

Welcome to NACK's Webinar

# Recruiting Underrepresented Minorities



Hosted by MATEC NetWorks [www.matecnetworks.org](http://www.matecnetworks.org)

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Nanotechnology Applications and  
Career Knowledge Center  
located at Penn State University



National  
Science  
Foundation

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# NACK's Webinar Presenters



**Angela Berenstein**  
Nanotechnology  
Education Programs  
Coordinator at the  
University of California



**Kristi Jean**  
Nanoscience  
Coordinator at  
the North Dakota  
State College of  
Science



**Carrie Leopold**  
Outreach  
Coordinator at  
the North Dakota  
State College of  
Science



**Shannon Hogan**  
Educator at Carver  
High School of  
Engineering &  
Science



**Amy Brunner**  
Process Development  
Engineer at Innovative  
Micro Technology



# Objectives

- Discuss recruitment strategies
- Share resources
- Gauge the impact
- Identify ways to overcome obstacles



# Barriers and Obstacles

- What are some common barriers and obstacles that minorities face when it comes to pursuing a STEM related career?



# Barriers and Obstacles

- Access to resources
- Stereotypes
- Lack of role models
- Isolation

Source: **Caroline Simard, Ph.D.**, Director of Research and Executive Programs at the Anita Borg Institute for Women and Technology; Obstacles and Solutions for Underrepresented Minorities in Technology: [www.anitaborg.org](http://www.anitaborg.org)

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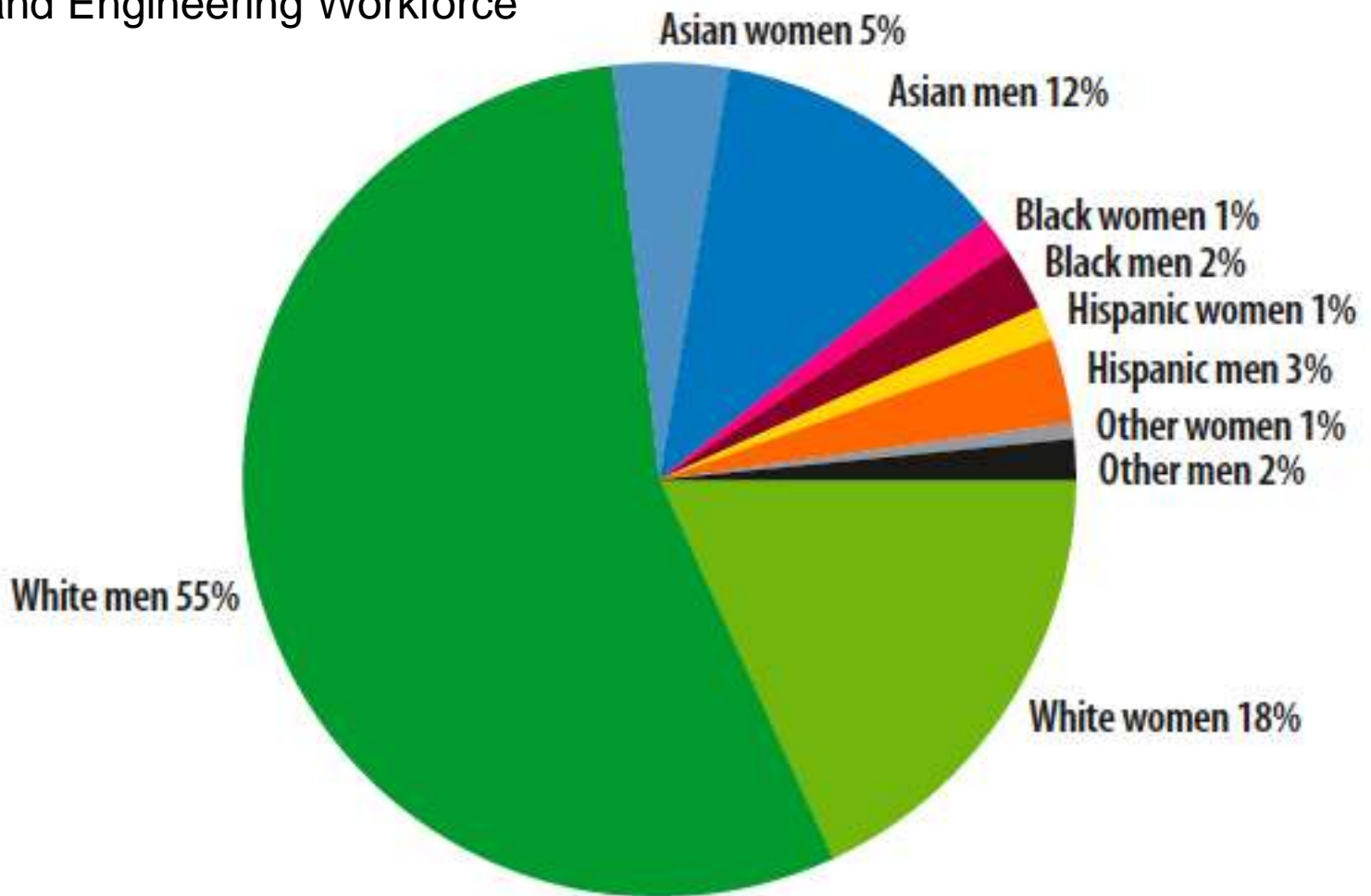
# Defining URM

