SEPA SCIENCE EDUCATION PARTNERSHIP AWARD NEWSLETTER

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August 2009 Edition, #6

HI-LITES

In this issue…

CHECK IT OUT!

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SEPA WEBSITE

The SEPA website is a great resource. Projects are categorized into curricula, films/multimedia, museum exhibits, equipment loans, teacher workshops, student programs, and parent workshops for easy access by users. You can also search for projects by PI name, project title, funding years, and key words. Be sure to visit the SEPA website, (http://www.ncrrsepa.org/) and send all updates about your project to the SEPA website staff, (teachhealthk-12@uthscsa.edu).

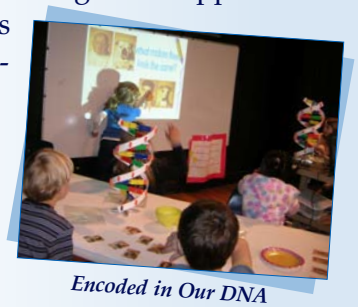
"DNA is Elementary"

Helping K–12 Students Become Fluent in the Language of DNA

Barbara R. Baumstark, Ph.D., PI

In Fall 2008, Georgia State University (GSU) was provided with funding from **SEPA** to explore the metaphor of DNA as a language. Our prediction is that the language of DNA, like other second languages, can be effectively mastered by children at an early age. Through this program, we believe we can reinforce students' language and spatial skills while simultaneously helping them to understand the fundamental principles of classical and molecular genetics. This will be accomplished by developing a series of teaching modules focused on DNA and genetics which are designed to appeal to children in grades 1 – 3. When introduced to genetics in an age-appropriate manner, children as young as six years old successfully grasp concepts (*such as dominant/recessive relationships*) which are often challenging to older students following a traditional curriculum. Children as young as six years of age can effectively grasp concepts that make up the foundation for our understanding of molecular genetics.

Genes Make Each of Us Unique



Encoded in Our DNA

> *"Our prediction is that the language of DNA, like other second languages, can be effectively mastered by children at an early age."*

Our project goals are:

- To ***work*** with teachers in the design of age-appropriate, inquiry-based learning modules for Georgia K-12 students which provide a solid foundation in genetics.
- To ***pilot-test*** these learning modules in the ***City Schools of Decatur***, a suburban school district close to Atlanta, Georgia.
- To ***conduct*** follow-up studies on children participating in the pilot project in order to assess the effect of these modules on their subsequent mastery of molecular genetic concepts.
- To ***incorporate*** the elements of the pilot project into a program that can be delivered to schools throughout Georgia.

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University of Kansas Medical Center
Department of Pathology • Patricia A. Thomas, M.D., PI

camp pathological

Camp Path*O*logical: A Life Science Training Program for Students and Families

Family Genetics Night, in July provided an evening of fun and learning about DNA through interactive learning stations for children, teens, college students, parents and grandparents. Virtual stations, DNA puzzles, building DNA models, writing post cards to genetic diseases found through the DNA recipe station kept everyone busy learning new and different areas of genetic identity. **SEPA** partner, Kansas City, Kansas Community College hosted the event. A second Family Genetics Nights in July "Disparities in Infant Mortality" supplied students with the knowledge of racial/ethnic disparities and the complications of teen pregnancy.

Camp Path*O*logical summer program has been an active model of creative, relational instruction, interactive learning and student presentation development. With a theme of **Infant Mortality** instructed through the healthy mother/baby and "what went wrong?" model, students learned to identify healthy anatomy of the male and female reproductive systems and relate this information to the role hormones play in these systems.

Through instruction and models, pathology department specimens and through tours, students became acquainted with primary causes of US infant mortality. Students learned to analyze symptoms and began analysis of how to influence their community in creating a healthy model for pregnancy and child birth. They participated in a simulated birth with the Nursing Skills Lab Team. Using a "what went wrong?" model, the SIM mother was programmed to have gestational diabetes, extended labor and birth presentation difficulties.

Camp Path*O*logical high school students coached *"SIM Mom Cynthia"* through childbirth and delivery of *"SIM Baby Hal"*. Students learned the importance of proper diet and exercise in sustaining a healthy pregnancy.

Students developed Media Campaigns for radio, TV, Internet and print news on areas of the curriculum to display at Closing Ceremonies, July 24th in the final week of **Camp Path*O*logical**. Proposals were made by students to area radio stations, Public Health Centers and cable TV through Kansas City, Kansas Community College to display and broadcast their campaigns. **Camp Path*O*logical** faculty and staff were trained in learning styles and interactive arts by an artist collective, Storytellers Inc. to enhance their relational, instructional methods.

