

University of Maine System Education & Research Perspective on Fostering a Vibrant Biotechnology Sector in the State

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**Presentation to the Advisory Panel to Better Understand and Make Recommendations
Regarding the Implications of Genome-Editing for the Citizens of the State**



Strong preparation at PK-12 in all STEM areas



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Career & Education Development

English Language

Standards & Instruction - Science & Engineering

| Strand | Life Sciences (LS) | | |
|--------------------------|--|---------|---------|
| Standard | LS3 Heredity: Inheritance and Variation of Traits | | |
| | Childhood | | |
| | Grade 3 | Grade 4 | Grade 5 |
| Performance Expectations | <p>3-LS3-1 Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms. Further Explanation: Patterns are the</p> | | |

05 -071 Chapter 132 - Learning Results : Parameters for Essential Instruction

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| | | | |
|--|---|--|--|
| | <p>similarities and differences in traits shared between offspring and their parents, or among siblings. Emphasis is on organisms other than humans, such as lupins, apples or garden plants. Analyzing and Interpreting Data, Inheritance of Traits, Variation of Traits, Patterns</p> <p>3-LS3-2 Use evidence to support the explanation that traits can be influenced by the environment. Further Explanation: Examples of the environment affecting a trait could include normally tall plants grown with insufficient water are stunted; and, a pet dog that is given too much food and little exercise may become overweight. In addition, hydrangea grown</p> | | |
|--|---|--|--|



Awareness/exposure to choices in STEM careers beginning in PK-12

ACTION A1:

Maine's Career Exploration

Research shows that heightened economic mobility for children is a result of “the connectedness, the day-to-day interactions, the diversity of people and experiences, the exposure to others, and sense of belonging.”¹⁶ We will use our neighborhood businesses and employers to enrich student learning.

Maine Career Exploration will start while students are in kindergarten and work with students until one year following graduation from high school. The mission of the program is to connect students and their families to the Maine economy, and to grow our own talent.

MAINE JOBS AND RECOVERY PLAN

Maine Jobs and Recovery Plan

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Maine Career Exploration Program

Department of Economic and Community Development

Allocation: \$25,000,000

Apply Now:

- [Application Portal \(closed May 26, 2022\): Children's Cabinet Pilot Program](#)
- [Application Portal \(closed May 12, 2022\): Statewide Expansion of Extended Learning Opportunity \(ELO\) Programming](#)

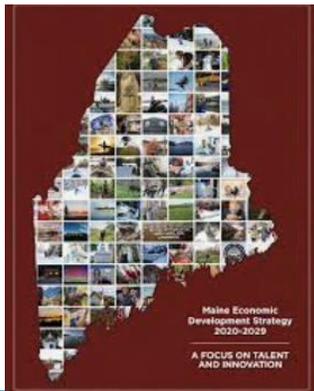


Options and retention in career pathways and postsecondary programs

In 2018, 44% of Maine's workforce has a work credential that goes beyond a high school diploma.¹³ A "credential" is a two or four-year college degree, or a license in the trades, or a professional certificate. The goal set in Maine law to increase this proportion to 60% by 2025.¹⁴

THE MAINE EDUCATION FUNNEL EFFECT AND ACHIEVEMENT GAPS

| | | | |
|---------------------------------------|----------------------------|--------------------------------|--------------------|
| ENTERING 9TH GRADE | 100% | 100% | 100% |
| HIGH SCHOOL GRADUATES | 79% | 95% | 87% |
| ENROLL IN COLLEGE 2017 | 40% | 71% | 55% |
| RETURN FOR 2ND YEAR OF COLLEGE (2018) | 28% | 62% | 46% |
| EARN A 2- OR 4-YEAR DEGREE | 16% | 44% | 30% |
| | ECONOMICALLY DISADVANTAGED | NON-ECONOMICALLY DISADVANTAGED | ALL MAINE STUDENTS |



Student Readiness for Success in STEM Fields

UMaine:

- ~90% of students who take mathematics placement exam are placed into at least College Algebra
- ~30% now meet Calculus 1 standards.
- ~75% of first-year students who take a math course in their 1st semester earn a grade above a “D”

