The University of Montana

Native American Research Labs

Division of Biological Sciences

Collaborative Models: The University of Montana

Native American Research Laboratories

Michael Ceballos
Research Assistant Professor
Director – UM Native American Research Lab

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Overview

I. Background

I. The Native American Research Laboratories (NARL)

I. The Unique NARL Approach

I. NASA and NARL Collaborations

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Background

I. TCUs are not comparable to HBCUs and HSIs so using the same paradigms to increase minority participation does NOT work. Novel collaborative approaches MUST be implemented.

I. To increase the number of Native Americans in science, programs, federal agencies, and private funding agencies MUST understand that there are three populations of Native students that all must be equally served to really make a difference.

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Background

I. Of the ~35 accredited Tribal Colleges across the country not a single institution offers a bachelor's degree in biological and chemical sciences. (1 if BIA-controlled are included)

I. In AY2005-2006, first Research Laboratory for Biological and Chemical Sciences at a TCU with the intent of providing research opportunities to TCU students and developing a BS

I. Of the ~35 accredited Tribal Colleges across the country only one institution offers a bachelor's degree in engineering (computer). (2 if BIA-controlled are included)

I. Of the ~35 accredited Tribal Colleges across the country not a single institution offers a master's or doctorate degree in science or engineering.

II. Of the ~35 accredited Tribal Colleges across the country , there are very few, if any, PhD-prepared Native faculty/scientists.

I. Over 10 million dollars per year (low estimate) are poured into the TCU system for STEM.

How many Native American Ph.D.'s ('hard sciences') have come out of the TCU system?
How many Native American Master's students ('hard sciences') have come out of TCUs?
How many Native American engineer's with advanced degrees have come out of TCUs?
How many Native American student co-authored peer-reviewed publications from TCUs?

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Background

I. Sending Native students off for summer research internships – not always productive

I. Limitations of Providing Science Opportunities at TCUs
   A. Lack of opportunity for academic year (i.e., long-term) research experiences at TCUs
   B. Lack of faculty research expertise (No Ph.D.-prepared Native faculty with research exp)
   C. Limited access to state-of-the-art research instrumentation (moth-ball instruments)
   D. Lack of culturally-relevant faculty role models/mentors
   E. TCU science faculty have high teaching loads
   F. No tenure system/high turn-over in TCU system
   G. Lack of opportunity for both fac/stud to develop collegial relationships in science
   H. Lack of cross-cultural opportunities

III. Limitations of Native-serving Programs at Universities
   A. Programs are almost exclusively directed by non-Natives; usually placement programs
   B. Native students are often isolated in labs with no other Native students (intimidating)
   C. No Tenured/Tenure-Track Native American Faculty Role Models in the 'hard' sciences
   D. NOT CONSIDERED MSIs – NO EQUAL ACCESS FUNDING OPPORTUNITIES

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Background

I. The GREAT OVERSIGHT

A. TCU students are only one of three major populations of Native Students that need to be served: non-reservation Natives, Natives High School Grads → University

A. The ROI is miserably low because NO ONE is effectively addressing the issue of providing tenure-track academic positions for Native American faculty who are actively engaged in research and who can serve as culturally-relevant role models

B. Native students often enter universities with deficiencies in math and science; a true "bridge" program is required; not just a "program" but a real "solution" a facility dedicated to training Native students so that they can become competitive in traditional university labs and competitive for graduate school.

A. "Training" programs MUST be directed by Native American faculty

II. Native American Research Laboratories at The University of Montana

A. Division of Biological Sciences (400 ft^2) + Department of Biomedical Sciences (120ft^2)
B. Successes: More than 60 students in first 2 years of operation, 2/3 Native

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The Native American Research Lab

The University of Montana Native American Research Laboratories (NARL) were established in 2007 to provide "hands-on" research opportunities for Native American undergraduate students, graduate students, and, even, high school students in a highly interdisciplinary and cross-cultural research setting guided by culturally-relevant faculty role models and mentors.

Although NARL is dedicated to serving Native American students, the lab also supports non-Native students and international students to facilitate cross-cultural exchange and intercultural collegiality.

NARL provides students with: "cutting-edge" research opportunities; access to modern instrumentation; training in state-of-the-art research methods; opportunities for intertribal and cross-cultural exchange and collaboration; access to culturally-relevant near-peer mentors and faculty advisors/role models; opportunities for 'merit-based' funding; and, opportunities for co-authorship/publication and presentation at national science conferences. NARL maintains high standards of excellence.

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Unique NARL Approach

1. NARL employs culturally-relevant faculty with research expertise
2. NARL is a mentorship and training program, not a placement program
3. NARL maintains active research awards in addition to ed enhan awards
4. NARL is well-equipped (although space is becoming limited)
5. NARL uses near-peer mentoring and group project approaches
6. NARL provides opportunities for cross-cultural interaction


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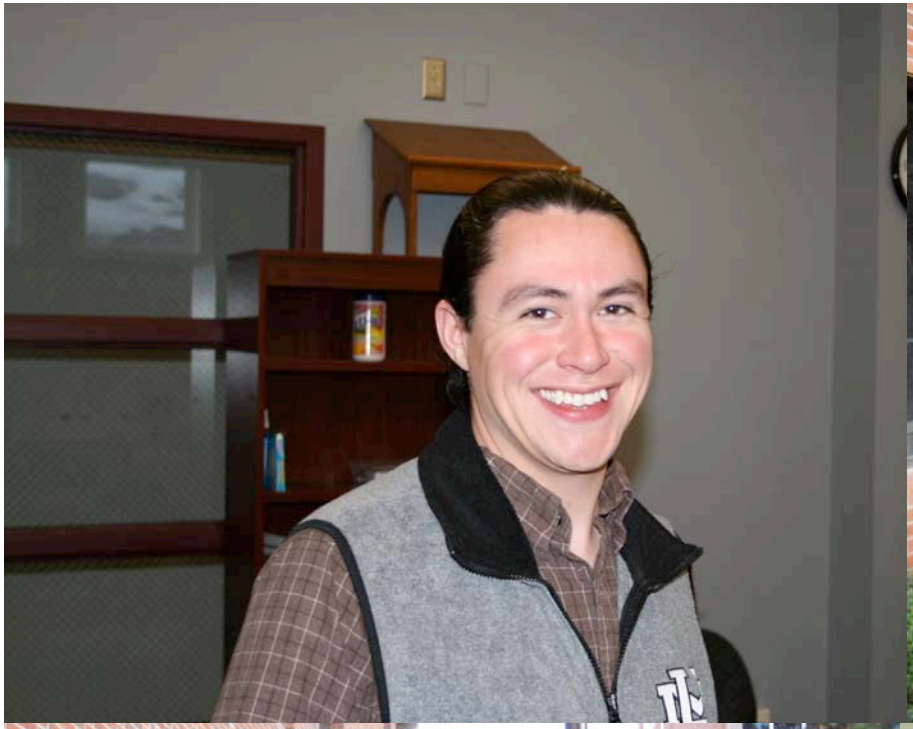