Ten Research Interns working with NIH sponsored Research Teams at KUMC have been engaged in research team work with the General Clinical Research Center. Four **Biomedical Library Interns** continue to assist in identifying evidence-based literature for **Camp Path*O*logical** curriculum while Biomedical Interns provide instruction to the 25 **Camp Path*O*logical** students on Academic Medical Search through the support of Archie Dyke Medical Library staff.

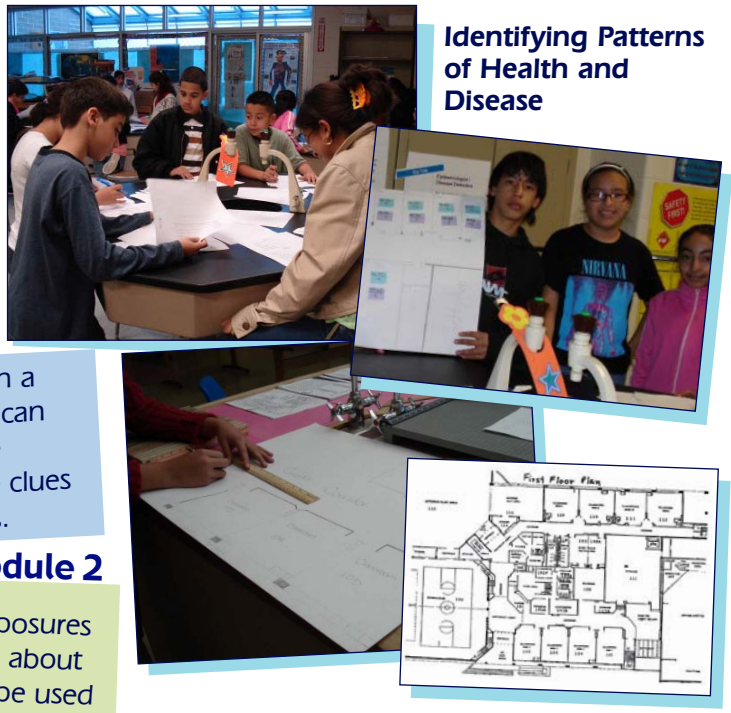
Participants in **Camp Path*O*logical** *activities*

OVERVIEW: **Camp Path*O*logical** *continues to increase the students' understanding of clinical research, healthy life choices and provides options for a future role in community health – while introducing them to a university research hospital. This has been accomplished by providing them with hands-on learning focusing on clinical study, research and clinical trials.*

"Epidemiology and the Energy Balance Equation"

Mark A. Kaelin, Ed.D./Wendy Huebner, Ph.D.

This **SEPA** project will create, prepare teachers to teach, and evaluate a curriculum, called "**Epidemiology and the Energy Balance Equation**". The curriculum will help develop middle school students' understanding of the science of epidemiology by exploring patterns of physical activity and diet and their health consequences. This will be done by creating five teaching modules, each one developing one of the following five enduring epidemiological understandings.



Identifying Patterns of Health and Disease

Module 1

Health and disease are not distributed haphazardly in a population. There are patterns to its occurrence that can be identified through surveillance. Analysis of the patterns of health and disease distribution can provide clues for formulating hypotheses about possible causes.

Module 2

Causal hypotheses can be tested by observing the exposures and diseases of selected groups of people as they go about their lives. Data from these observational studies can be used to determine if an exposure and a disease are associated.

Module 3

Causation is only one explanation for finding an association between an exposure and a disease. Because observational studies are complicated by uncontrolled factors by the observer, other explanations must be considered. Judgments of causality are based on a review of a body of scientific evidence.

Module 4

When a causal association has been identified, decisions about possible prevention strategies are based on more than the scientific evidence. Social, economic, ethical, environmental, cultural, and political factors may also be considered in decision-making.

Module 5

The effectiveness of a health-promoting strategy can be evaluated by observing the frequency of an outcome in groups of people who were, and were not, exposed to the strategy. Costs, trade-offs, and alternative solutions must also be considered when evaluating the strategy.

A key component of the project is the after-school Epidemiology and Public Health Clubs that will provide a venue that circumvents the barriers of introducing new and innovative science curricula into already-packed middle school schedules.

The prototype for the after-school Epidemiology and Public Health Clubs has been established by science teachers, Lynn Tarant and Jeanne Murgolo, at Paterson, NJ's Charles J. Riley School 9.

When the Club began in September 2006, it was hoped that 15 middle school students would enroll. In reality, more than 30 students attended the first meeting and continued to attend throughout the next three school years. The pictures illustrate an important highlight of the Club experience, that of conducting a school-wide epidemiology investigation that called for Club members to explore the distribution of absenteeism among School 9 students over the course of the school year and to look for patterns in terms of the descriptive epidemiological factors of person, place, and time. One can see from the pictures how involved the Club students were in this investigation.

