

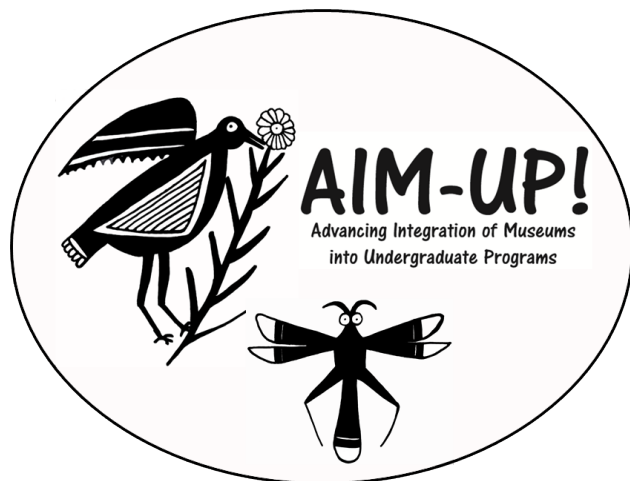
# Stimulating Changes in Undergraduate Education

- **Vision and Change—AAAS (2009)**
- **PULSE – (2012) Partnership for Undergraduate Life Sciences Education (NSF, HHMI and NIH)**  
40 Leadership Fellows
- **PCAST (Feb 2012) Engage to Excel**

replace standard laboratory courses with discovery-based, relevant research courses

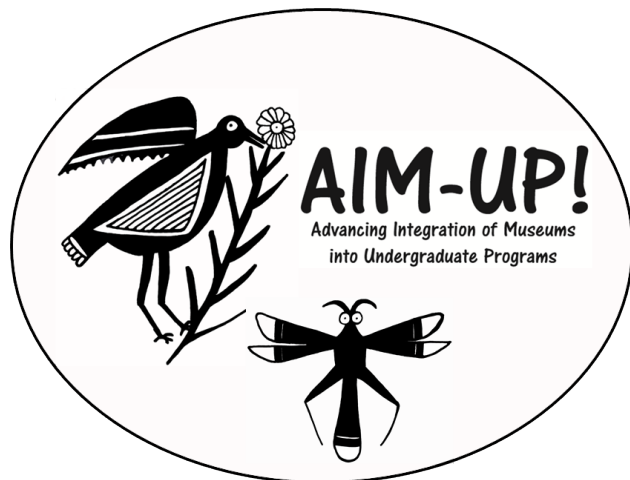
# Using Museum Specimens and Place-based Approaches for Engaging Students from Underrepresented (UR) Groups

Dr. Corey Welch  
Program Coordinator for Research  
Biology Scholars Program  
University of California, Berkeley

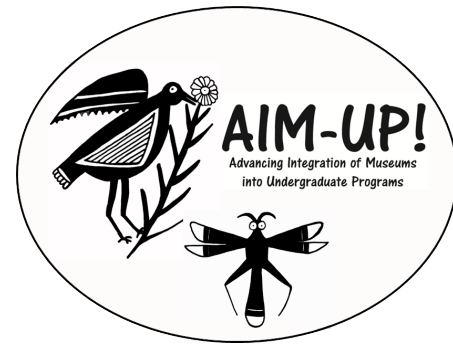


# Using Museum Specimens for Engaging Students from Underrepresented (UR) Groups

In January 2015,  
Program Manager for STEM Programs  
Iowa State University



**AIM-UP.org**



**Authentic** (students “do” science)

**Inquiry-driven** (hypothesis testing)

**Active** (hands-on participation)

**Place-based** (relevant to student body)

## OUTLINE:

1. The Challenge and define underrepresented (UR)
2. Biology Scholars Program as a Model for Student Success in the Biological Sciences
3. Two Recent Activities related to the AIM-UP Initiative
4. Culturally relevancy of Museums and Specimen-based Research
5. Two examples: *Peromyscus sp.* and Atrazine and Vertebrate Endocrinology
6. Summary of Symposium
7. General Q/A with all of the Speakers

## **PROBLEM:**

**Lack of diversity in STEM fields and careers, including museum specimen based research.**

Who is “underrepresented”?

Underrepresented Minorities (URMs)

1<sup>st</sup> generation college students

Lower income students (urban and rural populations)

What are some of the reasons these populations are not represented in STEM fields equal to their representation in society?

# Factors leading to underrepresentation in STEM fields?

## General STEM perspectives (Museum-specific ones later)

1. Less interest in biology majors? NO.

~23% of URM and Non-URM students pursue biology majors (entering freshman 2000-2006)

2. Lack of role models

3. Differing values: sacrifice/giving back to community is mentioned more frequently by underrepresented students

4. Over-confident and underprepared due to lower quality high school experience

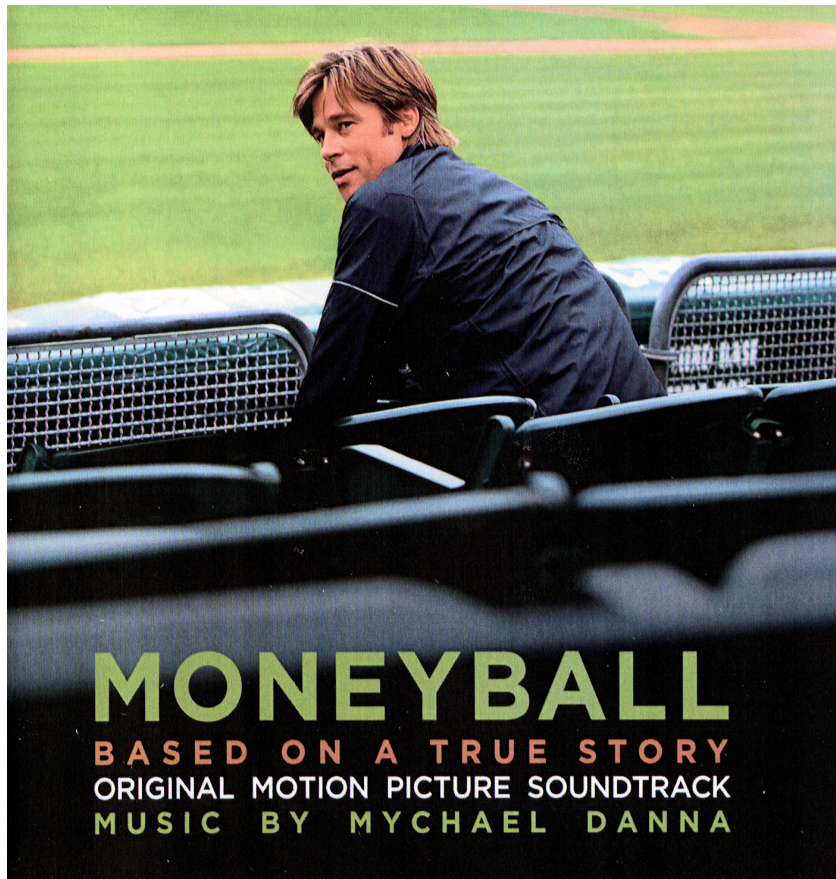
5. Major needs to be relevant to expectations of student/family/community

