Biomedical Sciences Program
States Funding Development of Biomedical Sciences Program:

- Connecticut
- Indiana
- Maryland
- Missouri
- Ohio
- Oklahoma
- South Carolina
PLTW Biomedical Sciences Program

- Address impending critical shortage of qualified science and health professionals.
- Prepare students for rigorous post-secondary education at two and four-year colleges or universities.
Biomedical Careers

--- some examples ---

- Doctor
- Nurse
- Dentist
- Veterinarian
- Pharmacist
- Paramedic
- Dietician
- Surgeon
- Research Scientist
- Health Information Manager
- Medical Technologist
- Radiologist
- Medical Technical Writer
- Physicians’ Assistant
- Biomedical Engineer
Sequence of Courses

- Principles of the Biomedical Sciences
- Human Body Systems
- Medical Interventions
- Science Research
Standards-Based

- National Science Education Standards
- Principles and Standards of School Mathematics
- National Health Care Cluster Foundation Standards
- Standards for English Language Arts
- Standards for Technological Literacy
- National Content Standards for Engineering and Engineering Technology*

* Once finalized
Curriculum Attributes

- Rigorous and Relevant
- Aligned with National Standards
- Project and Problem-based
- Integrate biology, chemistry, and physics
- Integrate science, mathematics, English language arts, and social studies
## RIGOR / RELEVANCE FRAMEWORK

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- **A**: Low Rigor, Low Context
- **B**: Low Rigor, High Context
- **C**: High Rigor, Low Context
- **D**: High Rigor, High Context

Application Model

Adapted from W. Daggett
The Four Courses
Course #1: Principles of the Biomedical Sciences

- Student work involves the study of human medicine, research processes and an introduction to bio-informatics.

- Students investigate the human body systems and various health conditions including: heart disease, diabetes, sickle-cell disease, hypercholesterolemia, and infectious diseases.
Course #2: Human Body Systems

- Engage students in the study of basic human physiology, especially in relationship to human health.

- Students will use LabVIEW® software to design and build systems to monitor body functions.
Course #3: Medical Interventions

- Student projects will investigate various medical interventions that extend and improve quality of life including: gene therapy, pharmacology, surgery, prosthetics, rehabilitation, and supportive care.
Course #4: Scientific Research

Students will identify a science research topic, work with a mentor from the scientific or medical community to conduct research, write a scientific paper, and defend their research conclusions to a panel of outside reviewers.
Attributes of Graduates

- Think creatively and critically.
- Able to problem-solve.
- Communicate effectively.
- Have professional conduct.
- Able to work in teams.
- Understand how scientific research is conducted, applied, and funded.
Principles of the Biomedical Sciences Course
Key Biological Concepts:

- Cellular basis of life
- Homeostasis
- Metabolism
- Inheritance of traits
- Defense against disease
Key Engineering Concepts:

- Process of design
- Feedback loops
- Fluid dynamics
- Relationship of structure to function
- Systems
Examples of Student Work

- **Activities**: build skills and knowledge
- **Projects**: build team work and allow students to practice the skills and knowledge with a real-world task
- **Problems**: build problem-solving skills, team work, encourage creativity, and allow students to apply skills and knowledge
Examples of Student Activities from Unit 2: Heart Attack

- Build a simple pump
- Measure factors that affect pump efficiency
- Dissect a sheep heart
- Use LabVIEW software and Vernier probes to measure EKG, heart rate, and blood pressure
LabVIEW Front Panel

Systolic
0 mm Hg

Diastolic
0 mm Hg

Mean
0 mm Hg

Pulse
0 BPM
Initialize an array with 5 seconds worth of samples.

When 0 means 5 seconds of data has been collected.

Replace the array elements with live data.

To compute BPM we do not simply count # of beats in this 5 second period. Instead we count how many beats occurred between the time of the first peak until the last. The first peak is used to start the timing, but not counted as one of the peaks in this time frame.
Examples of Student Activities from Unit 4: Sickle Cell Disease

- Make a chromosome spread
- Isolate DNA from plant cells
- Analyze karyotypes
- Build models of DNA and proteins
- Read a genetic map
- Use computer simulation software to build a designer protein
Karyotyping Activity

Patient A's Karyotype

Place this chromosome in the partially completed karyotype below by clicking on its homologous chromosome. If you match the chromosome correctly, you will proceed to the next chromosome. If you match incorrectly, a page will explain why the chromosome you chose is not the unknown's pair and you can choose again.
3-D Model of a Blood Protein
Curriculum Development Team

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Susan Moore-Palumbo
Stephanie Poll
Donna Putnam
Jean Schick
Angie Snyder
Tony Valentino, Ph.D.
Gene Williams
Curriculum Review
Reviewers:

- **Sarah Davis**: Middle school science teacher and consultant for Education Development Corporation
- **James Potter**: Research Associate in Hepatology at Johns Hopkins University
- **Meredith Durmowicz, Ph.D.**: Chairperson, Department of Biology, Villa Julie College
Curriculum Review Scoring Tool

Scored 93 separate characteristics from 1 (not present) to 4 (no revision necessary)

- Rigor and relevance
- Alignment of Key Concepts, Essential Questions, National Standards, Performance Objectives, and actual student work
- Vertical alignment to post-secondary educational requirements
Reviewer’s Scores:

The average total score of the ratings from the reviewers was 3.5.
Reviewers Comments:

Jim Potter: “The curriculum is very well designed and certainly provides rigor for a 9th grade curriculum. I was extremely impressed with the scope of the document. It is unusual for a 9th grade science curriculum.”
Meredith Durmowicz: “The activities offer a wide range of types of learning styles and activities, including visual (reading), tactile, oral, and graphically oriented activities. There are many opportunities for students to draw connections and demonstrate understanding in many different ways.”
Implementation
Field Test 2007-2008

- In 42 schools selected by the State Departments of Education or Workforce Development in the seven funding states.
- Same schools will field test each new course as it is released.
Expansion of Program

- **2008**—Expand field test implementation of first course into additional schools within the original states
- **2009**—First course fully implemented nationally including:
  - End-of-course exam
  - Purchase manual—national bid process
Current PLTW Biomedical Sciences Schools

- Arsenal Tech High School  Indianapolis
- Bloomington North High School  Bloomington
- Bloomington South High School  Bloomington
- Carroll High School  Fort Wayne
- Greenfield-Central High School  Greenfield
- Hamilton Southeastern High School  Fishers
- Hobart High School  Hobart
- McKenzie Career Center/MSD Lawrence  Indianapolis
- New Prairie High School  New Carlisle
- Owen Valley High School  Spencer
- Pike Central High School  Petersburg
- Pike High School  Indianapolis
- Shelbyville High School  Shelbyville
- Silver Creek High School  Sellersburg
- Warren Central High/ Walker  Indianapolis
- Warsaw High School  Warsaw
Contact & Resource Information

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WEBSITE  www.pltw.org