- Women, persons with disabilities, and three racial/ethnic groups—blacks, Hispanics, and American Indians—are considered underrepresented in science and engineering because they constitute smaller percentages of science and engineering degree recipients and of employed scientists and engineers than they do of the population.

SOURCE: *Women, Minorities, and Persons with Disabilities in Science and Engineering:2011* [www.nsf.gov/statistics/wmpd/](http://www.nsf.gov/statistics/wmpd/)



# Science and Engineering Workforce c. 2006

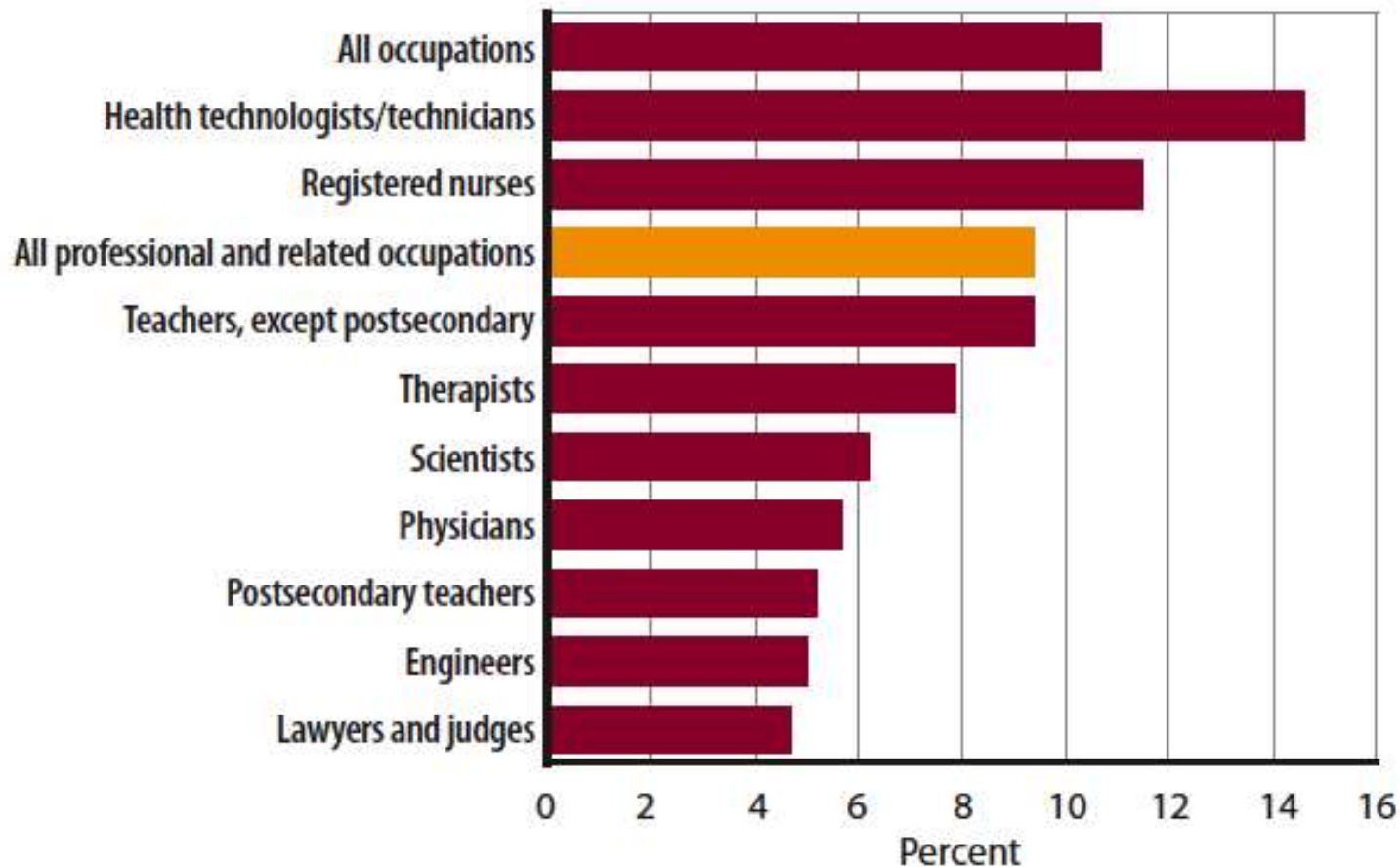


SOURCE: *Women, Minorities, and Persons with Disabilities in Science and Engineering:2011* [www.nsf.gov/statistics/wmpd/](http://www.nsf.gov/statistics/wmpd/)





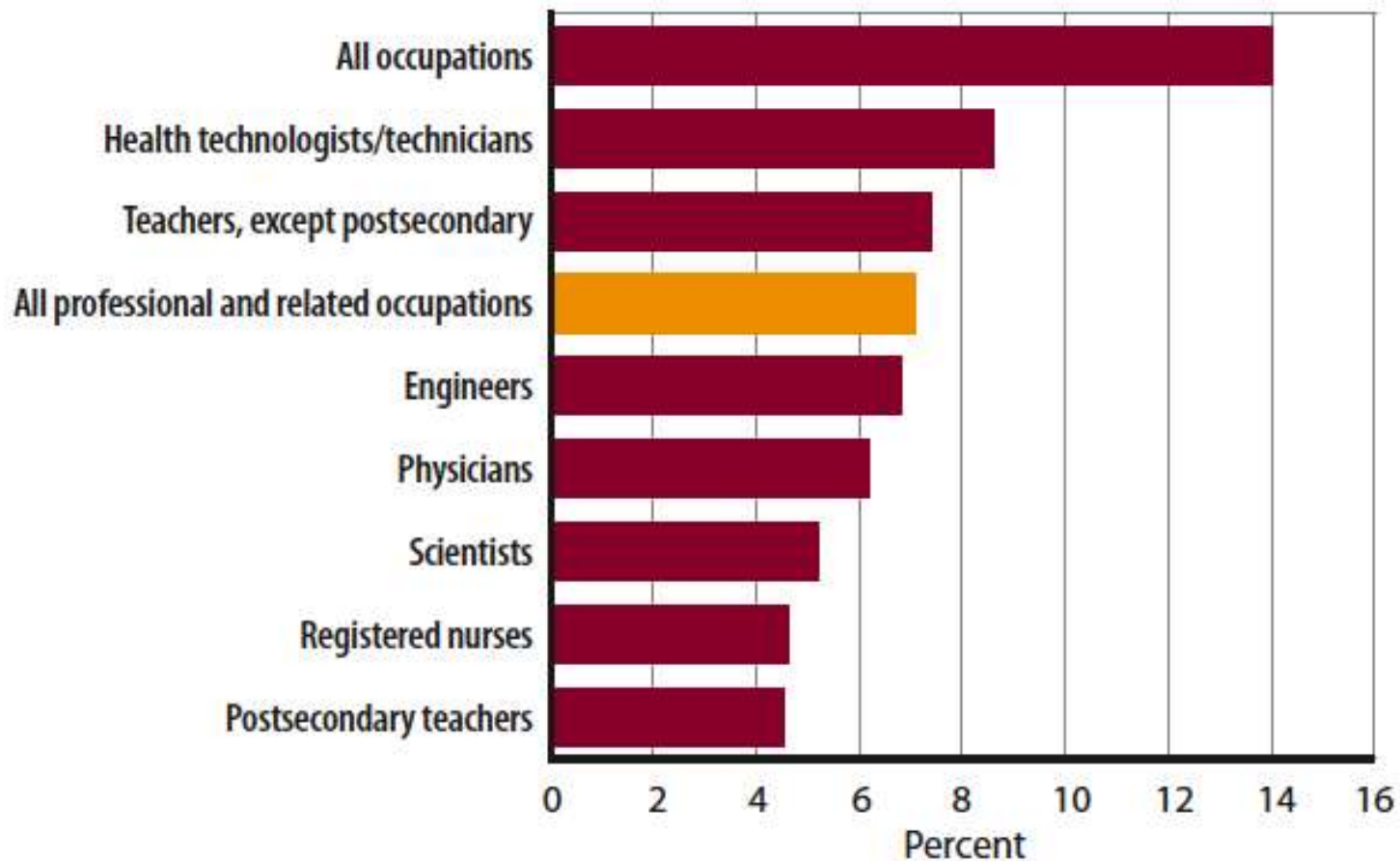
# Employed African American 16 years of age and older as a % of the selected occupations c. 2009



