Biotechnology and Forensic DNA Science Programs

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

By

Bruce A. Jackson, PhD
“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.

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 Descendants 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!”
INTER ACTE
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?