For the new **SEPA** project, "**Epidemiology and the Energy Balance Equation**", authentic assessments will be used to test the effectiveness of each of the **five teaching modules** in developing students' grasp of the enduring understandings. For example, the degree to which students have developed the second enduring understanding, about testing hypotheses, will be assessed by having students conduct investigations to test specific hypotheses, such as: **Students who watch more television eat more junk food**, among students from a particular class. To do so, each student will need to develop a survey instrument to collect data about the variables, ask for informed consent, collect and analyze data about the variables, calculate the relative risk of the outcome among students with varying degrees of exposure, write accurate statements about the hypothesis, and present their findings.

Investing in the Future: Collaborative Research Experiences for Students and Teachers A Special Education Partnership Award (SEPA/CREST)

Judith S Bond, Ph.D., Principal Investigator

SEPA students work in teams using pipettes to detect diabetes genes.

Family members prepare 100 calorie snacks.

Investing in the Future: Collaborative Research Experiences for Students and Teachers was developed over several years by Middletown Area School District, Penn State Hershey, Penn State Harrisburg, Lincoln University of Pennsylvania and the Whitaker Center for Science and the Arts. We have completed our first programmatic year of the **SEPA/CREST** program.

Our first activity was with our community partner, the Whitaker Center for Science and the Arts in Harrisburg PA. The **SEPA/CREST** team organized a one-day program in April 2009 with eight hands-on activity stations. The theme was **Pathways to Health**, with a focus on diabetes, nutrition and obesity. The hands-on activities included measuring glucose in simulated blood, blood pressure station, touch sensation and discrimination, visual acuity, weighing out amount of sugar

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Collaborations to Understand Research and Ethics (CURE)

Northwest Association for Biomedical Research ▪ Seattle

Jeanne Ting Chowning, M.S., PI

Embryonic stem cell research. Personalized genetic testing. Clinical trials in developing countries. Students encounter news stories on topics such as these on a regular basis. How are they being prepared to participate, as citizens, in complex conversations about the role of biomedical research in our society? How can students learn to make reasoned judgments about difficult bioethical choices?

CURE 2009 Student Research Fellows program

The need for our citizens to understand science and its connection to contemporary social issues is fundamental to developing a 21st century workforce. We must also prepare students to make difficult decisions about scientific discoveries that will impact them.

Collaborations to Understand Research and Ethics (CURE), a program of the **Northwest Association for Biomedical Research (NWABR)** focuses its efforts on promoting an understanding of the role of science in society. The program, which has just completed its first year, builds upon five years of previous **SEPA** funding. **CURE** engages teachers and students directly with researchers and bioethicists as they explore the critical role that both science and the ethics play in the responsible conduct of research.

Key programmatic components of **CURE** include the **Student Research Fellows program**, which provides an introduction to translational research and ethics (especially for high school students from backgrounds underrepresented in science), an Ethics in Science secondary teacher professional development program, curriculum development in Introductory Bioethics and Research Ethics topics, and a Youth Ethics Summit. These programs and resources are all developed in conjunction with highly experienced teachers, researchers, school districts, and ethicists.

More information about the **CURE** program and NWABR's resources are available at www.nwabr.org.

Learning Biological Processes through Animations and Inquiry: A New Approach

Principal Investigator ▪ J. Steve Oliver, Ph.D.

The participants of the **SEPA** project at the University of Georgia have worked the past 9 months to design and build interactive 3-D animations of biological processes that are incorporated into inquiry-based clinical case studies. Building these animations is the central focal point of our project titled: ***Learning Biological Processes using Animations and Inquiry***. The team working on this project include a 3-D computer graphics animator, Jared Jackson and a computer programmer, B.J. Wimpey who literally bring to life the visualizations of the biological processes, working with high school science teachers, professors, scientists, curriculum experts, and instructional designers. The faculty members actively participating in this project represent a variety of areas of expertise, including medicine, veterinary medicine, science education, mass communications, and dramatic media. Every Thursday morning this team and graduate students in science education meets in the College of Veterinary Medicine to evaluate improvements that have been made during the previous week and to discuss issues relevant to creation of these new curricular materials for high school science students.

Our first product, which we call **OSY – osmosis**, has been developed to a beta-test version that was recently tested with 35 high school students who were on campus for a STEM academy. The STEM academy was created by the Department of Mathematics and Science Education to expose high school students to possible careers in mathematics and science teaching. For our session during the Academy, we loaded **OSY – osmosis** on the computers of a College of Education computer lab, turned the high school students loose, and watched in awe as they were seriously engaged in the process while simultaneously enjoying themselves. Watching members of our **'target'** audience use our initial **SEPA** product was not only gratifying but it also gave us several ideas for improving it in preparation for a research effort we will begin this fall to evaluate **OSY – osmosis** and the three other inquiry-based products we have been working on since the start of this project.