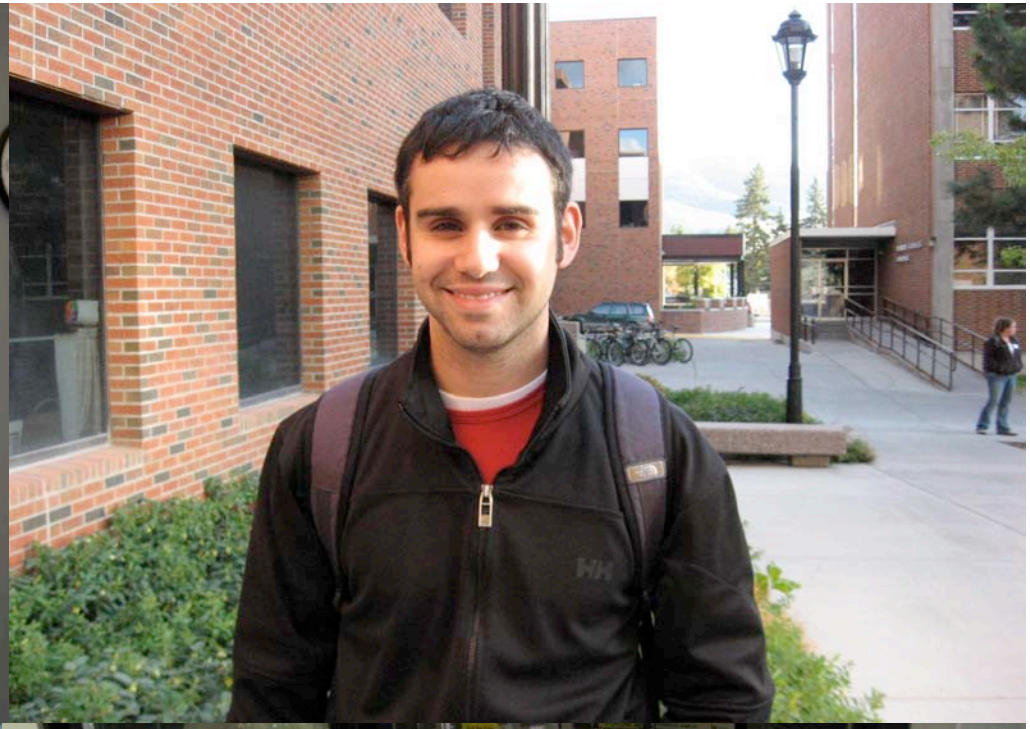


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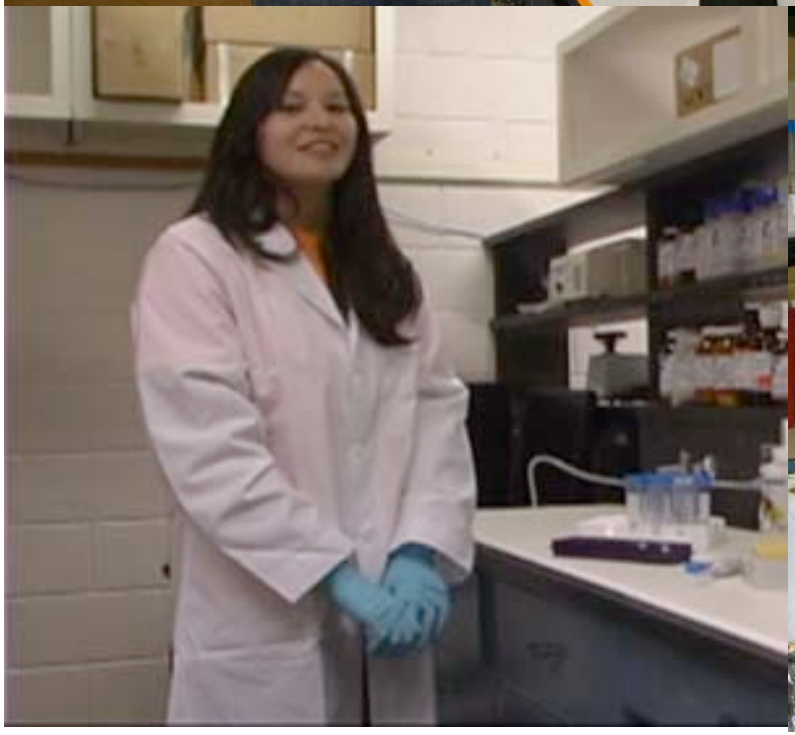



