Sygen International, a multi-national company with its North American research operations in nearby Franklin, Kentucky. This biotechnology-oriented scientist will do applied and fundamental research, together with consulting, supervision of postgraduate students, publications, and where appropriate, the technical support of commercial products. An international search is underway to identify candidates with outstanding records of scholarly achievement and scientific publication, demonstrated excellence in the areas of animal quantitative genetics or genomics, and successful incorporation of M.S. or Ph.D. students into research initiatives, as well as a history of developing a research program with a focus on technology that has potential to stimulate economic development.

This 2.5 million dollar collaboration with Sygen over a ten year period will help the Biotechnology Center to strengthen its relationship with the biotechnology industry in the state, as well as improve technical services to the State of Kentucky. As well, this senior scientist will help to develop strong skills amongst students in the biotechnology field.

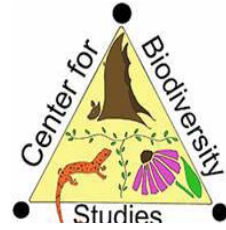
"This is good news for Kentucky," said Western Kentucky University President Gary Ransdell, "because biotechnology represents a critical component in Kentucky's vision for economic opportunities. Biotechnology's capacity in animal and plant breeding is the new frontier in Kentucky's new economy."

*~Submitted by
Sigrid Jacobshagen
Director, Biotechnology Center*



Two Sygen employees who are former WKU students demonstrate a common lab procedure in the Biotechnology Center during the announcement ceremony on June 28. **From left:** Sygen employee Yoganand Vandari (M.S. in Biology from WKU), Sygen employee Roy Griffin Tomlin (B.S. in Biology), Biotechnology Center Coordinator Xinnan Niu, Chief Technology Officer of Sygen Dr. Graham Plastow, and WKU President Dr. Gary Ransdell.

The Center for Biodiversity collaborates with the University of Nairobi



On July 01, 2005, ten WKU students, WKU President Dr. Gary Ransdell, and two OCSE faculty, Doug McElroy and Michael Stokes, both of the Center for Biodiversity Studies, arrived in Nairobi, Kenya. This trip was the culmination of three years of collaborative effort between WKU's Department of Biology and the Faculty of Veterinary Medicine at the University of Nairobi. Dr. Ransdell and administrators of the University of Nairobi signed a Memorandum of Agreement for wildlife-related research, paving the way for an active student and faculty exchange between the two universities and expanded research opportunities for both institutions.

Several months earlier, the WKU Department of Biology shipped sufficient equipment to the University of Nairobi (UofN) to establish a molecular forensics laboratory for wildlife-related conservation research. During this trip, the WKU students and UofN students worked together to set up the lab, the first in Kenya and one of the few labs in that country capable of DNA-based analysis. Kenya is home to some of the most spectacular wildlife in the world; but like many such wild places, it is rapidly succumbing to pressures of a rapidly expanding human population and associated food security issues.

Firearms-based poaching was common in Kenya in the 1970s and 1980s. However, the creation of a well-trained, well-armed, paramilitary national wildlife service with broad-ranging powers eventually put a halt to much of this illegal killing and trade in wildlife, particularly elephant ivory. An international agreement to ban the trade in elephant ivory also contributed greatly to the decrease in elephant poaching, culminating in the famous media event in Kenya when in 1989 the Director of the Kenya Wildlife Service and the President of Kenya ceremonially burned that country's stockpiles of ivory seized from poachers (see *Wildlife Wars* by Richard Leakey for an exhaustive treatment of this fascinating story).

Another type of poaching has become a real concern in Kenya, namely snaring. A snare generally takes the form of a loop of wire or rope set across a wildlife trail in such a way that animals become entangled in the loop which tightens around a neck or leg, slowly killing the animal or holding it to be killed by the poacher. Such snaring is done for a variety of reasons. One is human-wildlife conflict. As human settlements encroach on areas used freely by wildlife, villagers set snares to protect crops from the wildlife which eat them or to kill wildlife that they perceive as a danger to themselves or their livestock. Some poachers catch animals for personal consumption, an understandable activity in a country where hunger is a way of life in many rural areas and starvation may be a real concern. The most worrisome reason for poaching, however, is financial gain. Some poachers sell the meat from the animals they catch, and there is good reason to believe this is done on a commercial scale in some areas. Such illegally marketed game meat is called bushmeat. Because of the extent of this activity, the immense difficulty in capturing snarers, and the relatively light punishments meted out to those who are caught, snaring represents a crisis in wildlife conservation in Kenya and in other African countries.

