



HURI SURI Helping Future Biotechnologists in Rural Appalachia HURI-up with Undergraduate Research—Innovations and Ideas

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“major changes in the teaching of undergraduate biology are needed to bring undergraduate biology courses into the 21st century.....

because modern biology has....undergone major transformations...

emerging technologies ...

interdisciplinary collaborations...

rapidly open new areas of biological research...

pioneer new approaches...

that enhance our understanding of living systems.”

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“Students should have opportunities to participate in authentic research

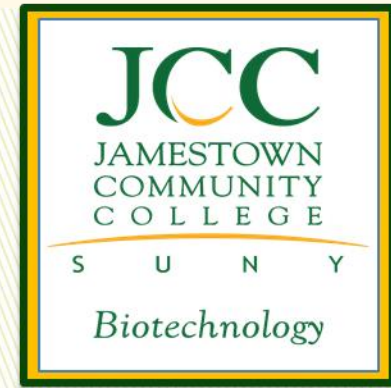
experiences and learn how to evaluate complex biology problems from a variety of perspectives,

not just recite facts and terminology.” NSF

All JCC Biotech courses
have meaningful
undergrad research
experiences.



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Biology: A Molecular Approach (BAMA) Innovates First Semester Biology

- **hold students to task-** no multiple choice—ever
- **Extended periods of undergraduate research**
- **Teaching the 3 R's in context**
 - **Reading-** professional (scientific) literature
 - **Writing-** multiple iterations of scientific write-ups
 - **Arithmetic-** teaching chemistry and lab math in lecture and lab
- **Professional Accountability**
 - Professional conduct rubric- minimizing waste from irresponsibility
 - Lab notebook rubric
- **Reinforce abstract concepts with computer modeling and practical problem solving**
- **Emphasize sweeping ideas** and not minutia
- **Spiraling back to foundational ideas repeatedly later in the semester**

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HURI SURI Network

JCC
JAMESTOWN
COMMUNITY
COLLEGE

S U N Y

Biotechnology



* **19 high schools trained to teach *BAMA on site***

* **Four-year partnerships:**

- University at Buffalo
- University of Rochester
- St. Bonaventure
- Penn State College of Medicine
- Penn State Behrend
- Penn State Main Campus

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- **135 hrs of training** for high school teachers representing 46% of area school districts.
- **\$10,000** in new science equipment.
- Additional professional development funds.
- **Support teachers during implementation**



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Outcomes



- **Improved Retention** in STEM Programs at JCC vs. standard first semester bio course:

Dual Enrollment Course	% JCC students enrolling in STEM
Standard Bio Course	34
BAMA	67
National Average	50

- **Improved performance** in gatekeeper courses in biology programs
- **Highly statistically significant increases in critical reasoning**
 - For 2 years in JCC Biotech
 - For dual enrollment BAMA classrooms
- **National recognition- JCC Biotech designated a High Impact Program** by Center for Assessment & Improvement of Learning (TN Tech)

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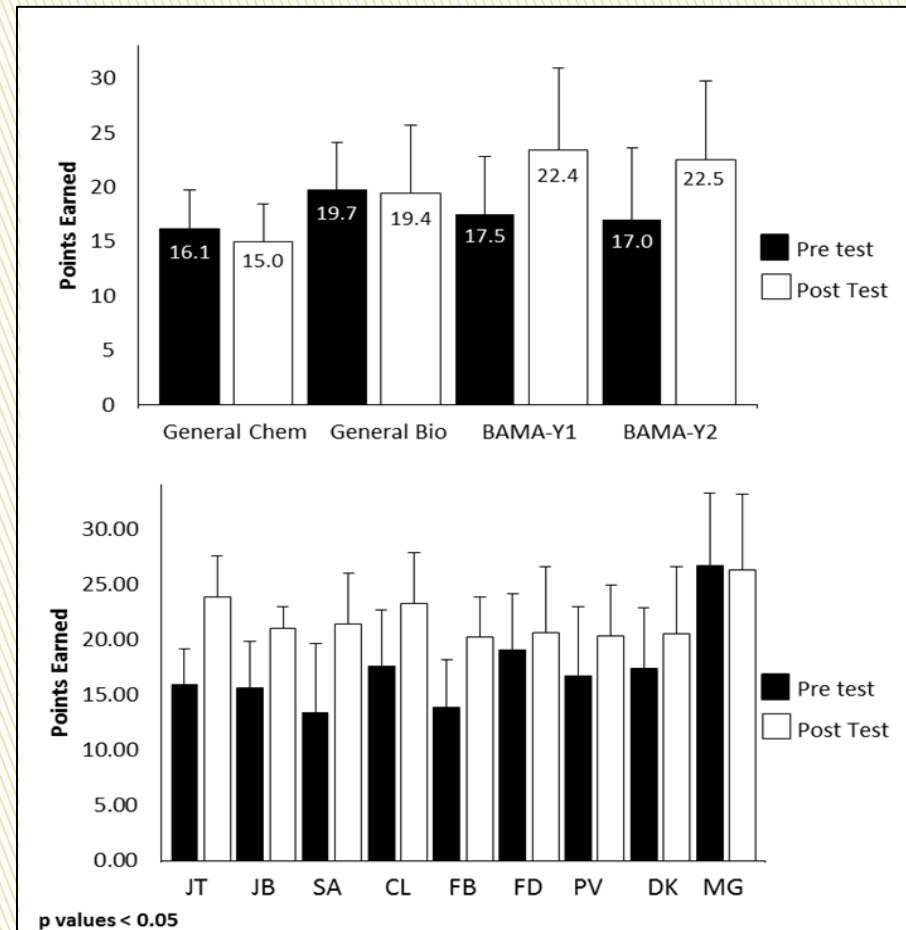
Large Gains in Critical Reasoning for JCC Biotech and BAMA Students



- **Assessed with CAT test**
<http://www.tntech.edu/cat/home>
- **BAMA gains in Critical Thinking**
 - JCC Biotech BAMA
 - Dual enrollment BAMA
 - not Standard Gen BIO
- **National CAT test norms**
 - Community College average = 13.5
 - 1st year students in 4 year program = 13.7
 - Seniors in 4 year program = 19.0

Conclusion:

Consistently, first year JCC Biotech students who took BAMA on average scored **HIGHER** than **seniors** graduating with **4 yr degrees**.



Internship Mentor Comments

“... Overall, [students] notebook was *among the best of all students to ever rotate in my lab.*”

“... [Student] functioned at the level of a *graduate student.*”

“I think [student] is in the *top 1% of students* and in the *top 10% even of Master’s level students.*”

“... [Student] is *tremendously competent* in many of the laboratory techniques that [student] learned prior to entering my lab.”



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Effective Innovations in Science Teaching Offered By HURI SURI For Your Consideration:

- 1) Integrate undergraduate research often and deeply into curricula
- 2) Use an interdisciplinary approach
- 3) Emphasize contextualized “3 R’s”
- 4) Emphasize contextualized critical reasoning often and by multiple means
- 5) Establish STEM networks between high schools, community colleges and 4 year institutions

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Next Generation STEM Learning for All

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Partnerships for Pathways to STEM Workforce

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