SOURCE: *Women, Minorities, and Persons with Disabilities in Science and Engineering:2011* [www.nsf.gov/statistics/wmpd/](http://www.nsf.gov/statistics/wmpd/)



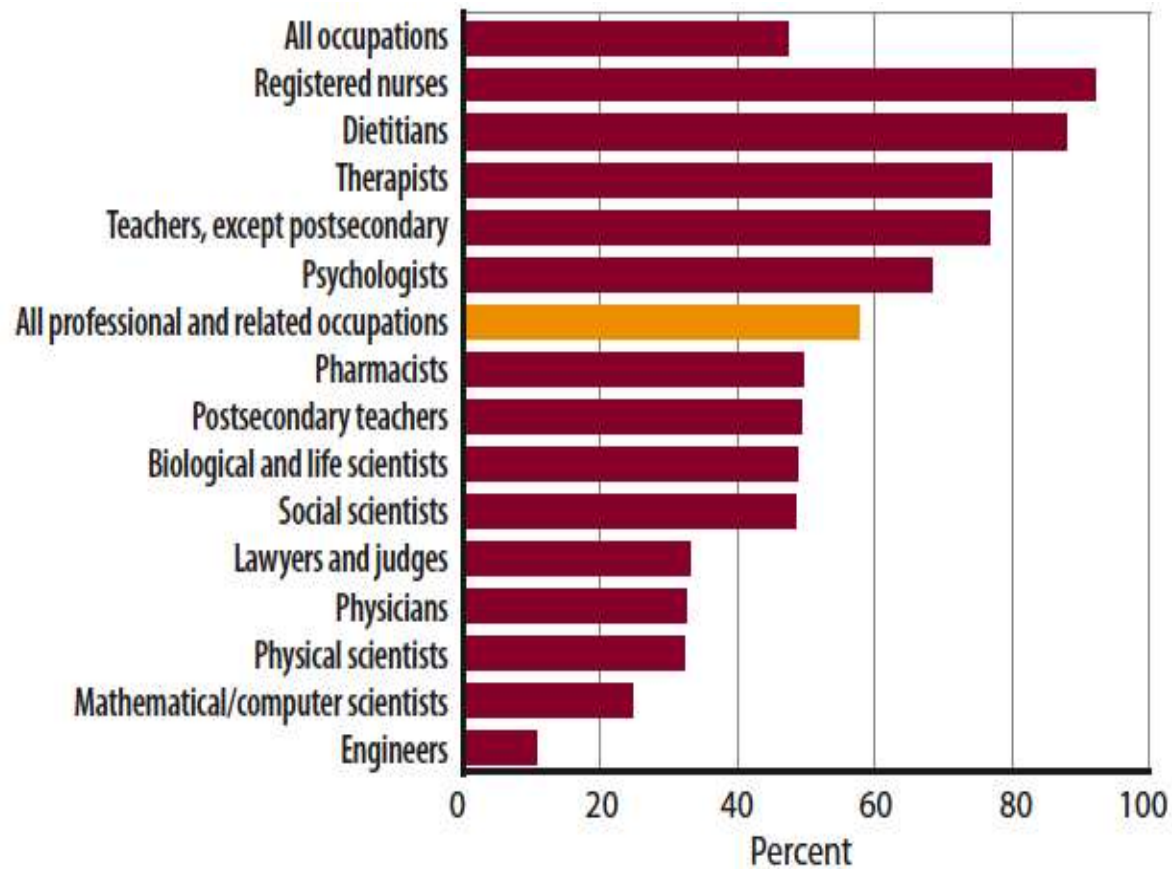
# Employed Hispanics 16 years of age and older as a % of the selected occupations c. 2009



SOURCE: *Women, Minorities, and Persons with Disabilities in Science and Engineering:2011* [www.nsf.gov/statistics/wmpd/](http://www.nsf.gov/statistics/wmpd/)