Much of this bushmeat may enter the commercial meat marketing system in Kenya. A Kenyan butchery or meat market is typically a small stall without climate control and with little or no way to protect the meat from insects. As a result, meat stays in the market for a very short time, and markets keep little stock. Meat in these markets is supposed to be inspected, and this may be true for hanging carcasses, but much meat is sold as 'steak', irregular cuts of meat with no bones. Such meat cannot readily be identified as to the source species, but it is sold as beef or goat. The proprietor of a market may be able to buy bushmeat cheaper than domestic meat and either pass those savings along to customers or pass the meat off as domestic in source.

A 2004 study sponsored by the Born Free Foundation and carried out by the NGO Youth for Conservation and by the Kenya Wildlife Service demonstrated a high proportion of bushmeat in samples collected from 200 plus butcherries around Nairobi. Unfortunately, the results of this study were based on lab techniques that may have been flawed and were not very powerful.



WKU senior Allison Harnish interviews women from the villages of the Kasigau area in Southeastern Kenya to determine local attitudes towards wildlife tourism. (Photo taken by Doug McElroy)

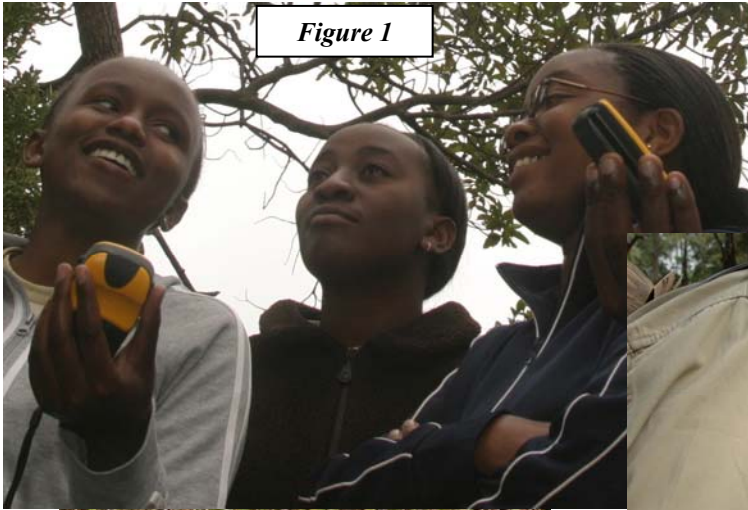


Figure 1



Figure 2



Figure 3



Figure 4

Figure 1: University of Nairobi and Youth for Conservation students and volunteers learn GPS techniques. (Photo by Chet White)

Figure 2: WKU President Gary Ransdell and a curious warthog at a conservation facility near Nairobi, Kenya. (Photo by Mike Stokes)

Figure 3: WKU senior Robin Brotherton removing a snare in the Taita-Taveta District of Kenya. (Photo by Doug McElroy)

Figure 4: Elephants in Tsavo National Park, once a hotbed of ivory poaching. (Photo by Maggie Mahan)

(Continued from Page 2)

In 2003, Dr. Charles Kimwele of UofN contacted Doug McElroy here at WKU because of some molecular wildlife forensic work done at WKU. DNA-based molecular forensics techniques are capable of identifying tissue to species of origin and, given a sufficient regional genetic database, of identifying the samples to area of origin. Such techniques are a powerful tool for identifying and prosecuting poachers, as has been demonstrated by the US Fish and Wildlife Service. We invited Dr. Kimwele to WKU to begin development of the molecular markers necessary for such work; and during our trip to Kenya this year, we collected meat samples from more than 130 meat markets. Dr. Kimwele is bringing these samples with him, and they will be analyzed in the WKU Biotechnology Center with the assistance of our students. Dr. Kimwele will be the first Walter Scott Visiting Professor of Physiology, an endowed position in the Department of Biology at WKU. The results from this research will represent an important step in Kenya's fight against poaching in the 21st century. We hope to eventually build a genetic database that will allow the Kenya Wildlife Service, UofN, and WKU to map origins and routes of bushmeat acquisition and distribution. Such knowledge should dramatically contribute to interdiction and prosecution efforts.