6. Science research often must align with #3. Bias toward “white lab coat stereotype”.

(ex. pocket gopher systematics vs. cancer researcher)

7. Institutional Barriers (Stereotype Threat, Imposter Syndrome)

How we traditionally *train, recruit, and mentor* biology students fails to deal with a variety of important factors that impact student retention and success.



Goal:

Finding undervalued talent

Moving beyond the traditional measure of success (e.g. GPA/SAT)

How though?

Biology Scholars Program,  
UC Berkeley



# Biology Scholars Program: Est. 1992, nationally recognized ~425 current students, 2500 alumni

## Biology Scholars Program

AT THE UNIVERSITY OF CALIFORNIA, BERKELEY

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# Biology Scholars Program: Est. 1992, nationally recognized ~425 current students, 2800 alumni

## Biology Scholars Program

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15 universities around the country have programs modeled-directly after the BSP program.

Several of which, started by BSP Alumni

[Meet our Members](#)





**~425 current students, 2500 alumni**

70% URMs (African American, Hispanic, and/or American Indian),  
70% Female,  
80% from Low-income backgrounds and/or the First Generation.

BSP students on average have a lower incoming GPAs and SAT scores than the campus average (Matsui et al. 2003). Not a “skim program” of taking the “talented top 10%”.

Fewer AP classes for low income/rural CA students (unpub. data).

## Traditional measures

SATs and high school GPAs  $\neq$  good predictors of success

We look at socio-economic and historical circumstances that contributed to those numbers in the first place.

## SELECTION

1. Written application reviewed by 2 staff, followed by an interview (~20-25% acceptance rate); Outreach limited to 2 summer programs (e.g. Bridge/Cal-So and transfer students)
2. Criteria
  - a. “distance traveled” - barriers and challenges they have negotiated,
  - b. their passion for science (written/oral), and
  - c. their demonstrated commitment to service.
3. Students can re-apply multiple times (2x year)

## BSP Philosophy:

A strength-based approach (NOT a Deficit model that is common to most university affirmative action type programs):

- advising (academic, financial, and career)
- peer-to-peer education and mentoring  
(non-competitive environment....share your knowledge)
- interaction between undergraduates, some graduate and faculty
- peer tutors for entry level biology, chemistry, math, biochemistry and physics courses
- alumni support (e.g. “you are in BSP for life”)
- BSP staff serve as coaches, not directive

## TWO Results:

1. Building Efficacy (e.g. traditional biology skills)
2. Building Identity as a biologist/scientist/researcher (Prieto et al. 2013)

So, how are the 3 underrepresented populations doing in Biology majors at UC Berkeley?

Low income and First Generation students graduate at similar rate (1-2% below) their peers, but they are more likely to graduate with a lower average GPA.

How about URM students?