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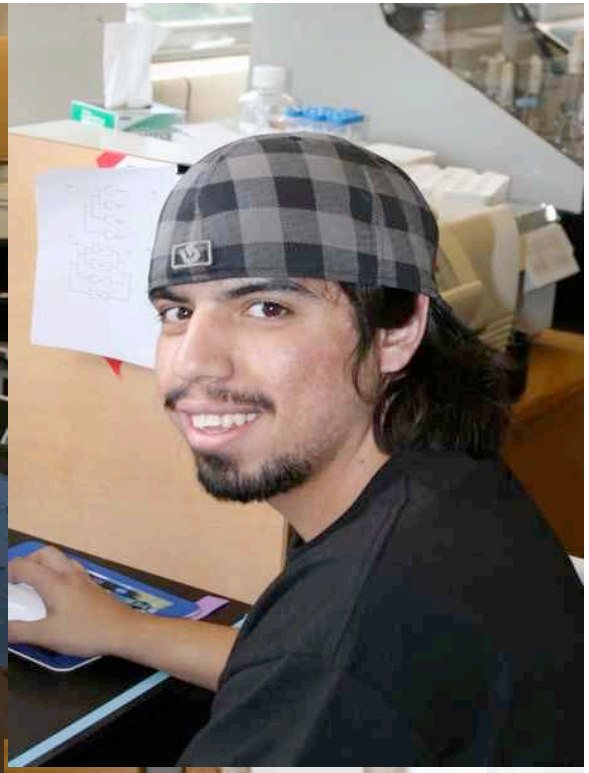
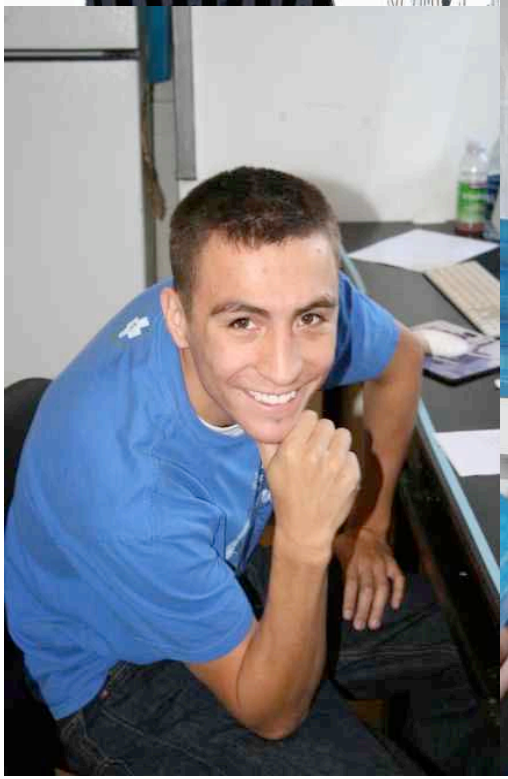



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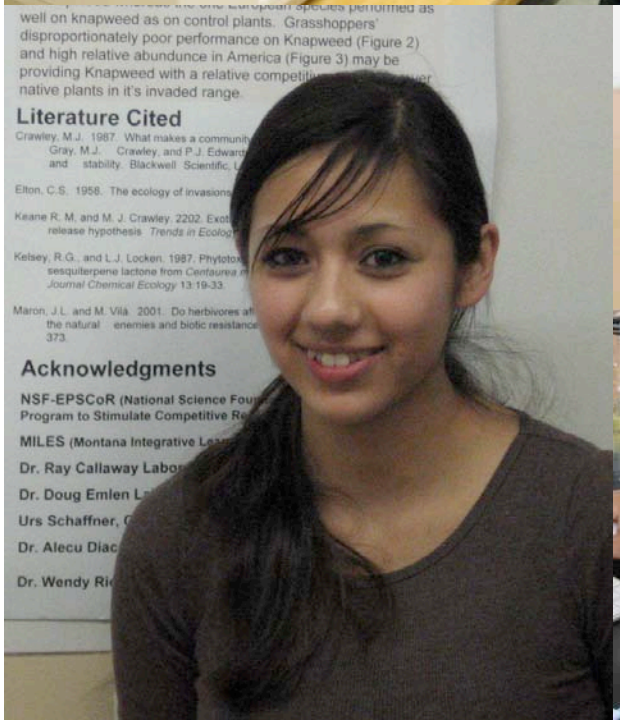
well on knapweed as on control plants. Grasshoppers'
disproportionately poor performance on Knapweed (Figure 2)
and high relative abundance in America (Figure 3) may be
providing Knapweed with a relative competiti
native plants in it's invaded range.
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373.
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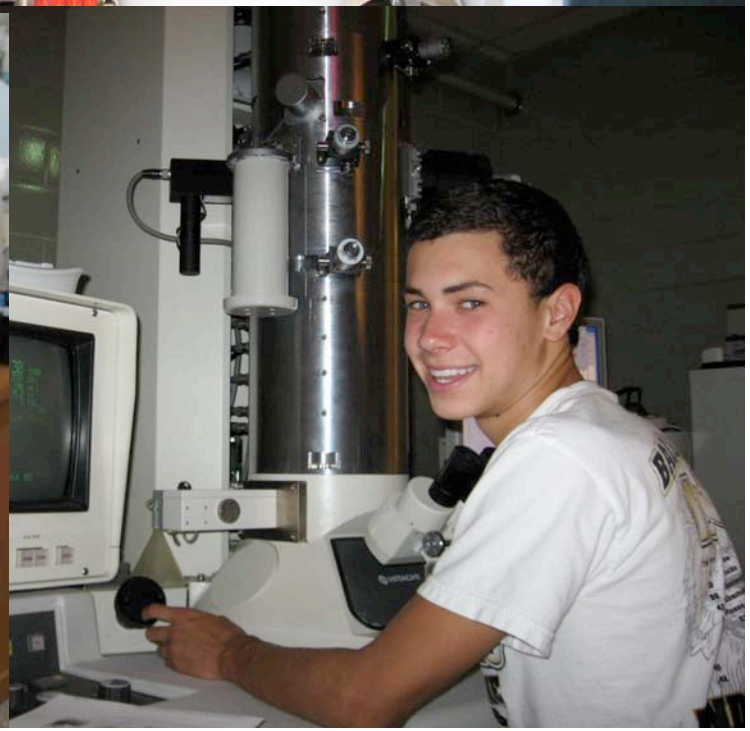
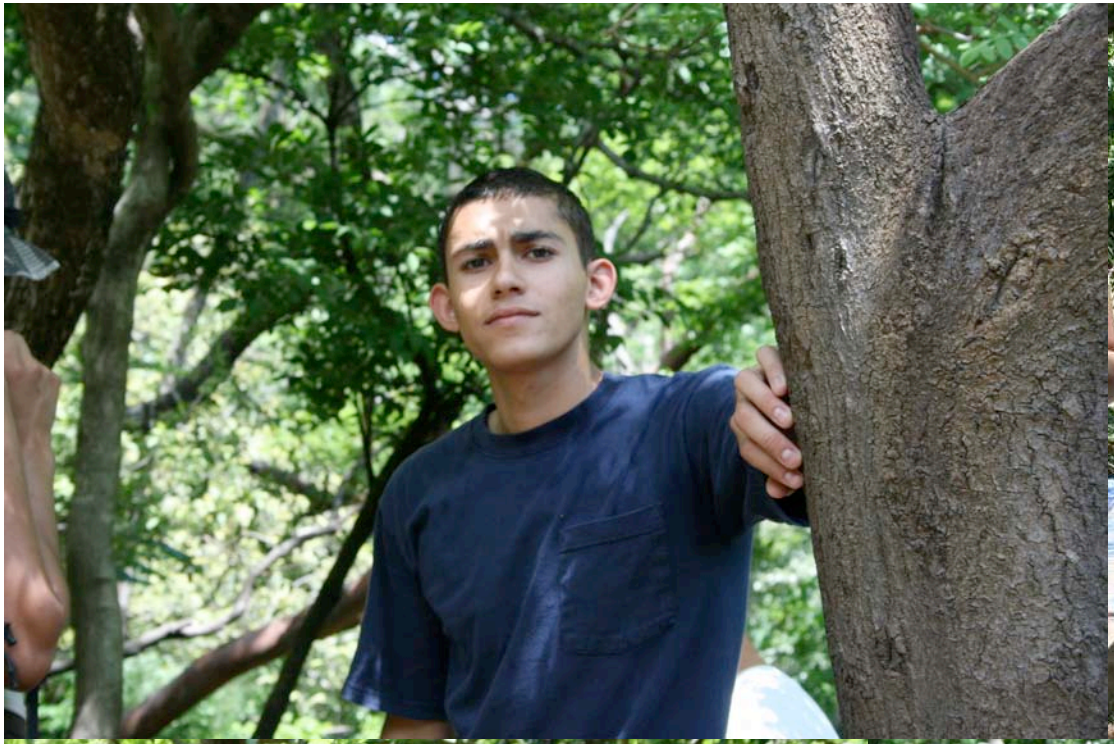
Dr. Alecu Diac
Dr. Wendy Ri