WKU students play major roles in these activities. Bradley Smith, a senior Biology major from Louisville, is writing his Honors Thesis on his upcoming analysis of bushmeat samples from 100 butcheries around Nairobi. This thesis will verify or disprove the Born Free study and represent our first verifiable data on the prevalence of bushmeat in the commercial meat industry of Kenya. Bradley arranged funding for this study and personally collected many of the samples.

WKU is also investigating the possibility of instituting a long-term wildlife ecology and sustainable development project in the Taita-Taveta District in southeastern Kenya near Tsavo National Park. Natalie Jones, a Biology graduate student from Owensboro, is writing her MS thesis on the potential for wildlife-based ecotourism and other sustainable development initiatives in this area. She will also be analyzing meat samples from rural butcheries in that region, a first step to quantifying the commercial snaring effort there. Allison Harnish, a WKU double major in Sociology and Anthropology, is writing her Honors thesis on community attitudes towards ecotourism in the villages in the area.

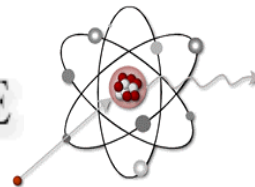
Other students from OCSE and other departments, including Matthew Ransdell from Political Science and Chet White from Photojournalism, accompanied us on this trip and contributed their expertise to our assessment of the region for future projects.

Such multidisciplinary, ambitious, student-oriented projects are the hallmark of the Applied Research and Technology Program and of the Biology Department. WKU is rapidly accelerating on a trajectory towards national prominence. Dedicated, academically talented, adventurous students such as those that contribute to this program are the fuel that will carry us to this new orbit. Some of these students have been chosen to be part of a group that will travel to Washington, DC this spring to compete with 50 other universities for Phase II funding from EPA. This Kenyan research program is currently partially funded by a grant to Drs. Stokes and McElroy from EPA for Phase I of its People, Prosperity and the Planet program. The students will make presentations in front of the National Academies of Science and Engineering, which comprise the top scientists and engineers in the United States. Last year this competition was carried nationally by MSNBC. Such national recognition is an acknowledgment of the emerging national excellence of WKU's research programs and of the caliber of its students.

We are grateful to many people for making this project a success. The support and encouragement here at WKU from Marilyn Anderson and Cindy Graham in the ARTP and OCSE Dean's offices is enormously appreciated, as is the encouragement of Blaine Ferrell, OCSE Dean. Richard Bowker, Head of the Department of Biology is a model of support for projects of enormous potential that do not necessarily fit old ways of operation. We very much appreciate Dr. Gary Ransdell's interest and enthusiastic participation in our project. The office of Study Abroad, ably led by Yating Chang, provided funding for some students. Finally, there is a tremendous amount of tedious work associated with such trips. While faculty take care of students and work on their projects, faculty spouses often do much of the heavy hauling. Julie Ransdell, Cheryl Kirby-Stokes, Kendra Jones and Pamela Kimwele spent many hard hours providing logistic and moral support in Kenya. The guidance and participation of staff and volunteers of Youth for Conservation and of the staff and students of UofN, notably Jackson Mugweru, were essential to our success.

*~Submitted by
Michael Stokes, Director
Center for Biodiversity Studies*

APPLIED PHYSICS INSTITUTE



2.5 MeV particle accelerator is under installation at the Applied Physics Institute

The 2.5-MeV particle accelerator has been transferred from the Army Research Laboratory to the WKU Applied Physics Institute. The High Voltage Engineering AK-2500 Van de Graaff accelerator is a positive terminal electrostatic accelerator driven by a mechanical belt system enclosed within a grounded, pressurized tank. Various types of positive ions (^1H , ^4He) can be accelerated to potentials up to 2.5 MV with currents up to 0.5 milli Amp.