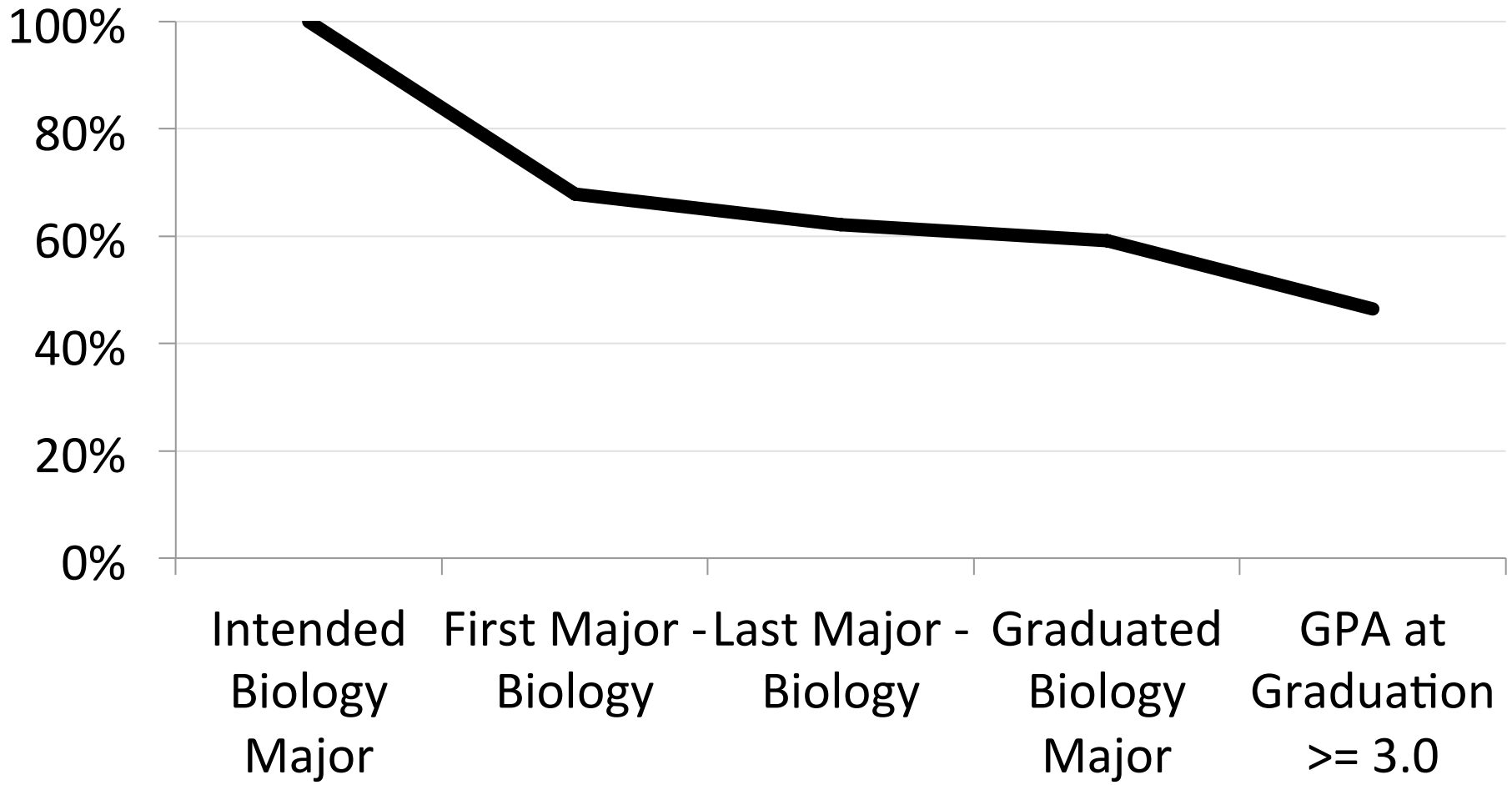


# Persistence of Intended Biology Majors

All Students

2000 - 2006 Entering Cohorts

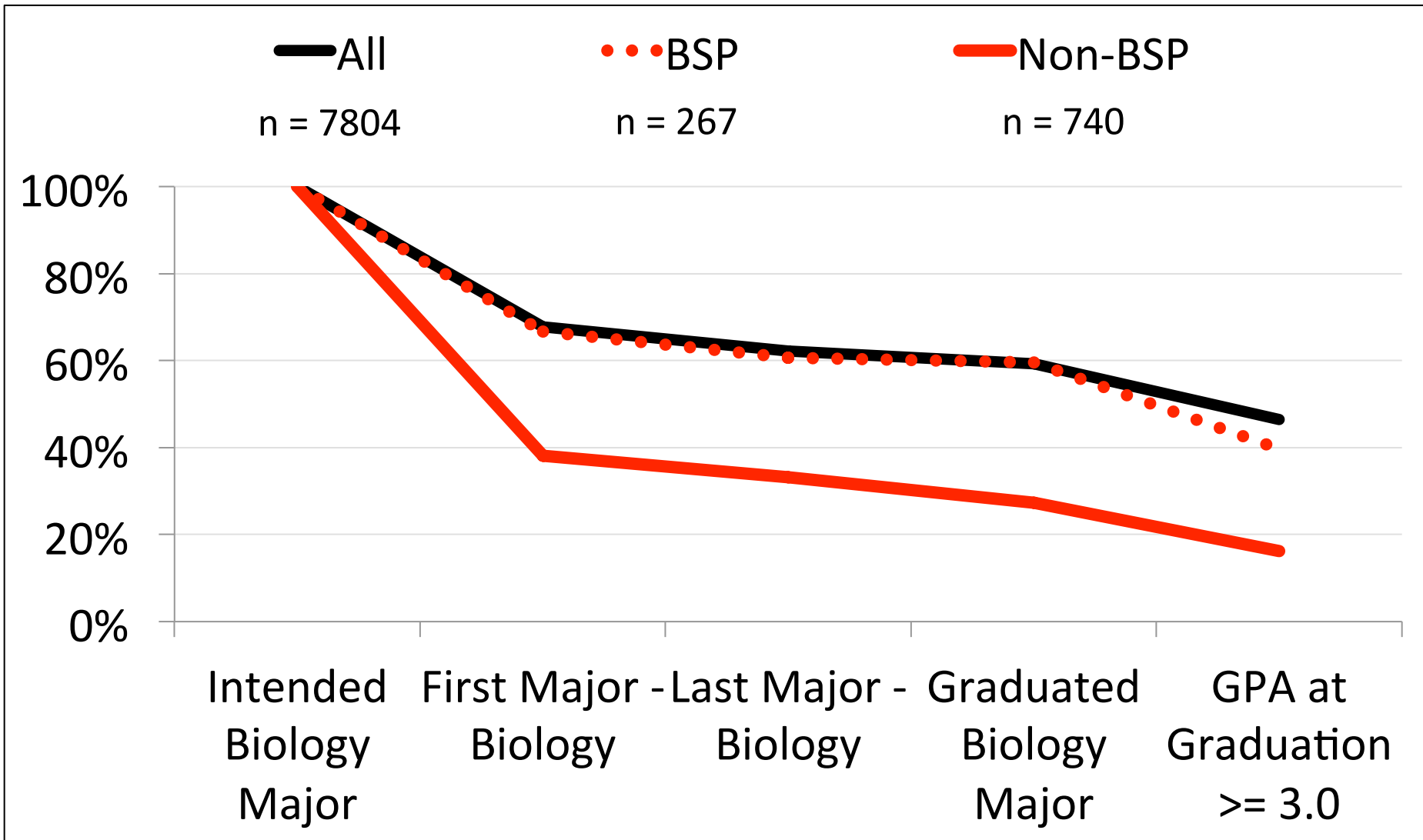
— All Students n = 7804



# Persistence of Intended Biology Majors

URMs

2000 - 2006 Entering Cohorts





# **Biology Scholars Program Summary**

**The work is on-going, it is data-driven, and adaptable to other institutions and programs. It is closing the achievement gap and stopping the leaking pipeline. It produces change agents/leaders.**

## **Other challenges and unknowns:**

**low income and first generation data from the campus at large (only the past 3-4 years). Tracking non-BSP graduates is challenge for comparisons.**

**Changing how we teach introductory biology and chemistry courses (e.g. dumping the curve, Pre-med. model, adding peer to peer active learning). Chemistry requirements prior to biology course eligibility.**

**UR Programs nationally tend to be 65-70% female. Why?  
BSP males do better than campus average. Why?**

# Hypotheses for underrepresentation in Natural History Museums?

1. Limited awareness and opportunities to interact with museum collections.
2. Under-utilized in undergraduate courses
3. Lack of role models
4. Cultural barriers (primarily for Native American students)
  - a. Sins of anthropologists past, storage of specimens, taboo of being around dead organisms.
5. Anti-evolution viewpoints (not unique to underrepresented populations)
6. Decline of field courses with labs and limited interactions with animals (e.g. impact on Hanta Virus)? Rise of Ecology courses without a field-based laboratory requirement.

