




Biotechnology and Forensic DNA Science Programs

A non-traditional approach to teaching
science to non-traditional students

By

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“No, Oz
never did give nothin’ to the
Tin Man.....



.....that he didn’t, didn’t
already have.”

America (“The Tin Man” Song)

The Three Biotechnology Programs at MassBay

1. The Biotechnology Program (the parent program) established in 1993
- 2., The Forensic DNA Science Program established 1995. The 1st degree program in forensic DNA analysis in the world and remains the only undergraduate program in this discipline.
3. The Marine Biotechnology Program, established 1995, is a unique *AS-Ph.D.* program that integrates molecular biology and marine science.

The Curriculum of the Biotech Program at MassBay is Unique Among American Undergraduate Institutions.

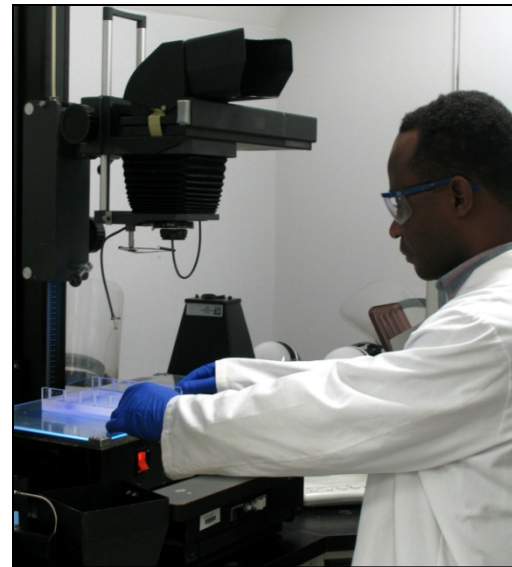
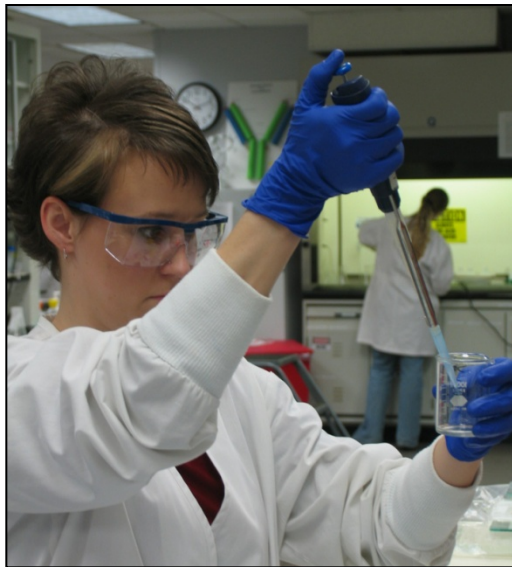
- ❑ A miniaturized doctoral program in biochemistry modified to a associate degree curriculum.
- ❑ Students learn science primarily through thesis-driven research in a “Grand Project”.
- ❑ Research tightly coupled to course work.
- ❑ Faculty mentoring and peer-mentoring are the foundations of the program.
- ❑ **Has produced seventeen Goldwater Scholars since 1996 (more than all UMASS campuses combined).**

Why has the Biotech/Forensic DNA programs been so successful?

- ❑ Exceedingly High Standards: **Stated, Demanded and Enforced***
- ❑ **Peer-Mentoring* (The key component)**
- ❑ Exciting, extensive and relevant research experiences
- ❑ **Rigorous Leadership Development**
- ❑ International Research Experiences
- ❑ Innovative Teaching Strategies

Biotechnology and Forensic Laboratories

- ❑ The Biotech and Forensic Labs are a Multi-million Dollar Facility – **Built Entirely with Private Money**
- ❑ Considered to be the Most Sophisticated Undergraduate Labs in the Nation.



Peer-Mentors Confer a Passion for Science and the Requisite *Habit of Mind*

- ❑ 1st-Year Students learn science through exciting, interdisciplinary research projects coordinated by Peer-mentors who are 2nd Year Students!
- ❑ Peer-mentors maintain standards and discipline and are held strictly accountable for research of mentees; and serve as the major recruiting tool.
- ❑ Peer-mentors confer and exhibit the *HABIT OF MIND* required for science (uninhibited creativity, self-discipline and perseverance are the key attributes of a scientist).
- ❑ Peer-Mentors Confer on Mentees an expectation of victory in all endeavors.