The accelerator is under installation at the API facility. The team of undergraduate students under guidance of Profs. Womble and Barzilov, and senior applications engineer Mr. Paschal are working on various tasks of installation project: accelerator high voltage parts, vacuum hardware, radiation shielding, beam optics, and others.

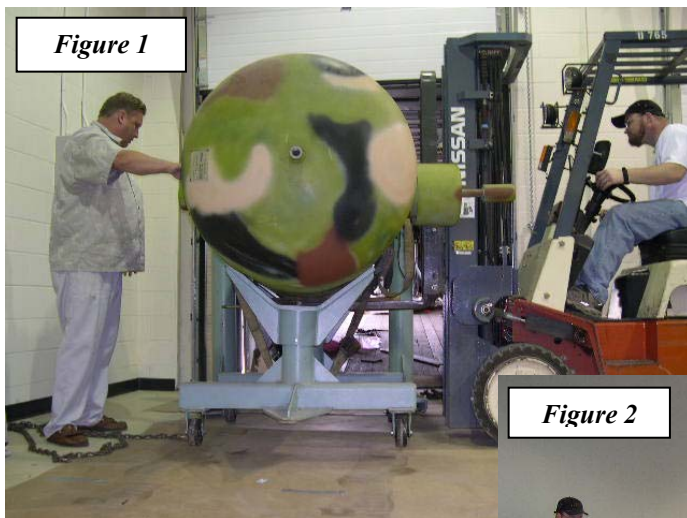


Figure 1

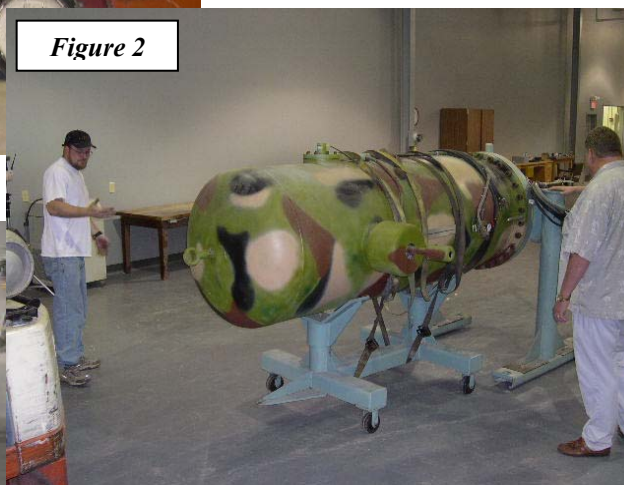


Figure 2

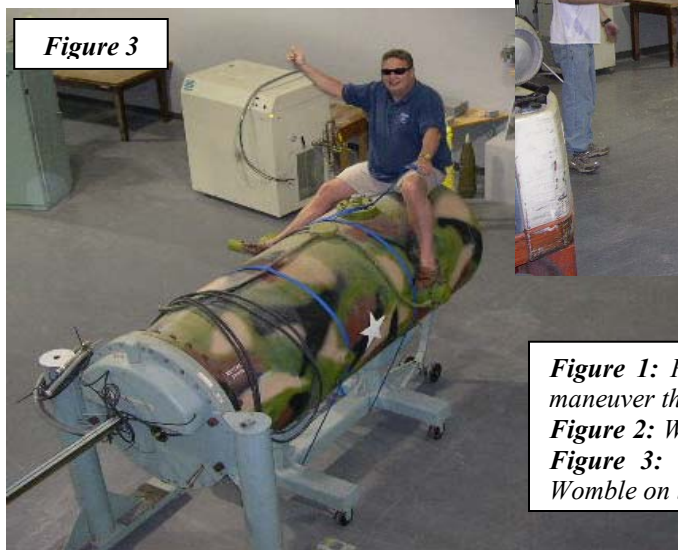


Figure 3

Figure 1: Phil Womble and Jon Paschal (on forklift) maneuver the accelerator out of the truck.