## Lack of role models

**Are you willing to be....**

**a minority (society)...**

**within a minority (career: a scientist)...**

**within a minority (e.g. mammalogy)?**

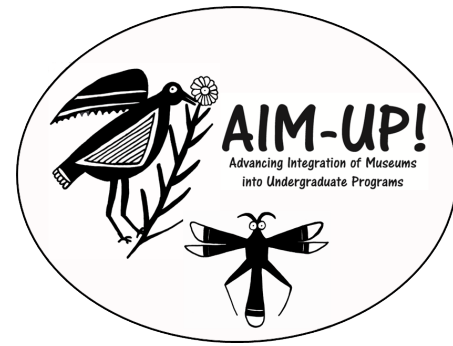
# Being a Minority within a Minority



**"The number of African Americans I know in the field of evolution, in tenure-track positions,... I'm sure I can count them on two hands if not one."**

**-Dr. Scott Edwards, Harvard University  
AIM-UP**

**Authentic** (students “do” science)  
**Inquiry-driven** (hypothesis testing)  
**Active** (hands-on participation)  
**Place-based** (relevant to student body)



**Before the Place-based examples, here are 2 other related activities to the AIM-UP mission.**



Haskell Indian Nations University, HINU  
Lawrence, KS (Spring 2011)

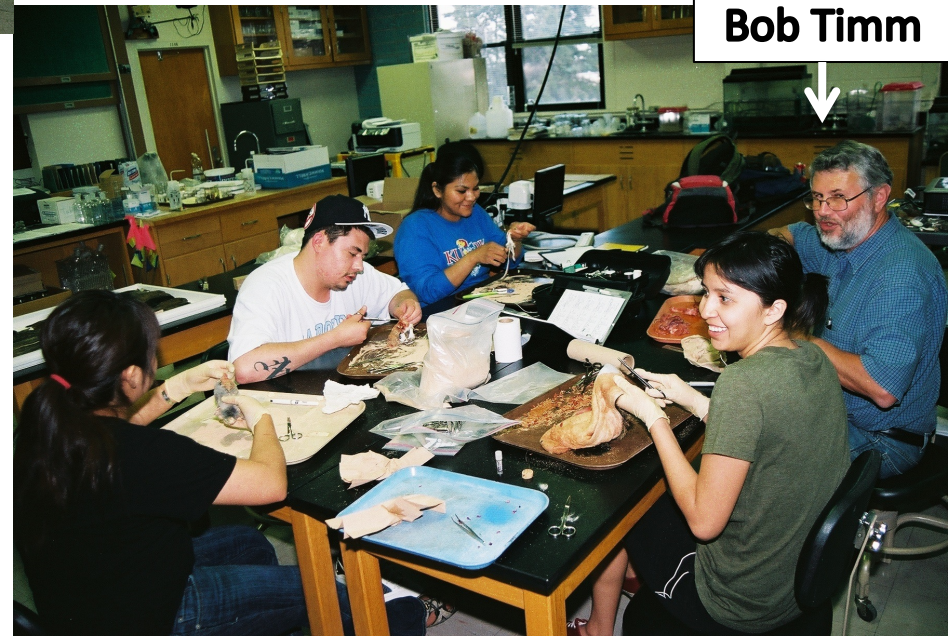
## Mammal Specimen Preparation Class

Class size limited to 5 students:  
15 weeks, Meet 1x each week 3 hours.  
13 specimens each, lab notebook

1. Use of Specimens in Research, Conservation, and Biodiversity.
2. Ethics of specimen collection.

~70% specimens in KU Research Collection

~30% went into HINU Teaching Collection



**Bob Timm**

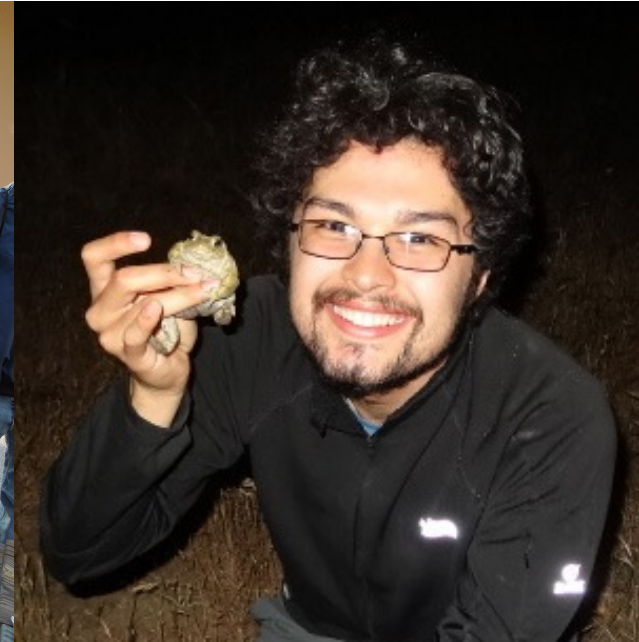
# Hastings Reserve Field Station Trip: Summer Researchers 2013/2014

Eileen Lacey, Paul Fine (plants), Myself, 2-3 UR Graduate students

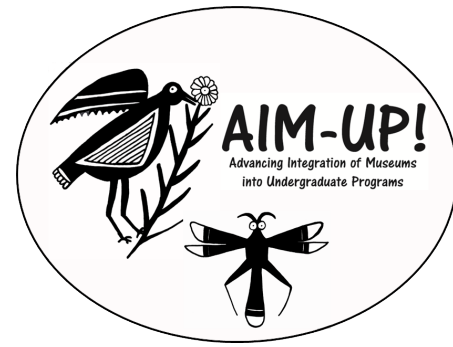


Pre-/Post- surveys regarding experiences with nature, field biology, fears, excitement, etc...

Great cohort bonding for Summer Undergraduate Researchers.



**AIM-UP.org**



**Authentic** (students “do” science)

**Inquiry-driven** (hypothesis testing)

**Active** (hands-on participation)

**Place-based** (relevant to student body)



# Why Place-based Approaches of using Museum databases are an ideal way to connect with students?

## Students' perspective:

- Often relevant to their personal/family/cultural history and values.
- Taps into existing experiences and knowledge base (ex: TEK)
- It provides a way to reduce the isolation of the academic learning and creates connections with their families.
- Native Americans = spatial thinking is culturally common.