Ongoing challenges UMS-wide:

- Needs for developmental mathematics
- Time management, study habits, how to learn
- Pandemic learning loss



Cultivating Interest in STEM College and Careers

- UMaine Cooperative Extension 4H school, community and camps
- USM Maine Robotics Camp
- STEM Outreach Center at UMaine
- Upward Bound Math Science Program
- UMaine Consider Engineering Program



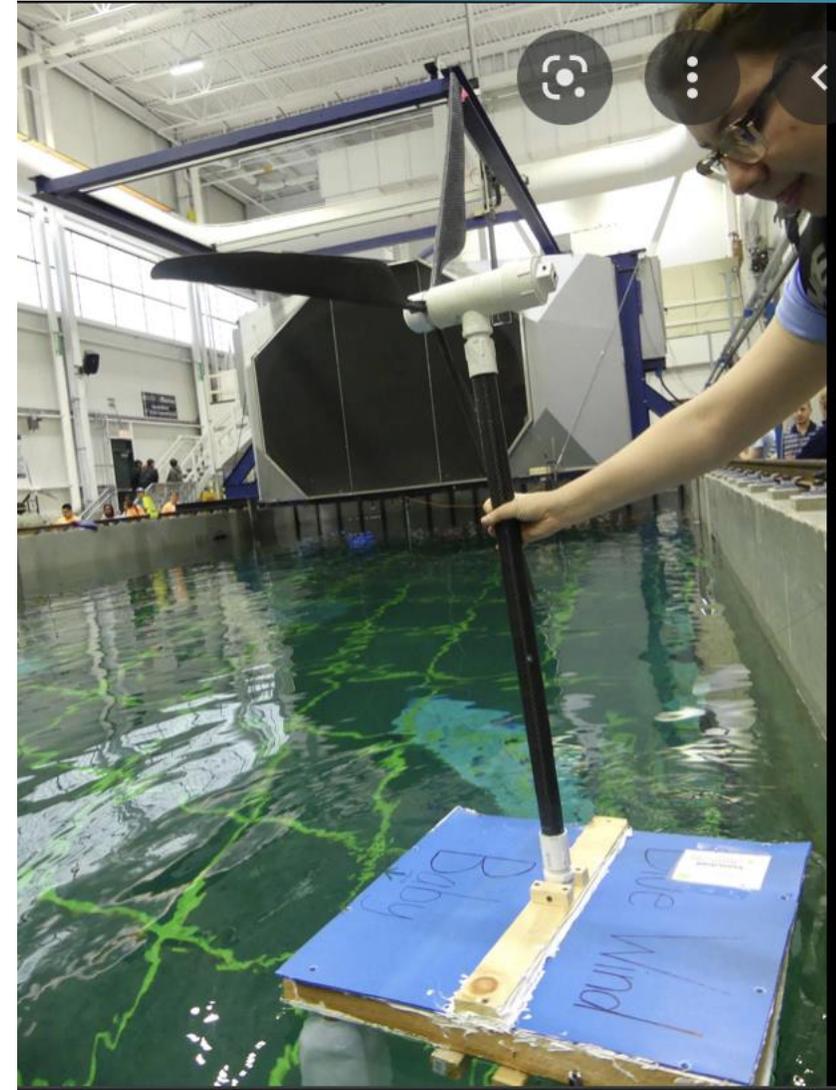
Expanding Your Horizons: 7th & 8th Grade Girls STEM conference