PEER MENTORING: The Program Foundation.
Students best learn when they teach what they themselves have learned!



Who are the Students in the Program*?

- **94%** are women
- **97%** are from non-traditional backgrounds.
- **14%** are single mothers
- **22%** are over 30-years-of-age (age range is: 17-62)
- **32%** are former high school drop outs with GEDs
- **17%** have been in the criminal justice system
- **34%** fall within the federally defined poverty line
- **7%** are veterans

** Many students fall within several of the above categories*

The Three Biotechnology Programs at MassBay

Biotech • Marine Biotech • Forensic DNA Science



Hands-On; Research-Based; Mentoring-Driven

1-Biotechnology



The Research of Biotech Scholars is Real and Relevant



Biotechnology **“Grand Project”**

“Role of changes in the regulation of Cyclooxygenase (COX) gene expression in the onset of human prostate and breast tumorigenesis”.

All Biotechnology Scholars Conduct an Independent Sub-Project of the “Grand Project” for Two Consecutive Years; Master Collaborative Research.



2-The Forensic DNA

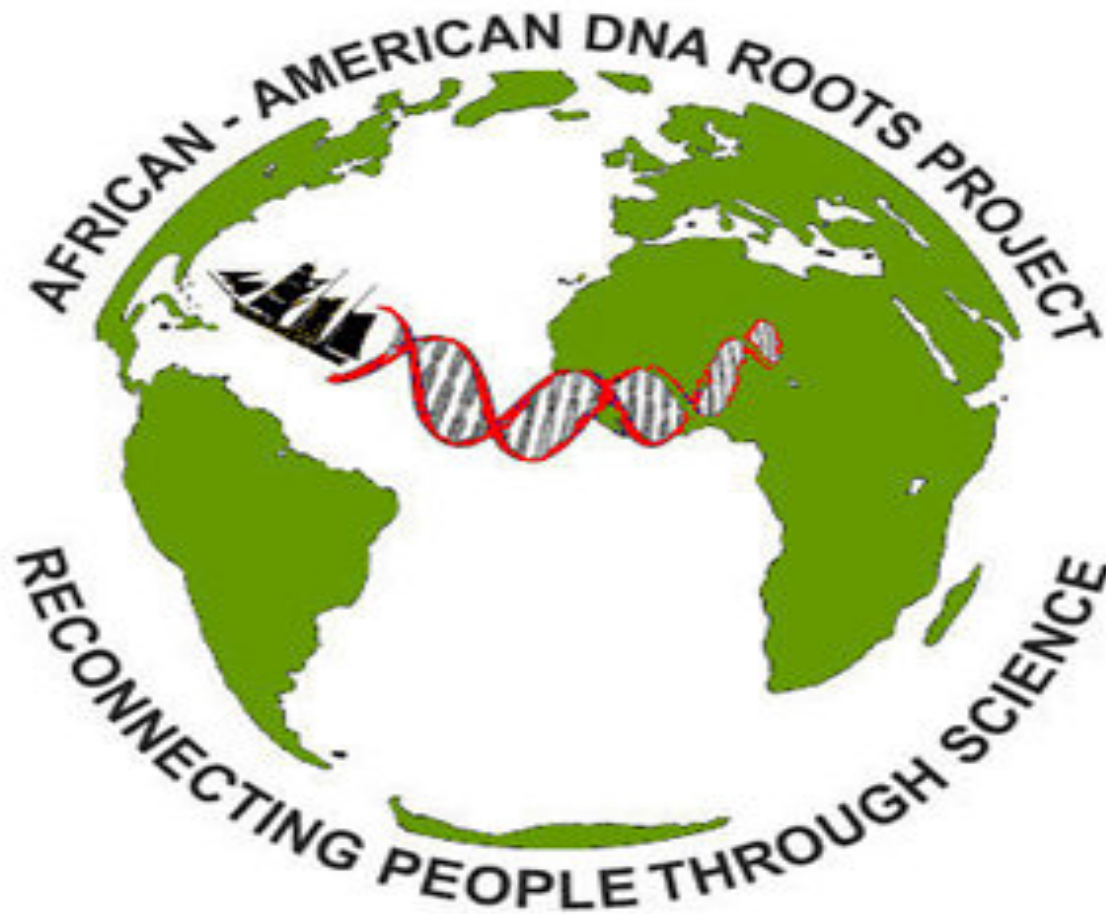
Science Program

Learning by Real Cases

Learning “CSI” is Real Baloney

MassBay Forensic Students
Conduct Investigations of

**Legal and Historical
Significance**



Uses the “African-American DNA Roots Projects as the Major Training Project.