## Faculty/Curator perspective:

- Museum people = wealth of natural history knowledge of local area + their research experiences.
- Extension of Public Outreach activities
- Adaptable to nearly any scale (county to global)
- Adaptable to lecture/lab/field teaching

# Using the Deer Mouse for place-based teaching modules



## The Ecology and Evolutionary History of an Emergent Disease: Hantavirus Pulmonary Syndrome

TERRY L. YATES, JAMES N. MILLS, CHERYL A. PARMENTER, THOMAS G. KSIAZEK, ROBERT R. PARMENTER, JOHN R. VANDE CASTLE, CHARLES H. CALISHER, STUART T. NICHOL, KENNETH D. ABBOTT, JONI C. YOUNG, MICHAEL L. MORRISON, BARRY J. BEATY, JONATHAN L. DUNNUM, ROBERT J. BAKER, JORGE SALAZAR-BRAVO, AND CLARENCE J. PETERS

### Outbreak of Hantavirus Infection in the Four Corners Region of the United States in the Wake of the 1997–1998 El Niño–Southern Oscillation

Brian Hjelle<sup>1,2</sup> and Gregory E. Glass<sup>3</sup>

<sup>1</sup>Departments of Pathology and Microbiology, University of New Mexico Health Sciences Center, Albuquerque, New Mexico  
<sup>2</sup>Division, TriCore Corp., Albuquerque, New Mexico  
<sup>3</sup>Department of Microbiology, University of New Mexico Health Sciences Center, School of Hygiene and Preventive Medicine, Albuquerque, New Mexico

Hantavirus cardiopulmonary syndrome (HCPS), a rodent-borne zoonosis, emerged in the Americas for at least several decades. It is hypothesized that the 1997–1998 El Niño–southern oscillation (ENSO) caused increased precipitation that allowed rodent population densities to increase, thereby increasing the possibility of transmission. A major result was a 1993–1994 outbreak of the disease in the Four Corners states of the United States. A second strong ENSO occurred in 1997–1998, after a period of public education about the risks of hantavirus infection that began during the 1993–1994 outbreak. The caseload of HCPS increased 5-fold above baseline in the Four Corners region in 1998–1999. Regions that had received increased rainfall in 1998 were especially affected. A large majority of the 1998–1999 case patients reported indoor exposure to deer mice. Hantavirus outbreaks can occur in response to abiotic events, even in the face of

In the spring of 1993, a previously undescribed disease emerged in the Southwest, killing 10 people during an 8-week period in May and June. Early during an infection, victims experienced flu-like symptoms for several days, but their condition suddenly and rapidly deteriorated as their lungs filled with fluids; death usually occurred within hours of the onset of this crisis period. There was no cure, no successful medication or treatment, and the disease agent (virus, bacterium, or toxin) was completely unknown. For the first few weeks, the mortality rate was 70%.

Researchers from many disciplines immediately focused on the outbreak, attempting to identify the agent and understand the causes and dynamics of the disease. Within weeks, scientists at the Centers for Disease Control and Prevention (CDC) identified the agent as a previously unknown hantavirus (Bunyaviridae), subsequently named Sin Nombre virus, or SNV (Nichol et al. 1993). Because hantaviruses were known

EVIDENCE FROM TWO EL NIÑO EPISODES IN THE AMERICAN SOUTHWEST SUGGESTS THAT EL NIÑO–DRIVEN PRECIPITATION, THE INITIAL CATALYST OF A TROPHIC CASCADE THAT RESULTS IN A DELAYED DENSITY-DEPENDENT RODENT RESPONSE, IS SUFFICIENT TO PREDICT HEIGHTENED RISK FOR HUMAN CONTRACTION OF HANTAVIRUS PULMONARY SYNDROME



1. Widespread in USA/Canada,
2. Commonly caught (field),
3. Good representation in collections.
4. Scale: local to continent.

Cute as a button (like Brad Pitt)

Some Examples:

Ecology: morphological/behavioral differences across its range

Disease: Hanta Virus, Lyme's Disease, public health, host-specificity, climate change (El Nino)

Behavior (across the Genus): Mating Systems *P. californicus* vs. *P. maniculatus*

Population Genetics (coat color genes and burrowing behavior): Hopi Hoekstra work

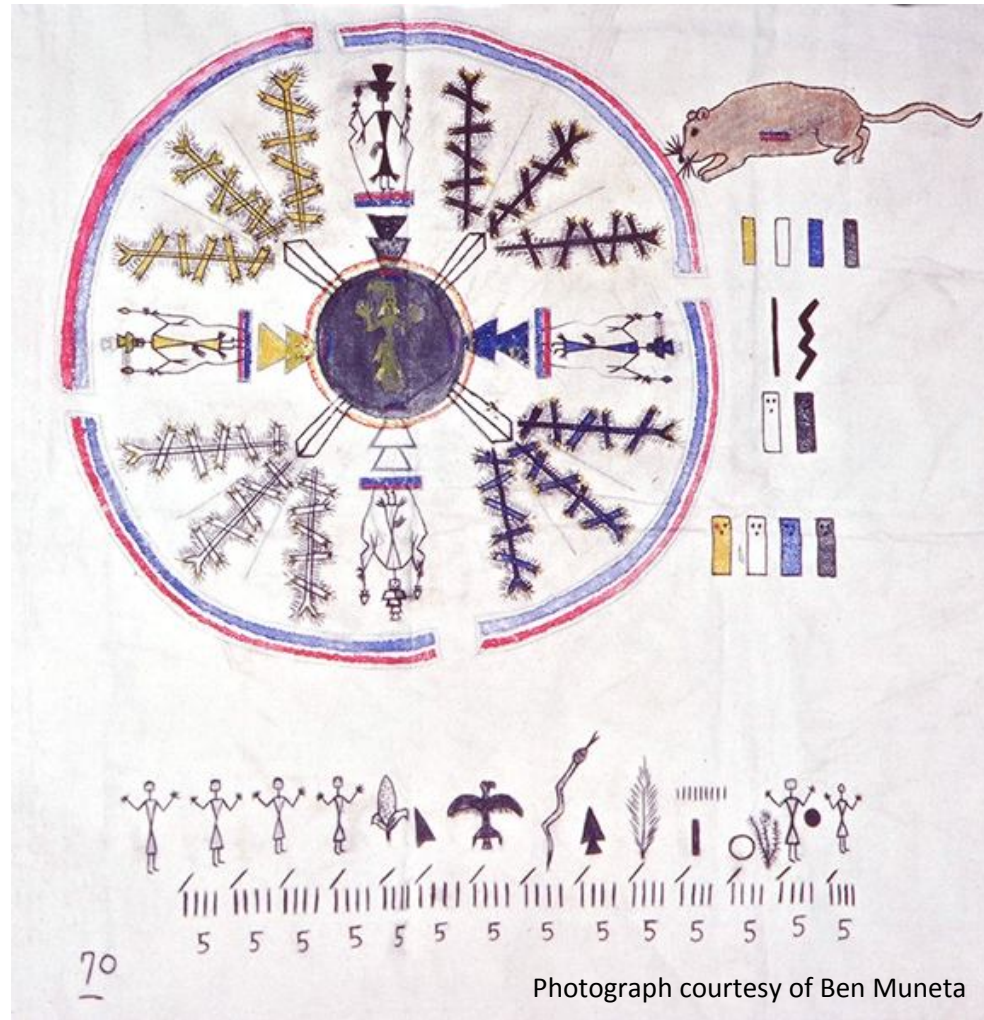
Physiology: Hemoglobin elevational work of Jay Storz