UMaine WindStorm Challenge

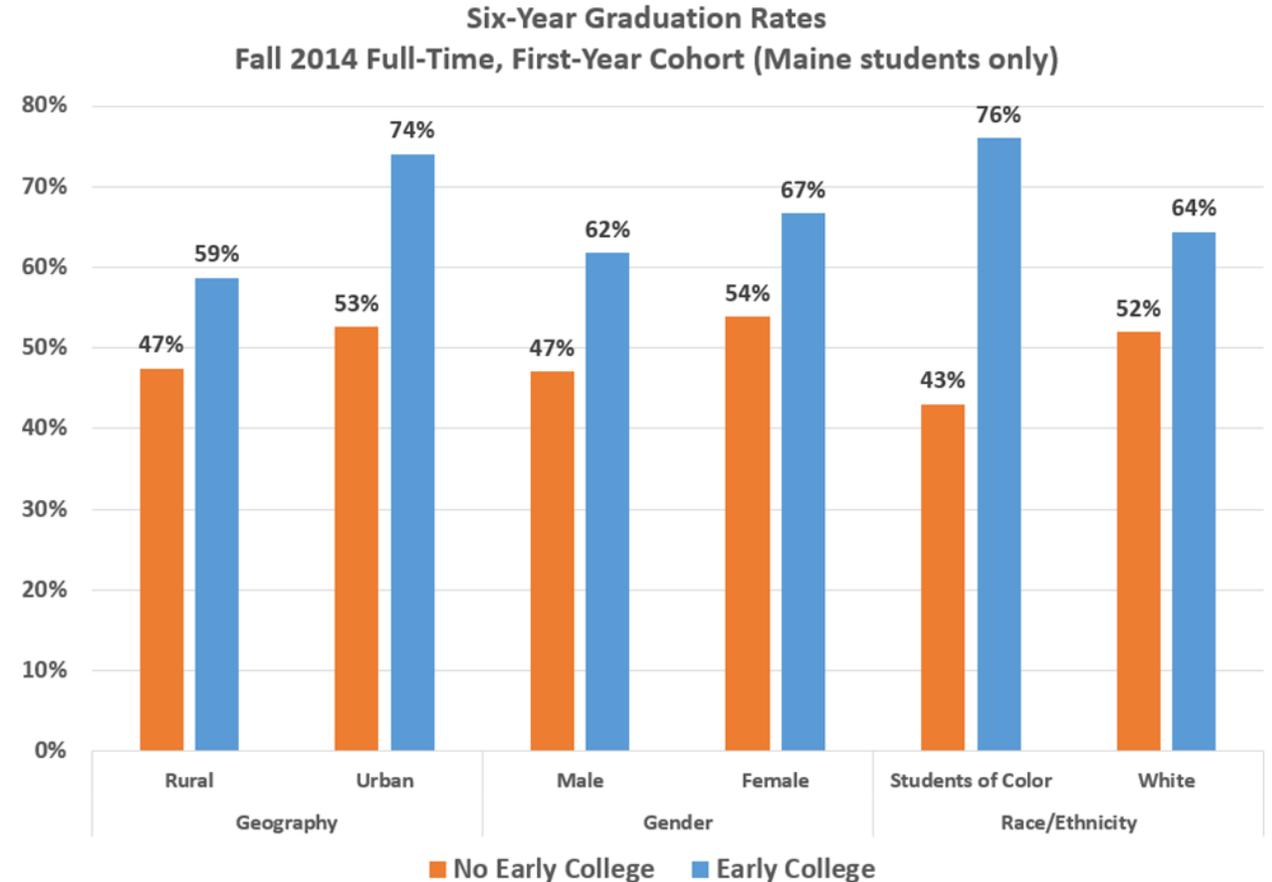
“I’m confident in saying that without the Windstorm Challenge, I likely would not have stayed in Maine to pursue my higher education, let alone end up working as an engineer. This competition was among the earliest experiences I had in extensive problem solving. This competition shows students what focusing on a STEM field can lead to and gets them to consider their futures at an earlier age.”

*-Nathan Faessler, 2011 Winner, Now
UMaine ASCC Engineer*



Improving STEM Readiness Through UMS Early College

- Allows students to take college credit-bearing courses at their high school, at UMS university or through UMS online at no cost to them
- Raises college aspirations, high school and college degree attainment, and college and career readiness while reducing student debt
- +/- 4,000 students enrolled annual, limited funding limits growth
- Many STEM-specific pathways



A Transformative Investment in the Future of Maine

Engineering, Computing & Info Science
\$75m support + \$75m challenge



Student Success & Retention
\$20m support + \$25m challenge



Graduate & Professional Center –
\$55m support + \$50m challenge



UMS TRANSFORMS Student Success and Retention

Research
Learning
Experiences

Gateways to
Success

Pathways to
Careers

Belonging, Agency, & Purpose

We want interventions that start with the student perspective & increase those who believe:

1. I belong here
2. I have something to contribute
3. I can tolerate and overcome challenges
4. What I do matters



UMS TRANSFORMS: Research Learning Experiences (RLES)

- Small cohort, credit-bearing courses that establish connections early that can last throughout their time at the university
- Engagement in authentic, open-ended research and scholarship, where the student shapes the narrative, and the product has meaning outside of the classroom
- Near-peer mentoring that provides achievable developmental examples and relatable student support
- Formal assessment to inform next steps



Required RLE for Incoming Microbiology, Molecular and Cellular Biology and Biochemistry Majors

Hunt for Viruses: Learn about the structure of DNA in genomes, with a particular focus on the role of viral genomes and their role in bacterial virulence. Develop skills in the extraction of nucleic acids from bacterial cultures and sequencing isolated DNA. Assemble bacterial genomes and hunt for viral/phage genomes that potentially contribute to bacterial pathogenesis. These bioinformatic analyses will be conducted in the fall.



UMS TRANSFORMS: RLE Bridge Week

*"When I started college last year, my goals were to simply obtain a degree and maybe get a soul-destroying desk job by the end of it. Now, especially after this week, I feel like my engines are revving. I want to get the highest grades I can, and more importantly **I want to learn enough to be able to make scientific contributions.**"*

*"This small snippet of the course has already piqued my curiosity, and I cannot wait to learn more, and do more, and ask more questions, and get the answers to those, and then **have even more questions.**"*

*"I think the coolest learning experience was the hands-on lab component - not a specific experiment, but just the whole process! **It was super exciting to actually DO things!** Lab work usually feels so tedious but this helped to show me what genuine exploration and experimentation felt like - it was **THRILLING!**"*



UMaine Phage Genomics Course

- Phage Genomics year-long , hands-on research course for first-year students
- Partnership between UMaine Honors College and Dept. of Molecular and Biomedical Sciences, Howard Hughes Medical Institute
- Students learn how to handle large data sets, and more importantly, *how to learn*
- Students publish in the genomics discipline and provide new genomic sequencing data to the scientific community
- 96% of MBMS grads employed in biomedical sciences or healthcare, or con't education



Maine IDeA Network of Biomedical Research Excellence (INBRE)

- Collaborative network of Maine educational and research institutions led by MDI Bio Labs and sponsored by National Institute of General Medical Sciences within NIH
- Within UMS, includes UMaine and Universities of Maine at Farmington, Fort Kent, Machias and Presque Isle
- Through Maine INBRE, UMaine will offer honors students “Molecular Mechanisms of Human Disease” in 2023 that will be taught by Dr. Ben King and include intensive week at MDIBL and spring semester UMaine course in lab and bioinformatics methods



Strengthening Maine's PK-12 STEM Educator Workforce

Maine Center for Research in STEM Education (RiSE Center) at UMaine conducts research, leads graduate education and professional development, and builds community partnerships to improve evidence-based STEM education in Maine and beyond

- Through Maine STEM Partnership, a statewide preK–16+ STEM education improvement network with 160+ Maine schools, 700+ teachers, 29,000+ students, the RiSE Center provides research-guided professional development from events to intensive fellowships, and classroom instructional materials
- STEM Education Research with recent projects focused on integrating computing into science teaching and learning, improving STEM teacher recruitment and retention, and building data literacy and career competency through coastal science education.

Maine Education Policy Research Institute (MEPRI) provides policymakers objective data, policy research and evaluation



Recommendations to Foster Vibrant Biotech Sector

- Support investments in UMS
 - High-impact research learning (MEIF)
 - Paid internships that lead to Maine careers
 - World-class faculty
 - Modern infrastructure
- Maintain rigorous standards for PK-12 Maine students and educator certification
- Invest in hands-on PK-12 learning opportunities including extended learning opportunities with community partners, facilities/equipment, public early college and educator professional development



Your Questions