# Employed women 16 years and older as a % of the selected occupations c. 2009

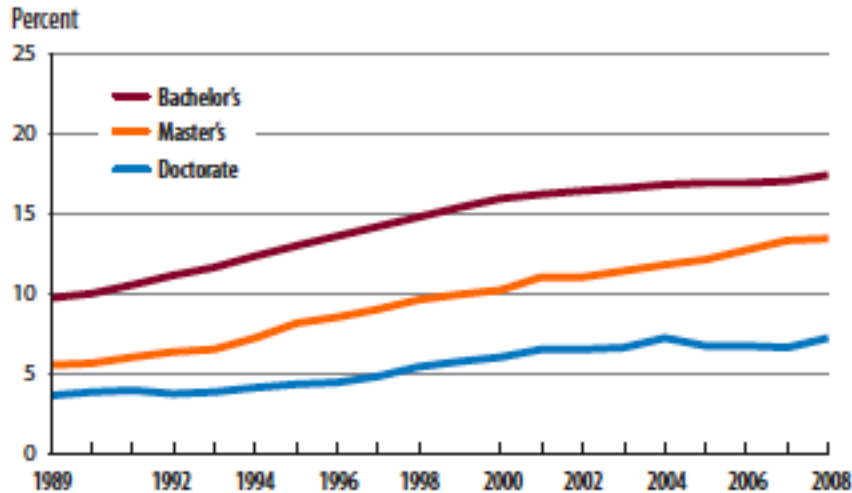


SOURCE: *Women, Minorities, and Persons with Disabilities in Science and Engineering:2011* [www.nsf.gov/statistics/wmpd/](http://www.nsf.gov/statistics/wmpd/)

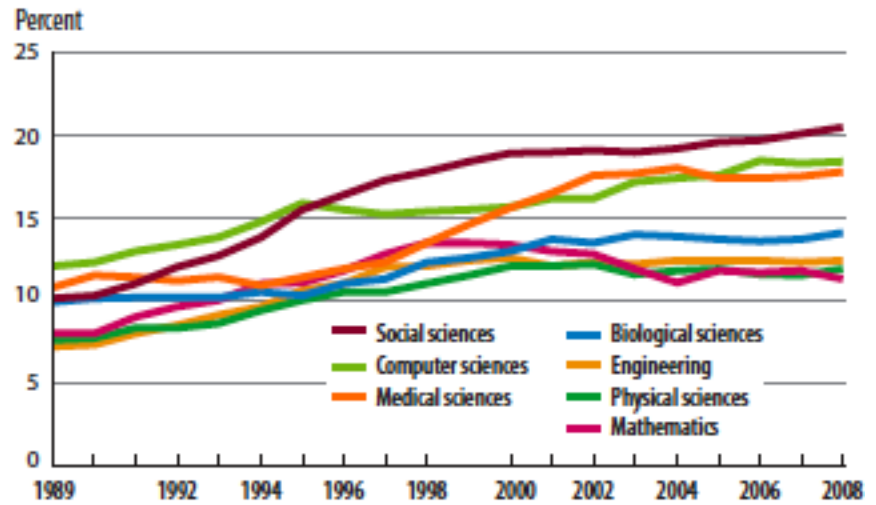


# Percent of Degrees Earned by URM

Science and engineering degrees earned by underrepresented minorities: 1989-2008



Science and engineering bachelor's degrees earned by underrepresented minorities, by field: 1989-2008



SOURCE: *Women, Minorities, and Persons with Disabilities in Science and Engineering:2011* [www.nsf.gov/statistics/wmpd/](http://www.nsf.gov/statistics/wmpd/)

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# The Importance of Diversity

- By increasing the diversity of a group we bring together people with different backgrounds and experiences which ultimately can allow innovation to flourish.



# Three programs

- UCSB
- GUESS
- Penn State Nanotechnology Camp

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# Nano-Camp



Angela Berenstein

Nanotechnology Education Programs Coordinator  
University of California, Santa Barbara site of the  
National Nanotechnology Infrastructure Network

# Why a 2-day NanoCamp at UCSB?

Students:

- *make* a micro-resistor, found in all electronics
- learn lab protocols and safety
- design and test an experiment in a clean room laboratory

# How teachers find NanoCamps

- existing relationships
- our website:  
[www.nanotech.ucsb.edu](http://www.nanotech.ucsb.edu)
- other teachers, parents, or students (word-of-mouth)
- professional development meetings (like this one)

# Local teachers recruit students

Students must be motivated

→ grades don't matter

We prioritize high-need students  
(minority, financially disadvantaged)



What do  
students do  
in a  
NanoCamp  
at UCSB?