Populations genetics and habitat fragmentation in New York City: *P. leucopus* by Jason Munshi-South's work

## TEK and Hanta Virus Discovery

Involvement of Navajo Traditional Ecological Knowledge that helped in identifying rodents as the source of hanta virus through observation of pinyon nuts, wet years (El Nino), and illnesses.

Traditional practice/taboo of rodents in one's hogan and the cleaning is in line with public health recommendations for control of hanta.



Photograph courtesy of Ben Muneta

Navajo/Dine Art that includes Deer Mouse and Annual Harvest .

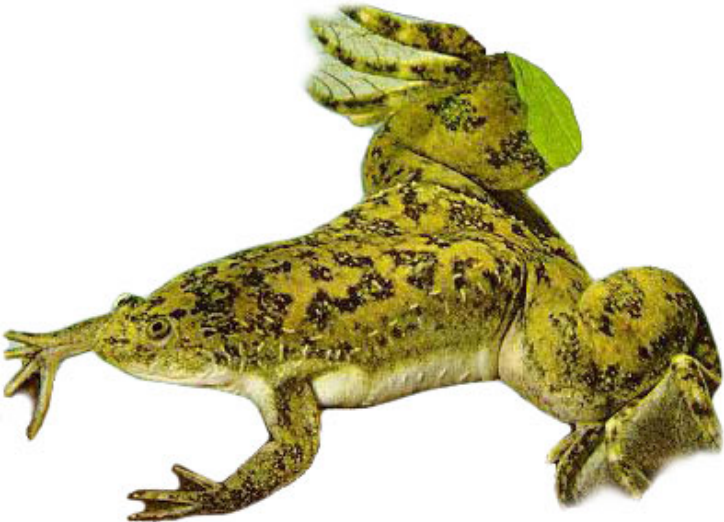
Last example: particular relevant to farmers, farm communities, and farm works (Latino/Hispanic Populations).

Atrazine and Vertebrate Endocrinology Disruption

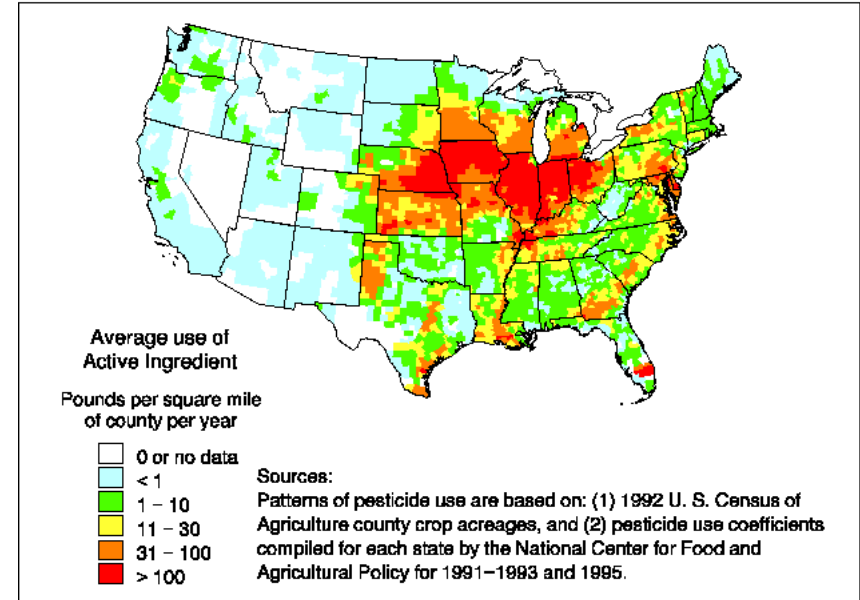
# Atrazine Use and Endocrine Disruption in Vertebrates