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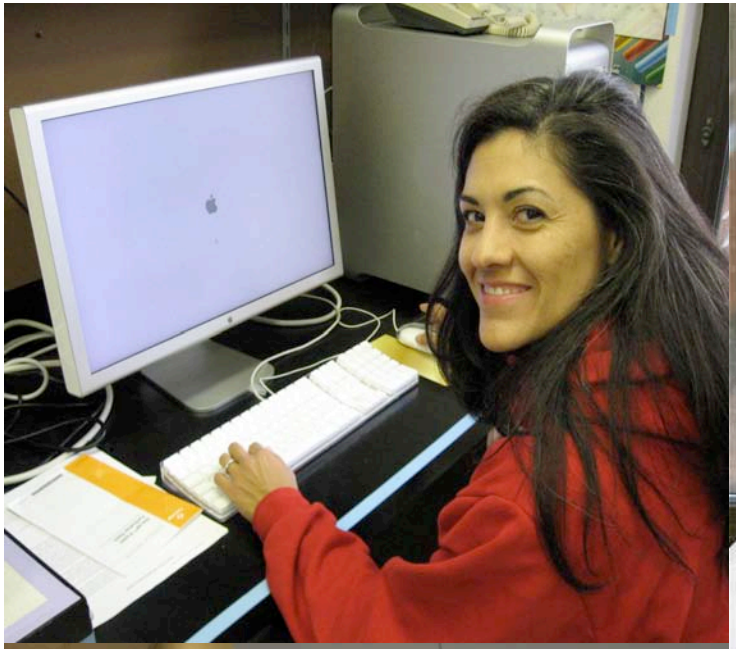