Figure 2: Womble and Paschal inspect the accelerator.

Figure 3: "Who says physics can't be fun?"—Phil Womble on the accelerator.

(Continued from Page 5)

This electrostatic accelerator will be used for establishing ion beam material analysis laboratory (IBMAL). When completed, the accelerator-based IBMAL will include several ion sources, focusing and analyzing magnets, beam lines, and high-vacuum end stations with sample environment handling and control capabilities. The accelerator will be used for integrated research and educational activities involving undergraduate students. The IBMAL providing service on a wide range of near surface analytical tools for investigating material problems will be utilized for interdisciplinary research projects in various disciplines where modification and precise analysis of materials are essential: Condensed Matter Physics, Chemistry of Materials and Analytical Chemistry, Mechanical Engineering, Nuclear and Atomic Physics, Biology, Geology.

We plan to routinely perform experiments using MeV-range ion beam analytical techniques, including Rutherford backscattering spectrometry (RBS) to determine the elemental composition of samples as a function of depth by measuring the energy spectrum of backscattered He ions, particle induced X-ray emission (PIXE), ion channeling spectrometry to determine sample quality and the distribution of impurities, resonant scattering and nuclear reaction analysis (NRA) which can be applied to certain light isotopes to measure reaction products and/or gamma rays from proton induced nuclear reactions.

*~Submitted by
Phillip Womble
Director, Applied Physics Institute*

WKU API Awarded U.S. Department of Homeland Security Project to Develop a Wireless Electronic Monitoring System for Securing Milk Transport from Farm to Processor

Bowling Green, KY – The U.S. Department of Homeland Security has awarded University of Kentucky (UK) and Western Kentucky University's Applied Physics Institute (WKUAPI) a three-year, \$1,500,000.00 research and development project to secure milk transport from farm to processor.

The award was announced in Somerset, KY by The National Institute for Hometown Security. Congressman Hal Rogers made the announcement. He was joined by U. S. Department of Homeland Security Under Secretary Charles McQueary, who leads the department's Science and Technology Directorate.

Prof. Fred Payne (UK) is the principal investigator for the project. Prof. Phillip Womble, co-principal investigator of the project and director of API, will lead WKU API's research team. Industrial collaborators include companies from Kentucky and Tennessee: Alan Wilson Trucking and Slayback Milk Transport (milk hauling); Southern Belle Dairy and Winchester Farms Dairy (milk processors); Bluegrass Tank & Equipment, Starr Stainless, Inc. (milk tank manufacturers); Dairy Farmers of America MidEast Council (dairy producer). Northwest Nuclear, LLC will collaborate in wireless asset tracking development. Balluff, Inc. will support the project with electronic sensors.

The contamination of bulk food poses a high consequence threat to our society. The goal of the proposed research is to develop a wireless security system that will assure the delivery of milk, milk samples, and security information from the dairy farm to the dairy plant. A systems approach will be used to identify the critical points for obtaining multi-dimensional security information: security event, time of occurrence, geographic location; and identity of truck driver. The wireless system will be designed to accommodate the future likelihood that dairy herd information must be transported to the dairy plant with the milk. The system will be designed to operate automatically and require minimal or no attention by the milk truck driver. A demonstration system will be tested in collaboration with farms and dairy plants.

Project developments will include a standard data collection protocol that is cost effective, compatible with existing milk transport infrastructure and has the support of the dairy farmers, milk haulers, and processors. The developed electronic system will be commercialized by presenting it to the collaborating dairy tank manufacturers, sensor manufactures and other interested parties. The milk transport security protocol may be applicable toward other bulk food transport situations both nationally and internationally. Successful development of this project will add significantly to the national security infrastructure for bulk food transport.

*~Submitted by
Phillip Womble
Director, Applied Physics Institute*

WKU API Receives U.S. Department of Homeland Security Award to Develop Rail Tank Car Leakage Detection System

Bowling Green, KY – The U.S. Department of Homeland Security has awarded Western Kentucky University's Applied Physics Institute (WKUAPI) and the Institute for Scientific Research, Inc. (ISR) a one-year, \$752,423.00 research and development project to improve the safety of the nation's railways.