In addition to **OSY – osmosis**, our team is working on building interactive animations for the subject matter content of osmosis, using cerebral edema as the focus of the case study, gas exchange in the lung of a person after a chlorine gas spill, and a dialysis machine filter (*commonly called an artificial kidney*) being used in a person with kidney failure secondary to diabetes. In each case, the animations will allow the student to explore, interact, and conduct inquiries about the effects of the particular diseases on the biological structure and function. To make these experiences real and meaningful to the students, we plan to include 8-10 seconds of video footage of patients (*most likely actors*) showing clinical symptoms of the diseases. In some cases these patients are humans and in other cases they will be veterinary patients such as dogs and calves.

Biology learners will be able to move through the blood as it is being filtered.

For the case study on **filtration**, our computer graphics artists have built 3-D models of a hemodialysis filter (*artificial kidney*). The high school students will be presented with a description of a diabetic patient in renal failure that is going to require dialysis for the first time. The students will be given background material (*history and laboratory data*) about this patient and then will briefly see the patient immediately before the dialysis session begins. They will then *fly into* the 3-D model of a dialysis filter,

"…and watched in awe as they were seriously engaged in the process…"

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A New Approach...*continued, previous page*

where they will be able to move from the blood into the dialysate and take measurements. In doing so, the students will learn the relative sizes of blood components (*cells, proteins, urea, glucose and electrolytes*), the goals of dialysis (returning blood concentrations of urea and potassium to normal levels, and removing excess body fluid), see how dialysis improves the patient's life, and gain an appreciation for the need for repeated dialysis in these patients.

On July 25th we concluded our first summer workshop with our partner teachers. On each day of that week, we met to examine the 3-D models and animations we have created thus far and to prepare these animations for use in high school science classrooms. We began by examining the animation we have created about diffusion. For this module, we have are creating an artificial lung the students will explore to collect data about gas exchange. The module will include both a diseased and normal lung for their data collection and comparison. For filtration, we are creating two related modules. The first will be the artificial kidney used for hemodialysis and the second module will be a renal glomerulus in a human patient with diabetes. In the latter module, the students will enter the kidney via the renal artery, fly down to the glomerular capillaries, and then be able to explore and measure the concentrations of the constituents of the blood and glomerular filtrated. Finally, we examined the animations related to the role of osmosis on the development of cerebral edema and its effects on neuron function in the brain. The students will learn how brain function is impacted by osmotic processes when concentrations of electrolytes in the blood and interstitium are abnormal.

3-D model of dialyzer

We plan to make an initial tryout of **OSY** and the animations in classrooms beginning in mid-September. Future updates to come. For more information, go to http://sites.google.com/site/teachbiology3d/.

Investing in the Future...*continued*

in common foods and beverages, preparing a 100 calorie snack, hop-skip-jump exercises, and paper chromatography. There were three mini-lectures: ***obesity, diabetes*** and the ***normal bacterial that inhabit the human body***. Over 250 visitors to the museum took part in the activities.

Museum visitors separate dyes in food colors under the direction of graduate students.

The first summer program involved 22 10th grade students and 5 teachers from the Middletown Area School District, two undergraduate teaching assistants from Lincoln University, and faculty from Penn State Hershey and Penn State Harrisburg. **Summer 1** was one week long with the students in the laboratory all day. The participants were organized into 6 teams with a team name selected by the students. The high school teachers worked with a student group in the morning, and then met with a faculty member from Penn State Harrisburg to discuss science pedagogy. **Day 1** focused on the anatomy of the normal laboratory mouse, including a presentation on the care and use of animals in research and a tour of facilities of the Department of Comparative Medicine. **Day 2** focused on induced diabetes and mice that inherited diabetes. Blood glucose was measured and the presence of the diabetes gene determined by Polymerase Chain Reaction amplification and electrophoresis. On **Day 3**, the participants prepared and cultured bacteria from mice, and conducted a survey for protease and catalase activities in foods and other commercial products such as detergents. On **Day 4**, the participants examined their bacterial colonies and examined stained bacteria under the microscope. The students also determined which colonies had catalase activity. The participants toured the library to see the transformation from print archives to computer based search stations. They prepared PowerPoint presentations describing their experience in **SEPA/CREST**. **Day 5** used problem/ case-based learning to explore the genetic bases of disease. The final afternoon consisted of presentations by the teachers as a group and by each of the six Teams. A brief graduation ceremony and reception followed.