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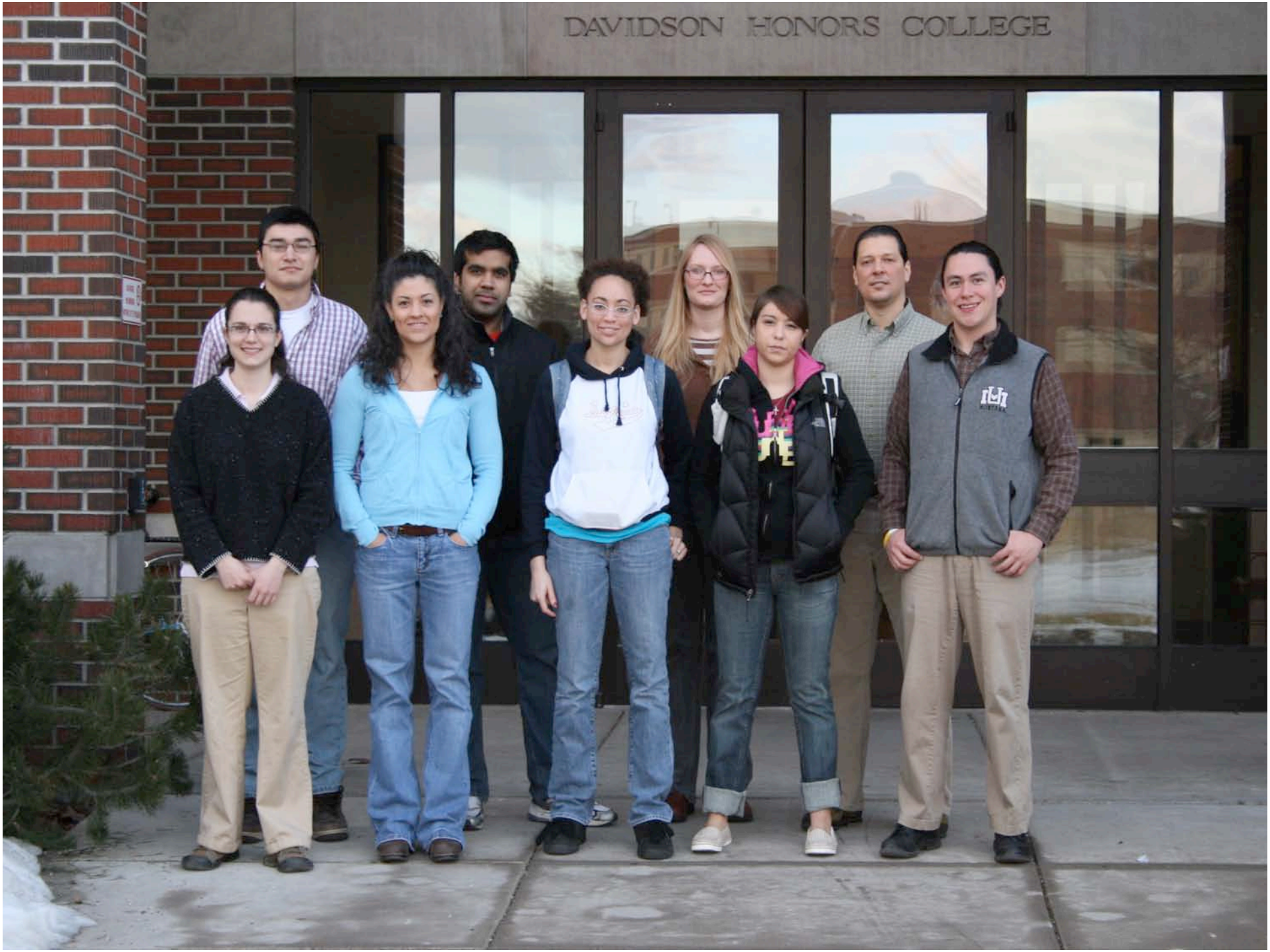
DAVIDSON HONORS COLLEGE


COLLEGE
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NASA and NARL

In the first 2 years of operation, NARL has served more than 55 students, two-thirds of whom are Native American representing more than 20 tribes from across the First Nations. (4 BS, 4 TCU fac, 2 Grad, 4 → 16 people)

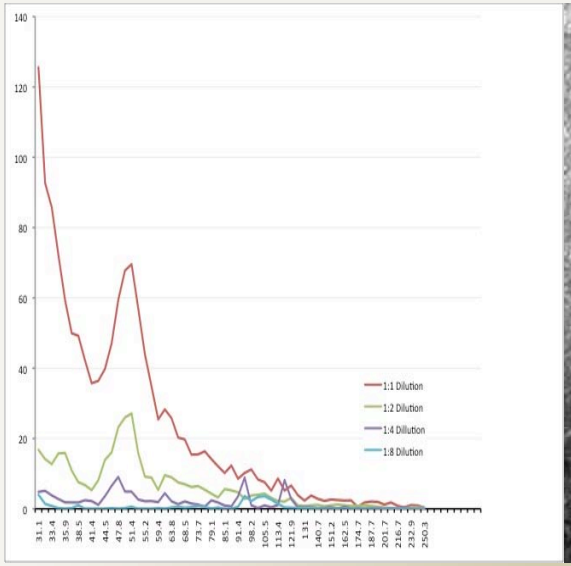
EVERY STUDENT RESEARCH PROJECT IS EITHER A DIRECT OR INDIRECT RESULT OF ACTIVE RESEARCH COLLABORATIONS BETWEEN NARL AND NASA AMES RESEARCH CENTER

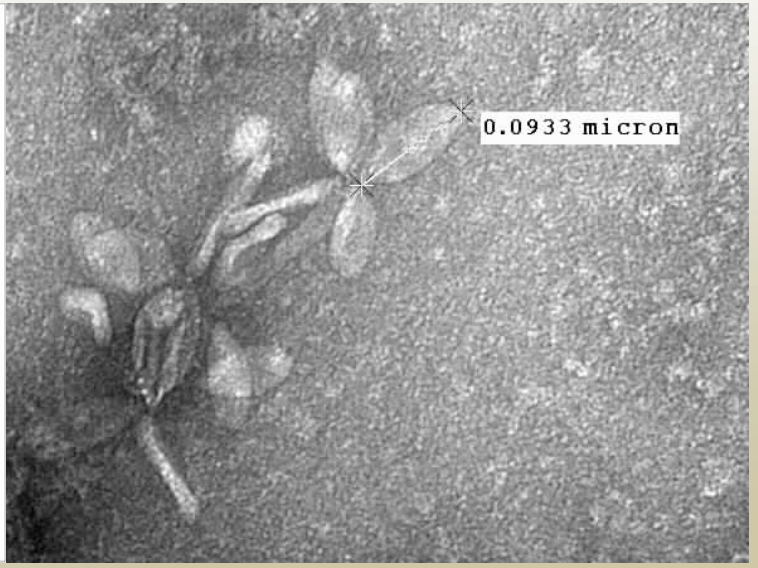
- ASTROBIOLOGY AND BIOFUELS/OMEGA PROJECT -