The project "Rail Tank Car Leakage Detection System (RLEAKS)" is aimed to develop a system that can detect and locate pinhole leaks in rail car containment vessels and provide alerts to railroad operators and security personnel. Pressurized rail tank cars transport and distribute large volumes of volatile liquids and gases throughout the nation each day, much of which is hazardous and/or flammable. RLEAKS will be a low-cost, distributed wireless network of acoustic sensors that incorporates intelligent location decision-making to monitor leaks, while minimizing false alarms and remaining non-intrusive to railroad operation.

The award was announced in Somerset, KY by The National Institute for Hometown Security. Congressman Hal Rogers made the announcement. He was joined by U. S. Department of Homeland Security Under Secretary Charles McQueary, who leads the department's Science and Technology Directorate.

"We are looking forward to working with ISR on this project to protect critical infrastructure in the United States. We appreciate the leadership of Congressman Hal Rogers in developing the National Institute for Hometown Security and allowing us to participate in this program," said Prof. Phillip Womble, director of API and principal investigator of the project.

"We are honored to be selected for the award. We are excited to develop and test cutting edge scientific approaches for critical infrastructure protection," said Prof. Alex Barzilov, associate director of API and co-principal investigator of RLEAKS project.

The main topics to be addressed in the RLEAKS project includes the following:

- Acoustic sensor adequacy with respect to environment, sensitivity, precision, line-of-sight limitations, power, weight, and volume;
- High-frequency sampling hardware and software;
- Algorithms for leak spectral analyses and isolation, first order leak detection, false alarm prevention, and leak localization;
- Integrated wireless network capability; and
- Ground control station for data fusion, visualization and storage, as well as wireless network management.
- A complete system demonstration to exhibit the capabilities and application of the sensor network will be conducted at the project's conclusion.

About the WKU Applied Physics Institute:

The Applied Physics Institute of Western Kentucky University has been performing homeland security oriented research and development since its inception in 1994. It has developed and helped to commercialize explosive, chemical agent, and radiological/nuclear detection systems. For information, visit www.wku.edu/API.

About the Institute for Scientific Research, Inc.:

The Institute for Scientific Research, Inc. (ISR) specializes in research and advanced development, providing multidisciplinary solutions to the leading-edge technology challenges facing its government, military and commercial customers. The organization offers an environment for cultivating fresh ideas and scientific discoveries from among a distinguished staff of scientists, engineers and support personnel. ISR is headquartered in Fairmont, West Virginia. For complete information, visit www.isr.us.

*~Articles Submitted by
Phillip Womble
Director, Applied Physics Institute
and Alex Barzilov
Assistant Professor
Applied Physics Institute*



Materials Characterization Center

Environmental Analysis Experiences for Appalachian High School Students and Teachers

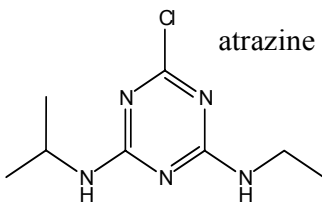
The PI (Eric Conte) and graduate student (Cierra Cross, African American female) hosted two high school teachers (Rebecca Smith and Susan Peck) from Appalachia (Adair County Kentucky) for a week long investigation of the environmental analysis of atrazine. On Monday, the teachers had an orientation meeting with the PI and graduate student. We then met with Dr. Chris Groves in the Geology Department and were given a detailed presentation about Karst aquifers and the transport of atrazine in these systems. We also met with Dr. Cathleen Webb of the Department of Chemistry for a discussion on the toxicology of atrazine. The next day was spent at Mammoth Cave National Park. Former Western Kentucky graduate student in hydrology, Katie Seadler, works at the park directing the environmental analysis laboratory. Ms. Seadler discussed proper sample handling procedures and brought us to several sites for hands-on sampling of water. We were also given a tour of the analysis laboratory and a private tour of a cave passage in the park. The next day (Wednesday) we met with Dr. Ouida Meyer in the Biology Department to discuss the possible ecological impacts of atrazine. The teachers were given a demonstration and then performed hands-on immunoassay determinations of atrazine with the PI and graduate student. On the fourth day the teachers were given a lecture on gas and high performance liquid chromatographic analysis by the PI. The teachers spent time in the laboratory of the PI and were introduced to the use of the high performance liquid chromatograph. The teachers injected samples and interpreted chromatograms. The last day, the teachers took part in the determination of atrazine by EPA methodology using gas chromatography-mass spectrometry at the Institute for Combustion Science and Environmental Technology at Western Kentucky University headed by Dr. Wei-Ping Pan in the Department of Chemistry. The teachers went through the entire sample handling and analysis procedure with the assistance of undergraduate students, Pauline Hack and Nathan Whitely.