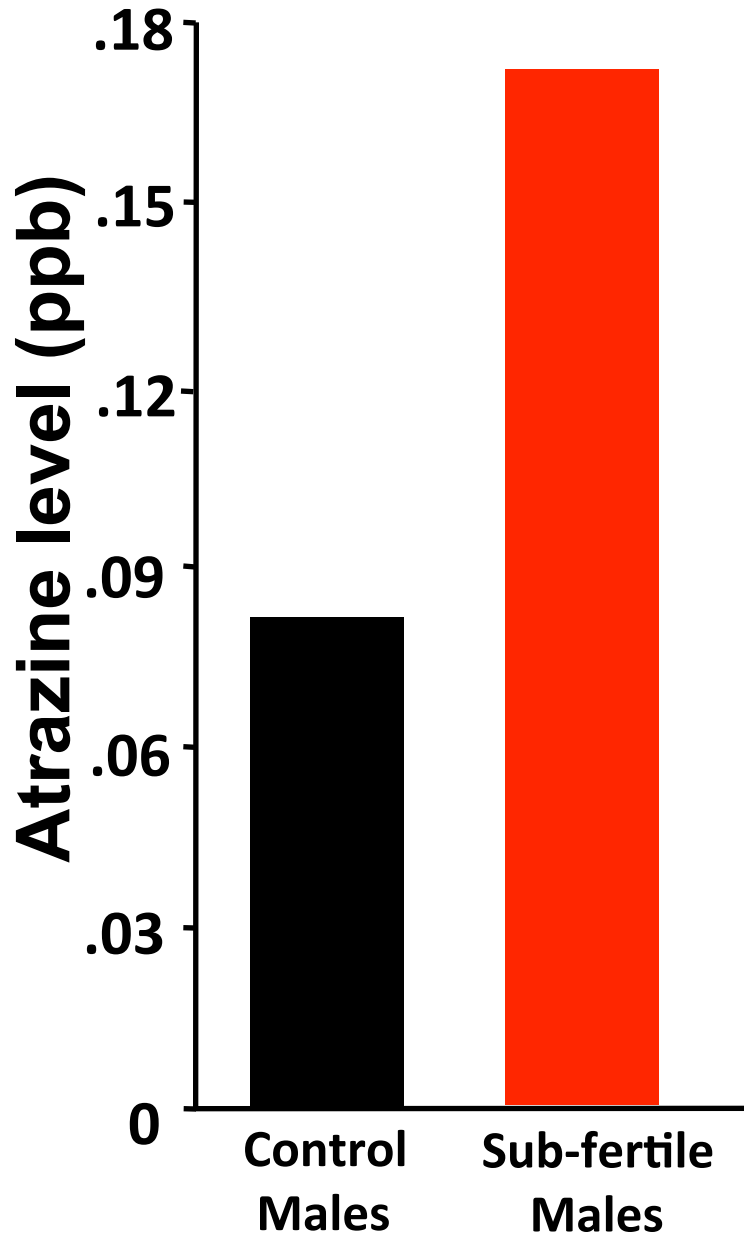
Dr. Tyrone Hayes



**ATRAZINE**  
ESTIMATED ANNUAL AGRICULTURAL USE



# Atrazine and human males



In humans  
Swan *et al.* 2003

***P* < 0.009**

Missouri Males

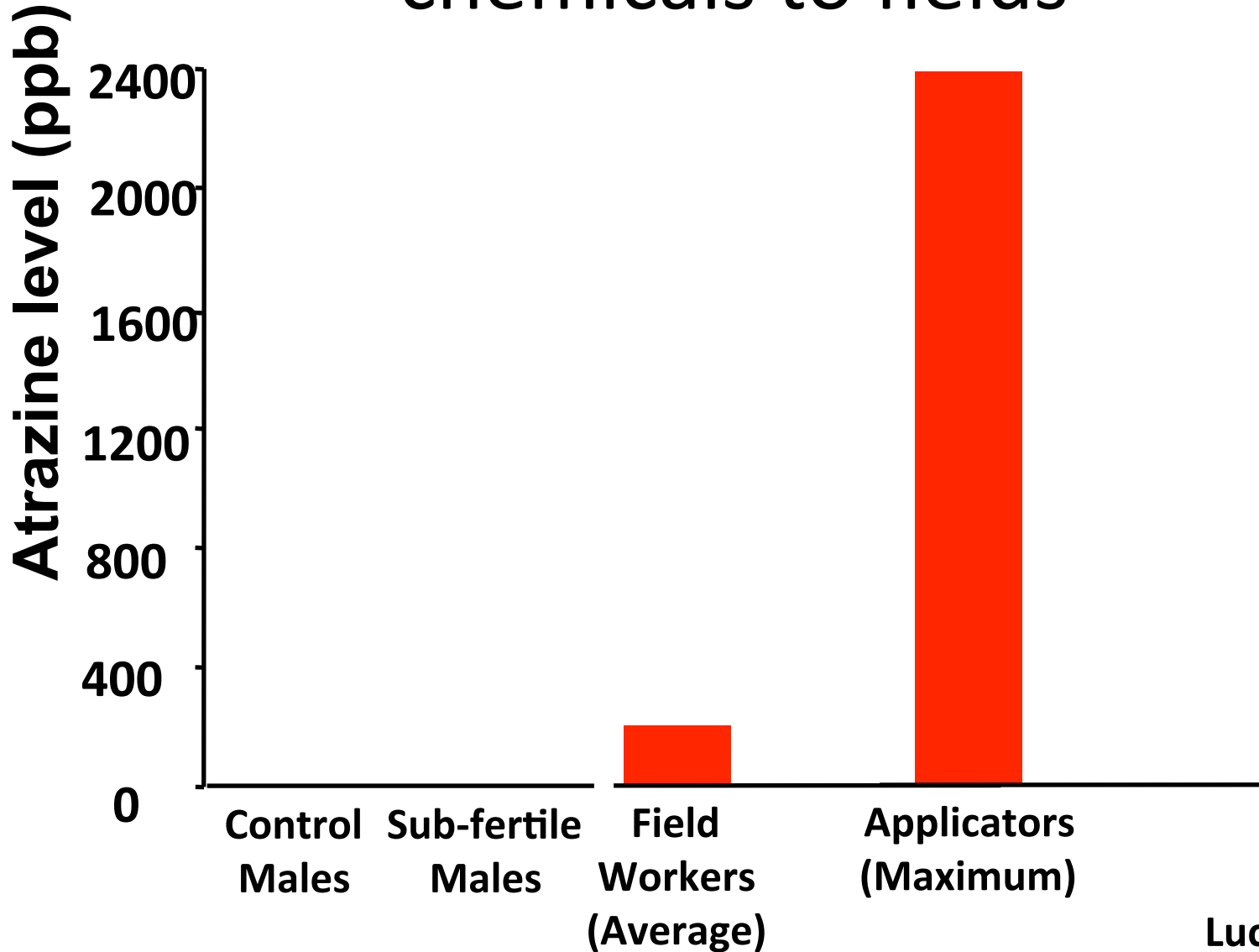
# Levels of atrazine in field workers



Lucas et al. 1993



# Levels of atrazine in workers that apply the chemicals to fields



**One last recommendation for increasing retention of UR students in your labs and at your university.**

**Get your undergraduate and graduate students to present at SACNAS.**

**-they give many, large travel awards too.**



**SACNAS**

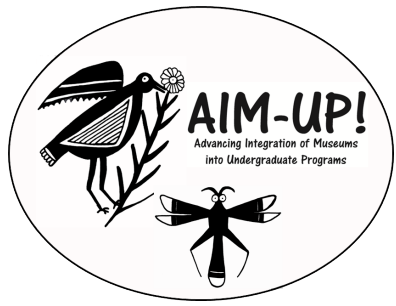
40 Years of Advancing Hispanics/Chicanos  
& Native Americans in Science

# Society for the Advancement of Hispanic/ Chicanos and Native American Scientists

Mission: Scientists fostering the success—from college students to professionals—to attain advanced degrees, careers, and positions of leadership in science.

Over 23,000 members, 90+ campus chapters, regional conferences, and an annual National Conference. \$15 to be a member.