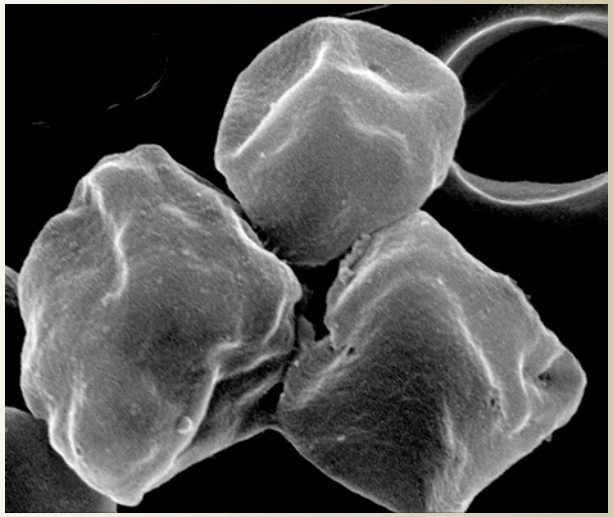
NASA and NARL

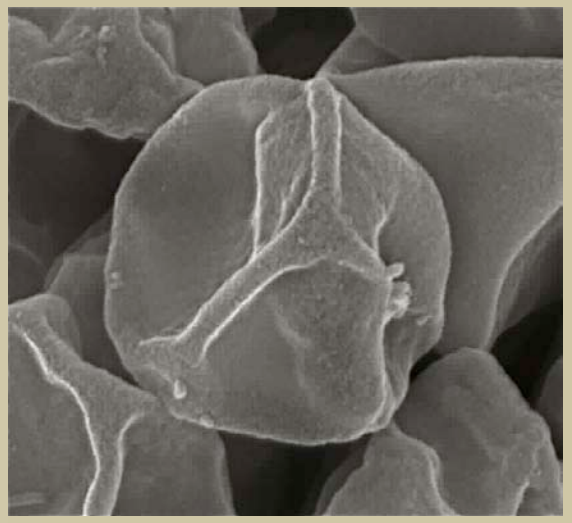
2006	**NASA Astrobiology Institute MIRS Faculty Award** (Ceballos)	
2007	**NSF RIG Award** (PI-Ceballos) Archaeal HSP Complexes and Viral Proteins: A Structural Biology and Biophysics Study	$174,800
2007	**NSF DRL Award** (PI-Gary; coPI-Ceballos) Astrobiology in the Secondary Classroom Project	$300,000
2008	**NASA EPSCoR Award** (sciPI-Ceballos) Biomolecular Substrates for Extraterrestrial Life: Revealing Secrets of Extremophilic Archaea and Their Viruses	$750,000
2009	**NSF EaGER Award** (PI-Ceballos) A Novel Enzyme Sequestration Platform: Rapid Development of the “Rosettazyme” for Cellulosic Substrate Deconstruction	$300,000

NASA and NARL – Extremophile Virus-Host Coevolution









Lysogenic Viruses: 1 Host – 2 Virus System

Equation 1: $$dH_{AS}/dt = \rho_{AS}H_{AS} - \gamma_{ASVA}H_{AS}V_A - \gamma_{ASVB}H_{AS}V_B - \delta_{AS}H_{AS}$$

Equation 2a: $$dH_{AIVA}/dt = \rho_{AIVA}H_{AIVA} + \gamma_{ASVA}H_{AS}V_A - \delta_{AIVA}H_{AIVA}$$

Equation 2b: $$dH_{AIVB}/dt = \rho_{AIVB}H_{AIVB} + \gamma_{ASVB}H_{AS}V_B - \delta_{AIVB}H_{AIVB}$$

Equation 3a: $$dV_A/dt = \rho_{VA}H_{AIVA} - \delta_A V_A$$

Equation 3b: $$dV_B/dt = \rho_{VB}H_{AIVB} - \delta_B V_B$$

H_{AS} – Susceptible $Host_A$

V_A – $Virus_A$

V_B – $Virus_B$

H_{AIVA} – $Virus_A$-infected $Host_A$

H_{AIVB} – $Virus_B$-infected $Host_A$

ρ_{AS} – growth rate of susceptible $Host_A$

γ_{ASVA} – rate/proportion of contact events with $Virus_A$ resulting in infection of H_{AS}

γ_{ASVB} – rate/proportion of contact events with $Virus_B$ resulting in infection of H_{AS}

δ_{AS} – natural death rate of susceptible host

ρ_{AIVA}– growth rate of $Virus_A$-infected $Host_A$

δ_{AIVA} – natural death rate of $Virus_A$-infected $Host_A$

ρ_{AIVB}– growth rate of $Virus_B$-infected $Host_A$

δ_{AIVB} – natural death rate of $Virus_B$-infected $Host_A$

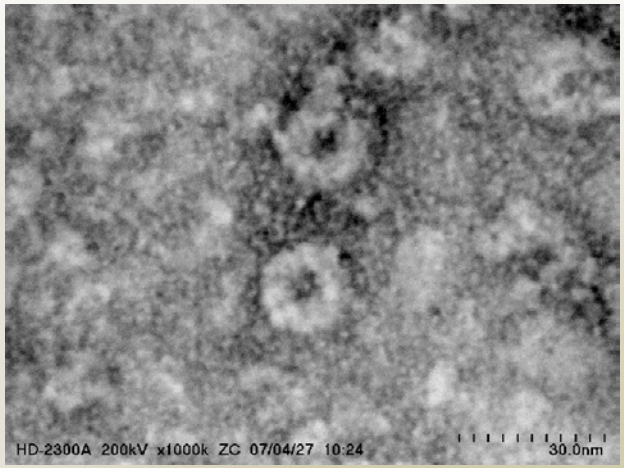
ρ_{VA} – replication rate of $Virus_A$ as a function $Virus_A$-infected $Host_A$ growth