The PI visited the teachers' high school (Adair County High School) in April 2005 and gave a presentation to students on atrazine transport. The day before the PI visit, students collected field samples in their neighborhoods. When the PI arrived, students performed hands-on immunoassay determination of atrazine using a kit the high school kept. We mapped the location of the collected samples and recorded the observed concentrations of atrazine. We discussed how variations can occur according to time of year, rainfall amount and type of water sample collected (lake, river, pond etc.). The PI welcomed these high school students to visit the Chemistry Department at Western Kentucky University and spent a day touring the facilities.

The teachers commented that they were very unsure of this workshop initially. They also mentioned they were very pleasantly surprised and how they relished the educational opportunity they had. The PI will offer this workshop again in the summer of 2005 with teachers from Edmonson County, Kentucky. We are grateful for the NSF support of this invigorating educational project.



Chemistry students from Adair County High School (Appalachia) performing atrazine immunoassay analysis and mapping the results of collected water samples.



*~Submitted by
Eric Conte, Director
Materials Characterization Center*



WKU Geoscience Students Study Natural Resource Management In Alaska's Tongass National Forest

Bowling Green, Ky. - A group of seven Western Kentucky University graduate and undergraduate students, led by Geography Professor Chris Groves and U.S. Forest Service Geologist Jim Baichtal, traveled to Southeast Alaska's Tongass National Forest for a weeklong short course this summer.

The group flew to Ketchikan, and from there traveled by floatplane to Prince of Wales Island, the site of the course. Tongass National Forest, the country's largest with an area of 17 million acres, lies primarily on remote islands off the western coast of Canada's British Columbia and contains the planet's largest remaining expanse of uncut coastal rain forest. The area also contains very significant cave and karst resources, including caves with archeological and fossil remains that offer key support for a theorized coastal migration route taken by ancient humans making their way from Asia into North America.

While the "glue" that bound the course together was the focus on various aspects of karst hydrology and geomorphology of the area, these are closely related to numerous aspects of resource management issues that challenge Forest Service land managers. One issue the class studied, for example, is how very acidic water draining from peat bogs in the island's mountain areas interacts with limestone bedrock in the karst areas, with the resulting geochemical processes having significant impact on the productivity of salmon spawning rivers draining from the large karst springs at the base of the mountains.

This class continued a growing, five-year collaboration between WKU and U.S. Forest Service scientists in Alaska. Two Hoffman Institute graduate students are working on thesis research projects in Tongass National Forest, following Bill Curry who completed his research on cave sedimentation rates there in 2002. The students, Johanna Kovarik and Melissa Hendrickson, are studying the relationships between logging practices and resulting impacts on groundwater hydrology and geochemistry.

"In my mind, these types of interactions are at the heart of the mission of WKU's Applied Research and Technology Program," said Dr. Groves, director of the Hoffman Environmental Research Institute within the ARTP. *"They provide great experiences that increase the technical fluency of our students, while proving a real service to federal land managers through research that helps them better understand the resources they are charged with protecting."*

Dr. David Keeling, Geography and Geology Department Head, added that *"this summer experience is an excellent example of how programs beyond the traditional classroom can enhance the learning process and provide students with a real link between the theoretical and the practical."*

~WKU Press Release by Tommy Newton

~Submitted by Chris Groves

Director, Hoffman Environmental Research Institute



Figure Left: Chris Groves and Scotty Sharp examine a fine marble karst exposure on northern Prince of Wales Island (picture by Sarah Rehkopf)

Figure Right: Alanna Storey, Sarah Rehkopf, Samantha Kramer, and Scotty Sharp take a break in White Canyon Cave.





