Since 1996, the Partnership for Minority Advancement in the Biomolecular Sciences has provided a slate of regional workshops for North Carolina biology teachers interested in learning important new scientific techniques. PMABS trains teachers to use Boston University School of Medicine’s cutting-edge CityLab modules in the biomolecular and health sciences. These inquiry-based modules, which address crucial topics in biology and place learning in the students’ hands, also effectively address strands and competencies in the North Carolina Standard Course of Study. PMABS is pleased to report that North Carolina teachers continue to leave PMABS workshops with proven curricular training, dry-lab materials, a $500 supply allowance – and, most importantly, an enthusiasm about teaching the CityLab modules to their students. However, many schools, particularly those in rural areas, lack basic laboratory resources for the delivery of the module’s all-important wet-labs. It is this need that PMABS hopes to address through Widening Horizons In Science Education (WHISE), a plan to encourage investment in the science infrastructure of individual schools in rural North Carolina.

The MYSTERY of the CROOKED CELL

Make a WHISE investment in . . .

About this Module

*The Mystery of the Crooked Cell* invites students to determine whether a hypothetical patient has normal blood cells, sickle cell trait, or sickle cell anemia. In the process, they come to understand the molecular basis of this incurable disease.

**DRY LAB:** In small groups, students investigate clues designed to lead them to a diagnosis. They manipulate models of normal and sickled cells moving through blood vessels, and other models of normal and sickle cell hemoglobin responding to the type of oxygen debt that causes sickle cell anemia’s painful symptoms. They use microscopes to compare samples of normal blood with that of the patient. And they examine the patient’s family history to determine the genetic probability that this patient inherited sickle cell anemia.

**WET LAB:** Hemoglobin electrophoresis is the most accurate test for sickle cell anemia. In a remarkably short time, students learn the complicated mathematics (*e.g.*, calibrating a Pipetman to one millionth of a liter) and technique of micropipetting, as well as the preparation of agarose gels, which electrophoresis requires. Every student has the opportunity to micropipette samples of hemoglobin into the gel he or she has prepared. Then, after applying an electrical current (a positive charge that attracts the negatively charged hemoglobin), the student is able to analyze the variations in banding that indicate whether the patient has sickle cell anemia, sickle cell trait, or normal hemoglobin.

Why Is This So Important?

In his book *Drawing Blood: Technology and Disease Identity in Twentieth-Century America*, WHISE collaborator Dr. Keith Wailoo describes the historical importance of sickle cell research, which provided “a conceptual cornerstone in the construction of molecular biology.” Dr. Francis Collins, the head of the Human Genome Project, recalls that – when he was in medical school at the University of North Carolina at Chapel Hill – a class discussion of sickle cell anemia inspired his interest in the relationship between genetics and medicine. Recognizing the benefits that derive from understanding sickle cell anemia, WHISE will be training North Carolina teachers in the pedagogy of two complementary modules: NIH’s *Human Genetic Variation*, which explores the cause of sickle cell disease and the benefit of human variation; and WHISE’s *Sickle Cell Anemia and the African Diaspora*, which addresses requirements for U.S. History and World History courses. Clearly, funding *The Mystery of the Crooked Cell* is a wise investment across the curriculum.
These supplies are needed for the important wet-lab component of *The Mystery of the Crooked Cell*. The items needed are listed in detail to underscore the complexity and necessary expense of modern biology education. A textbook simply cannot provide an adequate substitute for hands-on training in skills that are required for study at the college level or for work in a commercial or academic research lab. The costs given reflect North Carolina State Contract prices.

### Defining Terms

Just as the study of biology introduces young people to a whole new scientific vocabulary, so too does any involvement in the support and funding of biology education. Definitions of the following terms may be helpful in understanding the wish-list opposite:

**ELECTROPHORESIS:** a laboratory technique involving the separation of electrically charged particles (e.g., the protein called hemoglobin) placed in a solution (e.g., agarose gel), by passing electrical current through that solution.

**HEMOGLOBIN:** a protein in red blood cells (RBCs) that has two main functions: carrying oxygen throughout the body, and giving shape to the RBCs. The two main types of hemoglobin are hemoglobin A (HbA, “normal” hemoglobin) and hemoglobin S (HbS, “sickling” hemoglobin).

**MICROPIPETTE:** an instrument that measures and delivers minute volumes of liquid (e.g., samples of hemoglobin) in extremely precise amounts.

### Standard Course of Study Alignment

*The Mystery of the Crooked Cell* meets these biology competency objectives set for secondary schools by the North Carolina Department of Public Instruction: 1.01, 2.01, 2.03, 2.04, 2.05.

### Contact

For more information about WHISE, PMABS, and the CityLab curriculum:

*Widening Horizons in Science Education*

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