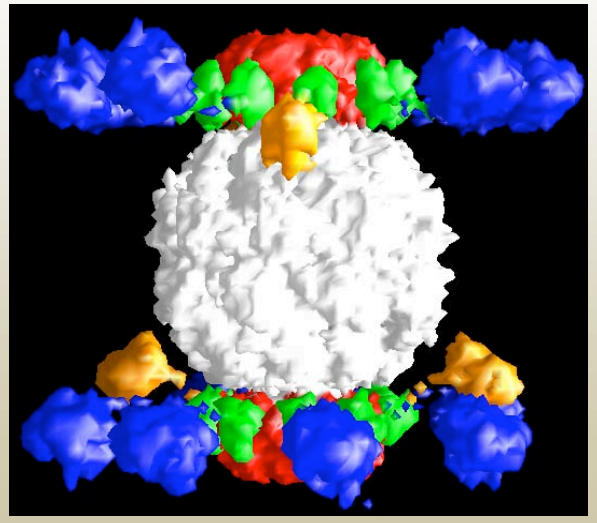
ρ_{VA} – replication rate of $Virus_A$ as a function $Virus_A$-infected $Host_A$ growth

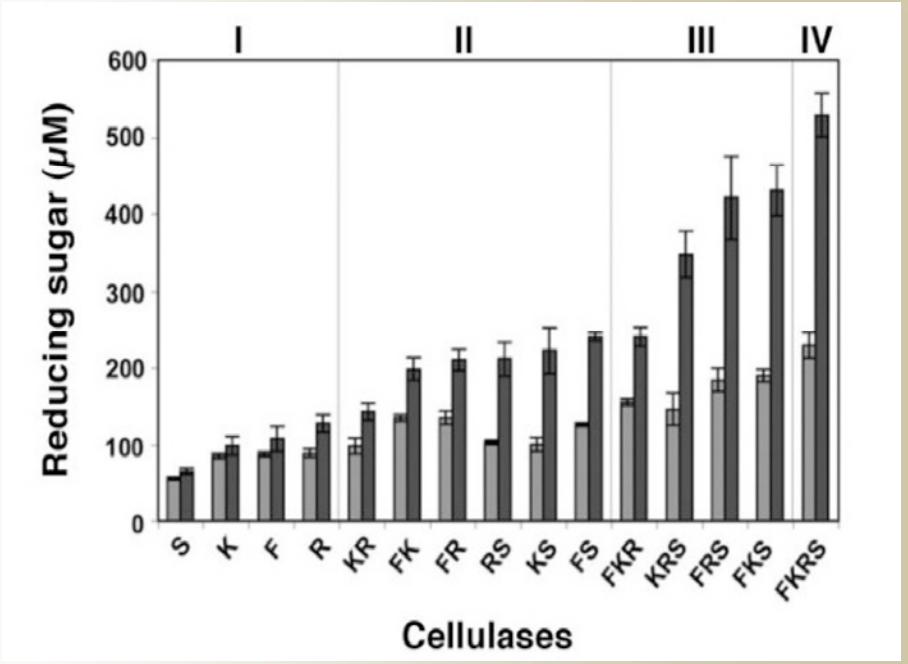
δ_A – natural removal rate of $Virus_A$ from the environment

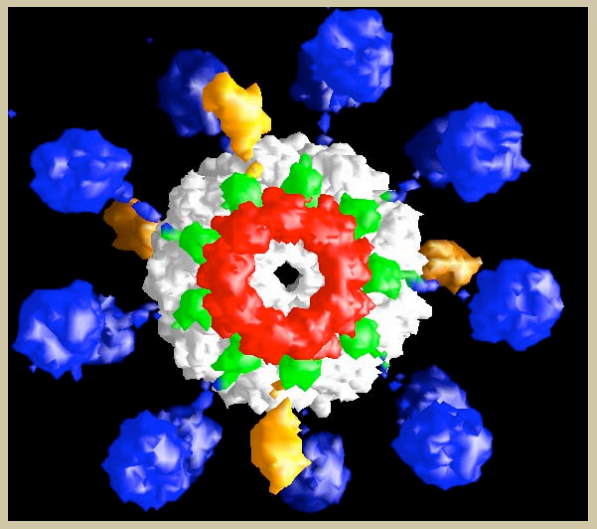
δ_B – natural removal rate of $Virus_B$ from the environment

NASA and NARL – Rosettazymes / Bioethanol Production

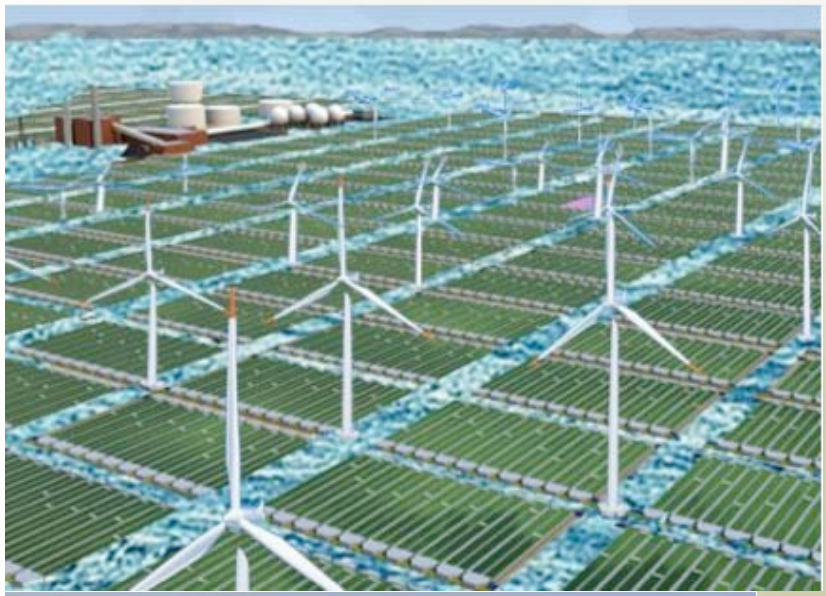


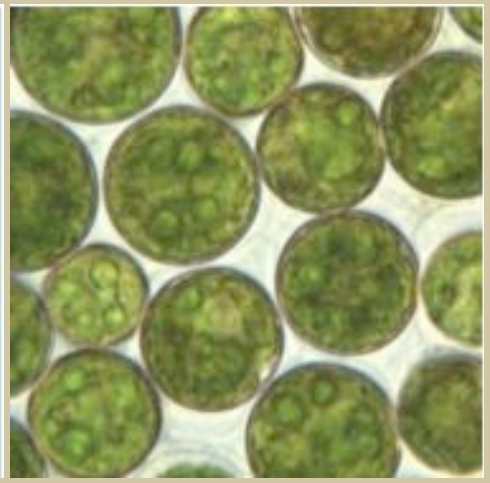






NASA and NARL – Algal-based Biodiesel / OMEGA project





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NARL DILEMMA

NARL has sufficient funds to carry-out core research related to awards;

