Pittsburgh Supercomputing Center Educational Approach

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Of course, we do “the usual”: Classes and Workshops

- Accelerating Applications with OpenACC
- Accelerator Programming with OpenACC and CUDA
- Anton Training
- Computational Methods for Spatially Realistic Microphysiological Simulations
- Computer Simulation of Biomolecular Dynamics and Reactions
- Extreme Scaling
- Introduction to Parallel Computing and MPI
- MATLAB Distributed Computing Server on PSC’s Blacklight
- One-day Bioinformatics Workshop

Of course, we do “the usual”

- One-day workshop on the assembly and analysis of Next Generation Sequencing (NGS) Data
- OpenACC Workshop
- OpenMP and Hybrid Programming
- Performance Engineering of Parallel Codes
- Phylogenetics
- Virtual Workshop on OpenACC
- Workshop on Computer Programming and Advanced Tools for Scientific Research Work & Quantum ESPRESSO Developer Training
- XSEDE New User Training (3 instances)

But we also do the unusual

We target younger students *through their teachers*.

U.S. definitions:

High school: starting ages 14/15 – 17/18

(pre-university)

K-12: Kindergarten through 12th grade

Ages 5-18

PSC Education Outreach Objectives

Improve:

- The quality and impact of Science, Technology, Engineering, Math (STEM) education by introducing *computational reasoning* and *computational tools* (modeling, simulation, visualization, etc.) into the K-12 curriculum.

Enhance:

- Connection of concepts across the curriculum
  - Integration of Math and Science
- Cross-disciplinary teaching of the STEM disciplines
- Understanding of complex scientific concepts
- Student motivation for STEM-related careers
- Utilization of technology in the classroom

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PSC Education Outreach Programs

http://www.psc.edu/index.php/eot

- **CAST:** Computation and Science for Teachers

  Introduce an overall computational approach to teaching high school science
- **CMIST:** Computational Modules In Science Teaching

  Create high school teaching modules connecting science and math based on current cutting-edge research from PSC's Biomedical scientists
- **BEST:** Better Educators of Science for Tomorrow

  Introduce Bioinformatics as a multi-disciplinary elective in high school curriculum

Computation and Science for Teachers (CAST)

- A program to infuse computational reasoning into secondary math and science instruction
- A collaboration of the Pittsburgh Supercomputing Center), the Maryland Virtual High School and the Southwest Pennsylvania Math&Science Collaborative (MSC)
- A Professional Development Experience for middle and high school math and science teachers.
- Goals:
  - Increase the use of *computational reasoning* to support theory and experimentation in scientific inquiry.
  - Increase the use of *interactive computational tools such as modeling and simulation* to support the teaching of scientific and mathematical concepts.
  - Improve the *learning experience and engagement* of students in *math and science*.

CAST Professional Development Program -- Two-Tracks

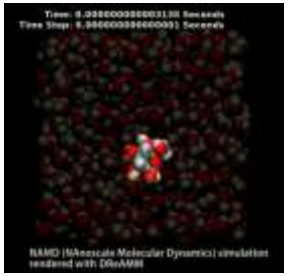
- The **introductory track** is a set of modules that focuses on how to use models and simulations that already exist and are available over the internet, with enough understanding about how such models work to know how to use them effectively in the classroom.
- The **depth track** is a set of modules that provides more in-depth understanding and hands-on experience with the different modeling tools. This track is intended for new CAST PDP trainers and also teachers who desire a deeper understanding of the tools.

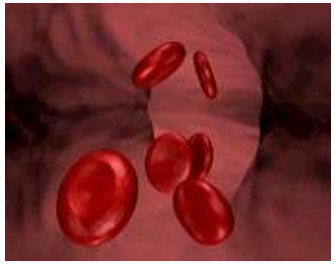
Both tracks explore three modeling tools:

- Excel models
- Agent models
- System or Aggregate models

Computational Modules In Science Teaching (CMIST)

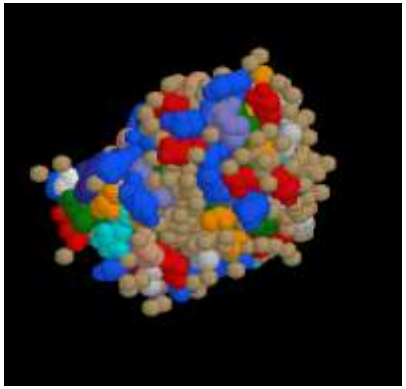
- CMIST modules integrate PSC's cutting-edge research directly into classrooms.
- Provides professional development for high school and university teachers to introduce computational modeling and simulations in their classrooms resulting in students exposure to new tools and to new STEM careers.
- Each CMIST module includes
  - Animations of pictures & lab experiments from textbooks currently in classroom use
  - Lesson plans, education standards, review and homework sheets with answer keys
- CMIST modules are currently in use by HS, undergrad & grad classes





- Now playing at a computer near you: http://www.nrbsc.org/cmist

Better Educators of Science for Tomorrow (BEST)



- Created a bioinformatics curriculum for High school by adapting existing undergrad/grad materials from PSC Minority Access to Research Careers (MARC) program
- High school physics, chemistry, biology, math & technology teachers attended established bioinformatics (MARC) Program
- Jointly developed a integrated, multi-disciplinary curriculum

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BEST Achievements/Plans

- Piloted & established in three area high schools
- Continuous improvement of the course based on classroom usage/feedback
- Currently in use at six area schools
- High school students (and teachers) exposed
  - to undergrad/grad bioinformatics curriculum
  - awareness of changing demands of future careers
- Initiated idea of integrative teaching
- Teach Back training for single subject teachers
- *Ready-To-Go*: Lesson plans aligned to state standards, along with integrated objectives, a midterm and a final exam

Key challenges/long-term goals for PSC's K-12 Programs

- Get ideas adopted into multiple high school curricula and collect real data on classroom usage and student learning
- Create a critical mass of users – build capacity within and across school districts
- Increase integration of PSC research into K-12 programs to bring "CURRENT" leading edge research into the classroom
- Achieve funding from Regional/State/National Resources

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