“Lady of the Dunes” (LOTD)

MtDNA Analysis in Massachusetts’ most
Celebrated Murder Case

- ❑ **July 1974, Woman Found Murdered on Dunes of Provincetown, MA Beach**

- ❑ **Hands were Removed to thwart ID**
- ❑ **Given the name "Lady of the Dunes"**
- ❑ **Work from our Program has Eliminated Several Possible Family Connections**
- ❑ **Our LOTD Sample has been Submitted to the FBI**
- ❑ **Placed into their database, *The mtDNA Population Database*, in hopes of an eventual match**



Portsmouth “African Slave Burial Ground” (ASBG)

Tracing the Origin of 300-year-old Remains
through mtDNA Analysis

When the state of New Hampshire found the ASBG bodies in downtown Portsmouth, they did not call UNH or Dartmouth. They called MassBay.



MassBay Forensic students determined the precise ethnic group assignments of the remains to be:

Haplogroup L3b/d (West African, common to Nigeria)



The Madison Project



Discovering Possible Descendents of the 4th
President, James Madison

- President James Madison of Virginia, 4th President of the United States



- History Books Indicate that President Had no Children
- Only three Step-children from his marriage to Dolly (a widower)
- President Madison had a son with an African slave, named Corinne

3-The Marine Biotechnology Program

Solving the world's marine
problems with Biotechnology.

The Marine Biotech Program's "Grand Project" is a Volcano



THE SOUIFFRE HILLS VOLCANO, MONTSERRAT

Marine Scholars study the effect of volcanic ash on the marine ecosystem of Montserrat for the government of that island and Great Britain

Student Research is Relevant and Useful



PLYMOUTH, MONTSERRAT BEFORE & AFTER

“Diving Buddies” Learning Marine Science from a mentor “who is like me!”





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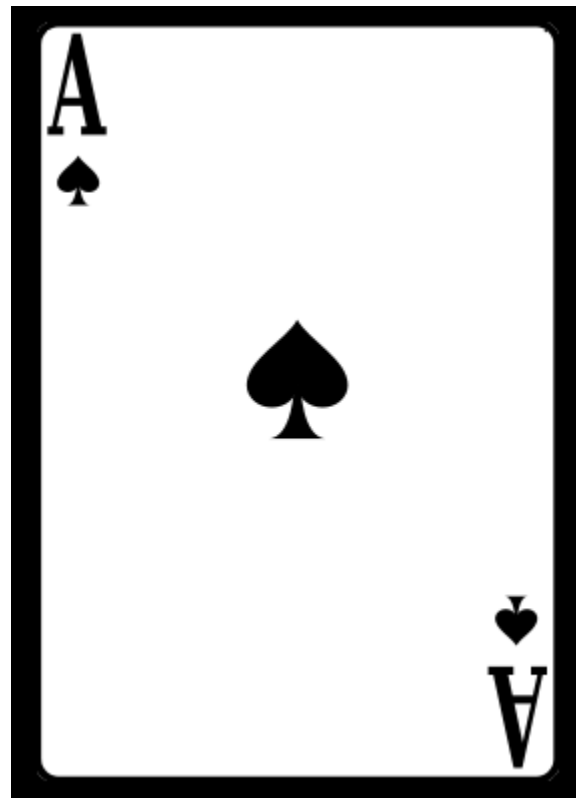
Ritual Traditions Reinforce the Sense-of-Excellence for Non-Traditional Scholars

The Two Key Rituals of MassBay's
Biotech Programs are:

□ **PATCH DAY**

□ **DEALING of the ACES**

How Good is this Model?







PAESMEM Ceremony, January 27, 2011
Oval Office, White House