HOWEVER,

NARL LACKS SUFFICIENT LABORATORY SPACE TO TRAIN STUDENTS

NARL LACKS TRAINING FUNDS FOR UNDERGRADUATES AND GRADUATES

NARL LACKS INSTRUMENTATION

NARL LACKS FUNDS TO EXPAND COLLABORATIONS WITH TSU AND UPR


URLEY
Maine

NARL has built ties with TCUs, HBCUs, HSIs, and other minority-serving institutions. These include research collaborations with Tennessee State University (an HBCU) and The University of Puerto Rico (an HSI).

Leads seek to develop a

Biosciences Center of Excellence for Minority Science Training

BioCEMiST

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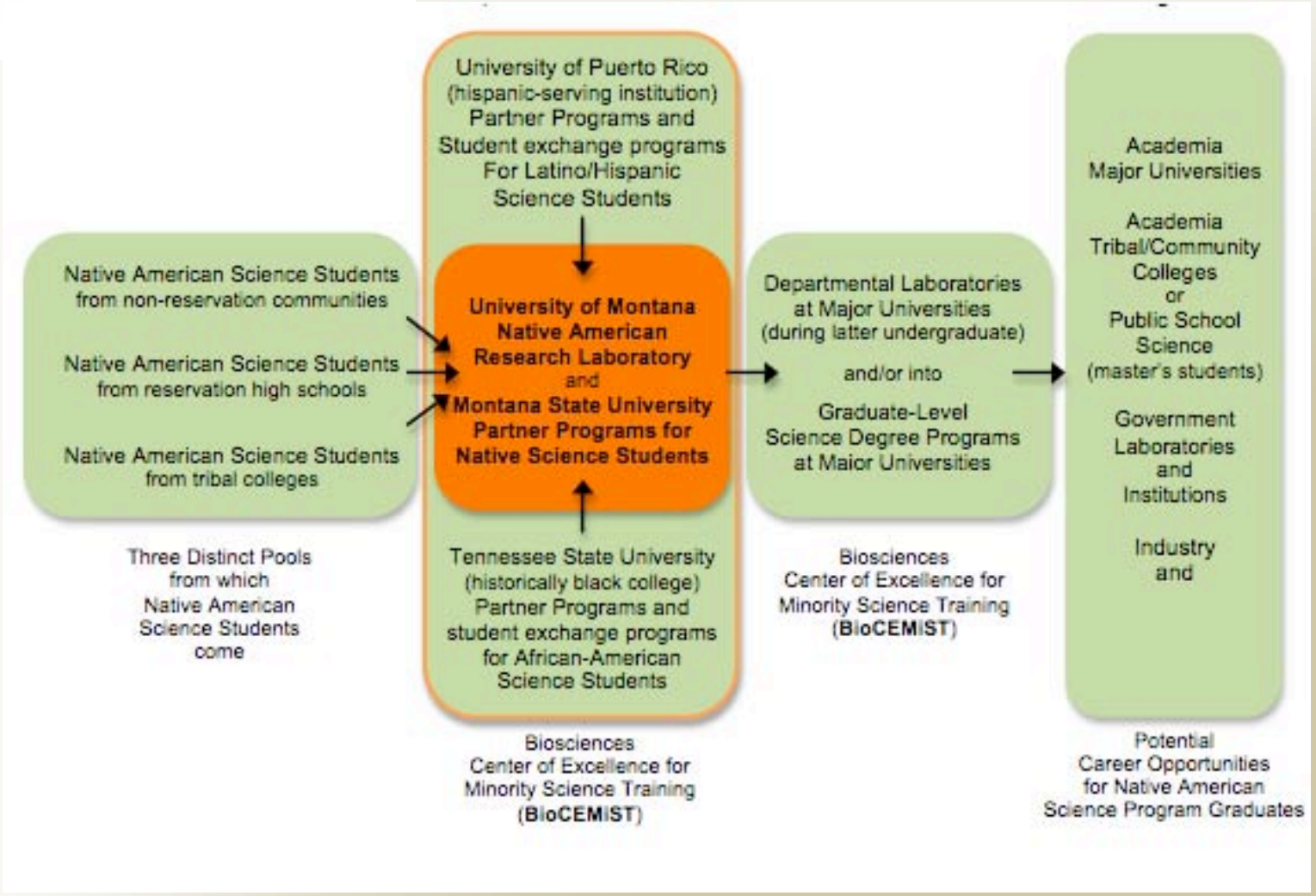
BioCEMiST



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BioCEMiST

Take Home Points:

1.MUST provide support Culturally-relevant faculty in tenured positions

1.MUST have Native programs at UNIs & TCUs directed by Native faculty

1.MUST recognize the THREE sub-populations of Native Students and not leave funding unbalanced so that non-TCU AI/AN are overlooked

1.MUST develop a REAL training facility for interdisciplinary research in a cross-cultural learning environment with modern instrumentation guided by culturally-relevant faculty role models/mentors

Biosciences Center of Excellence for Minority Science Training

BioCEMiST

Acknowledgements

1.Organizers of this MI Workshop (Langhoff, Berthold, all others)

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Benita,
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Maricela

Biosciences Center of Excellence for Minority Science Training

BioCEMiST

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NASA