Figure 1



Figure 2



Figure 3



Figure 4



Figure 5



Figure 6



Figure 7



Figure 8

Figure 1: The WKU class with Forest Service Geologist co-instructor Jim Baichtal. **Figure 2:** Forest Service Geologist Jim Baichtal examines remotely-placed hydrologic monitoring equipment that had been damaged by a black bear not long before the class visit to the site.

Figure 3: Melissa Hendrickson in Cavern Lake Cave. In summer salmon swim upstream completely through this cave to spawn in the lake just upstream. **Figure 4:** The class listens to discussion within the mature rainforest on Prince of Wales Island. **Figure 5:** The class arrives at Thorne Bay. **Figure 6:** Sam Kramer examines a glacially deposited boulder in a current-day estuary. **Figure 7:** Graduate students Sarah Rehkopf and Melissa Hendrickson rest at the summit of Deer Mountain near Ketchikan. **Figure 8:** The class flew by floatplane to the small town of Thorne Bay, on Prince of Wales Island. The following day the group traveled several hours north on the island to the El Capitan camp where the class took place.

WKU Hoffman Institute Welcomes Spanish Post-Doctoral Research Scholar

Bowling Green, Ky. - Western Kentucky University's Hoffman Environmental Research Institute is honored to welcome Dr. Angél Fernández-Cortes, an expert in environmental monitoring from Almería, Spain, as a visiting scholar for the Fall 2005 semester.

Dr. Fernández received his Ph.D. in 2004 from the University of Almería and was subsequently awarded a Post-Doctoral Fellowship by his university to fund his research program at WKU.

Dr. Fernández's expertise in electronic computer data logging of field environmental parameters is proving to be especially useful in his work here at the Hoffman Institute's field site at Cave Spring Caverns in northern Warren County.

That project, in collaboration with USDA Agricultural Research Service hydrologist Dr. Carl Bolster, is using this technology to make high resolution measurements of karst groundwater quality beneath actively farmed fields and to understand better farming practices ultimately designed to find a balance between protecting groundwater quality and enhancing the economic health of farmers on the landscape.

After investigating a variety of research programs at universities around the world, Dr. Fernández applied to work at WKU because of the type and quality of the university's karst research efforts.

"Angél is a great addition to our research group this year and interacts very well with everyone here," said Dr. Chris Groves, Dr. Fernández' supervisor and director of the Hoffman Institute within WKU's Applied Research and Technology Program (ARTP).

In between his research work at WKU this summer, Dr. Fernández traveled with his WKU colleagues to the annual meeting of the National Speleological Society in Huntsville, Ala., and participated in a weeklong course in Natural Resource Management in Southeast Alaska's Tongass National Forest.

He will also give a seminar at WKU on Sept. 16 about his work on Spain's "giant geode," a 30-foot long and 10-foot high void recently discovered in a mine whose walls are covered with gigantic ice-clear crystals, some as long as two feet. Dr. Fernández's monitoring work in the void, which will be designated as a Spanish Natural Monument, showed that visits by three people for as short a period as 10 minutes raised the relative humidity enough to deteriorate the soluble gypsum crystals.

Dr. David Keeling, Geography and Geology Department Head, noted that "the fact that the department's research programs are now attracting post-doc researchers speaks both to the level at which the research groups are operating, as well as, in this case, the growing international reputation of WKU's karst programs." In 2004, Dr. Ezzat Raeisi, a noted karst scientist from Iran, studied at the Center for Cave and Karst Studies, also within the ARTP.

~WKU Press release by Tommy Newton

~Submitted by Chris Groves

Director, Hoffman Environmental Research Institute



Figure Above: Dr. Fernández travels by floatplane to participate in a 2005 WKU Resource Management class in Alaska's Tongass National Forest.

Figure Right: Dr. Fernández has participated in numerous cave expeditions while in Kentucky, for scientific monitoring, exploring, and survey.





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