- 1300 undergraduate presentations (travel awards)
- 200 graduate/post doctoral presentations
- PhD/MD recruitment and workshops



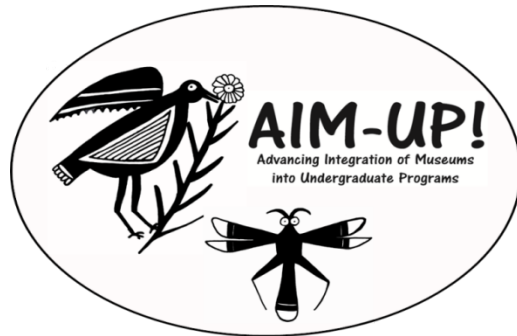
# Lessons from AIM-UP

1. **Collections are underutilized in Education and it is important for our institutions and society at large**
2. **We need more of you involved, your input (survey today and in the future). Share your “best teaching practices” and examples to [AIM-UP.org](https://aim-up.org) website.**
3. **Challenges and Barriers:**
  - a. **Expanded Use vs. Protection of the specimens**
  - b. **Conflict between educators and collection managers/curators**
4. **Discussion Questions for the Group?**

# Acknowledgements of Funding and Participating Organizations



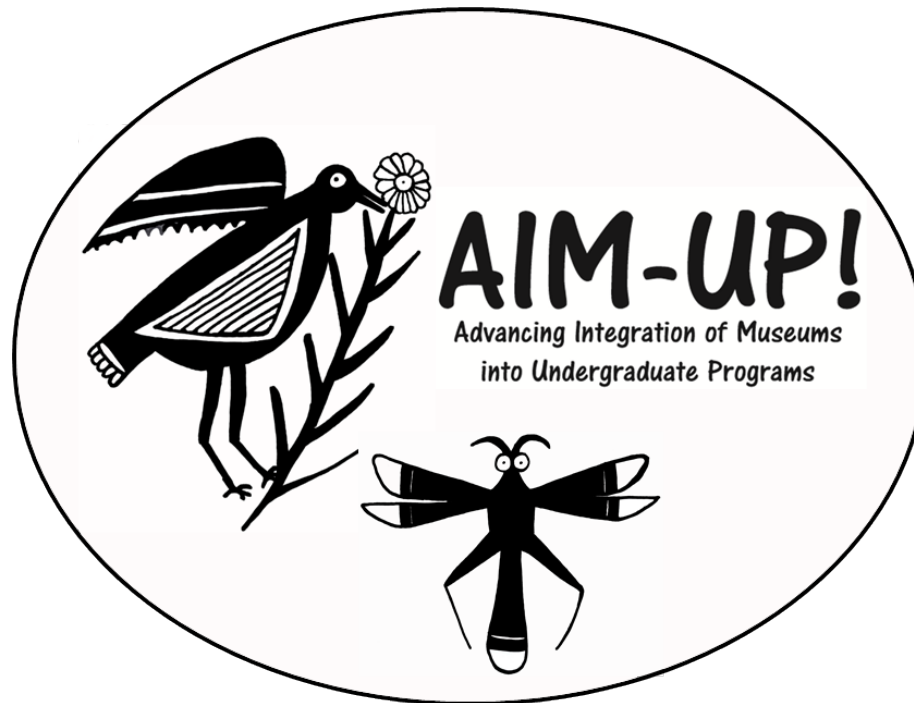
National Science Foundation  
Grant 0956129



University of New Mexico; University of Alaska, Fairbanks; Harvard University; University of California, Berkeley; Texas A&M University; City University of New York; Occidental University; University of Nevada, Reno; Arizona State University; University of Ohio; Florida Natural History Museum; University of Illinois, Champaign-Urbana; College of Southern Nevada; Northern Michigan University; University of Michigan; Massachusetts College of Liberal Arts; University of Colorado, Boulder; Denver Museum of Nature & Science; United States Geological Survey; United States Department of Agriculture

# AIM-UP!

(Advancing Integration of Museums into Undergraduate Programs)



A NSF-funded RCN

# What are some particular characteristics for 1<sup>st</sup> generation PhD students?

1. lower income
2. received less support from family related to college enrollment
3. more likely to have a full-time job while attending undergrad.
4. spend less time interacting with faculty
5. take longer to finish their BA/BS (higher drop out rate)
6. lower degree aspirations than their peers
7. more likely to be female
8. more likely to be people of color
9. more likely to identify with the 'imposter syndrome'

**Data: (from Terenzini et al 1996; Ishitani 2006; Nunez & Cuccaro-Alamin 1998, Pike & Kuh 2005; Gardner and Holly 2011)**

# Why Place-based is an ideal way to connect with students?

## EXAMPLE:

Tribal Colleges and Universities are incorporating tribal-specific traditional ecological knowledge and hands-on learning styles consistent with Indigenous philosophies into their biology programs (Cole 2006) and increasingly directing scientific research activities on reservations (Corbyn 2011).

Indian tribes manage ~100 million acres across the US and are home to critical habitat for a variety of threatened and endangered species. Biodiversity surveys and museum collections from these lands are typically spotty.



# ABRCMS: Annual Biomedical Research Conference for Minority Students

NOVEMBER 12-15, 2014



SAN ANTONIO, TEXAS

Annual Biomedical Research Conference for Minority Students

ABRCMS

PROGRAM

REGISTRATION & HOUSING

EXHIBITS & SPONSORS

ABSTRACTS & POSTERS

TRAVEL AWARDS

CONTACT US



Funded by a grant from the National Institute of General Medical Sciences of the National Institutes of Health

## WHAT'S NEW

- ♦ Exhibit Registration Opens is NOW Open
- ♦ Hotel Registration is NOW Open
- ♦ Conference Registration is NOW Open
- ♦ Abstract Submission & Travel Award Site is NOW Open
- ♦ 2013 ABRCMS Presentation Awards

## IMPORTANT DATES & DEADLINES

**April 18-24, 2014:** Exhibit Booth Registration Opens  
**May 12, 2014:** Conference Housing Opens  
**May 19, 2014:** Conference Registration Opens  
**June 2, 2014:** Abstract Submission Site Opens  
**June 2, 2014:** Student Travel Award Site Opens  
**September 5, 2014:** Abstract Submission Deadline  
**September 5, 2014:** Student Travel Award Submission Deadline  
**September 26, 2014:** Judges's Travel Subsidy Application Deadline  
**October 3, 2014:** LINK Travel Award Application Deadline  
**October 3, 2014:** FASEB MARC Travel Award Application Deadline  
**October 21, 2014:** Discount Conference Registration Deadline  
**November 12-15, 2014:** ABRCMS in San Antonio, Texas