If I gave you a grain of sand,  
and asked you to sculpt this:



what problems might you have?



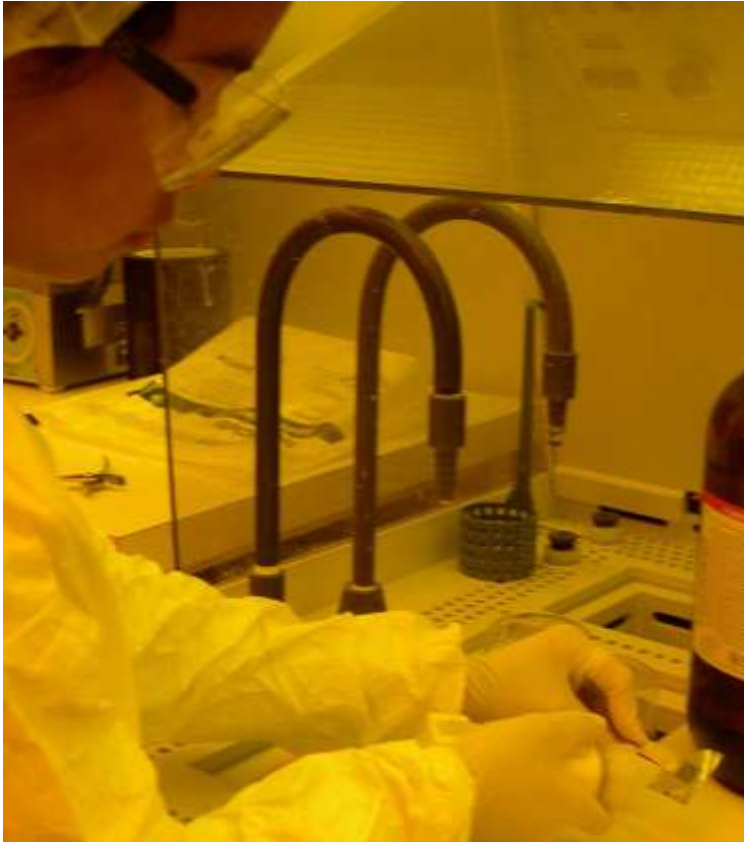
If I gave you a grain of sand,  
and asked you to sculpt this:



what problems might you have?

- What tools would we use to sculpt?
- How do we see what we're doing?

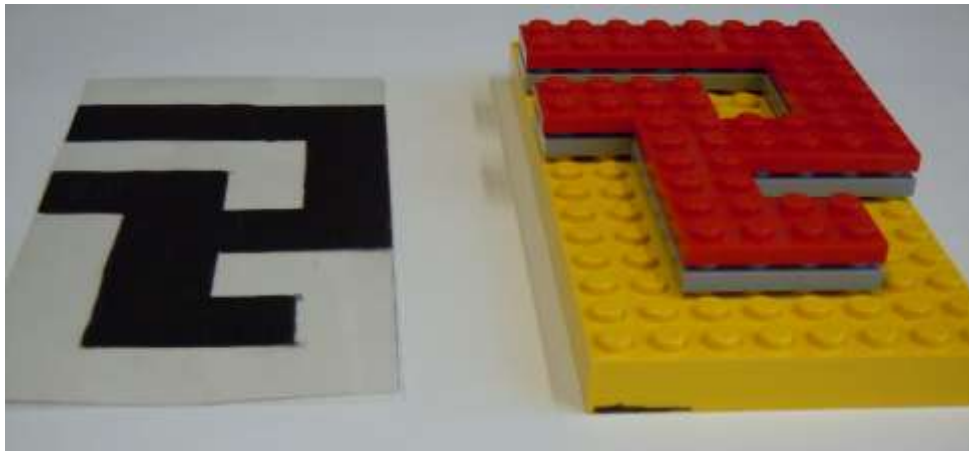
# Tiny sculpting with tricks of light and chemicals in a clean room



- Hands-on: students make microresistors
- Safety at point-of-use
- Analogies explain why we do each step

# Reinforce what they learned

- Lego models
- Recall the process they just did → we ask:
  - “and then what did you do?”
  - “and why did you do that?”



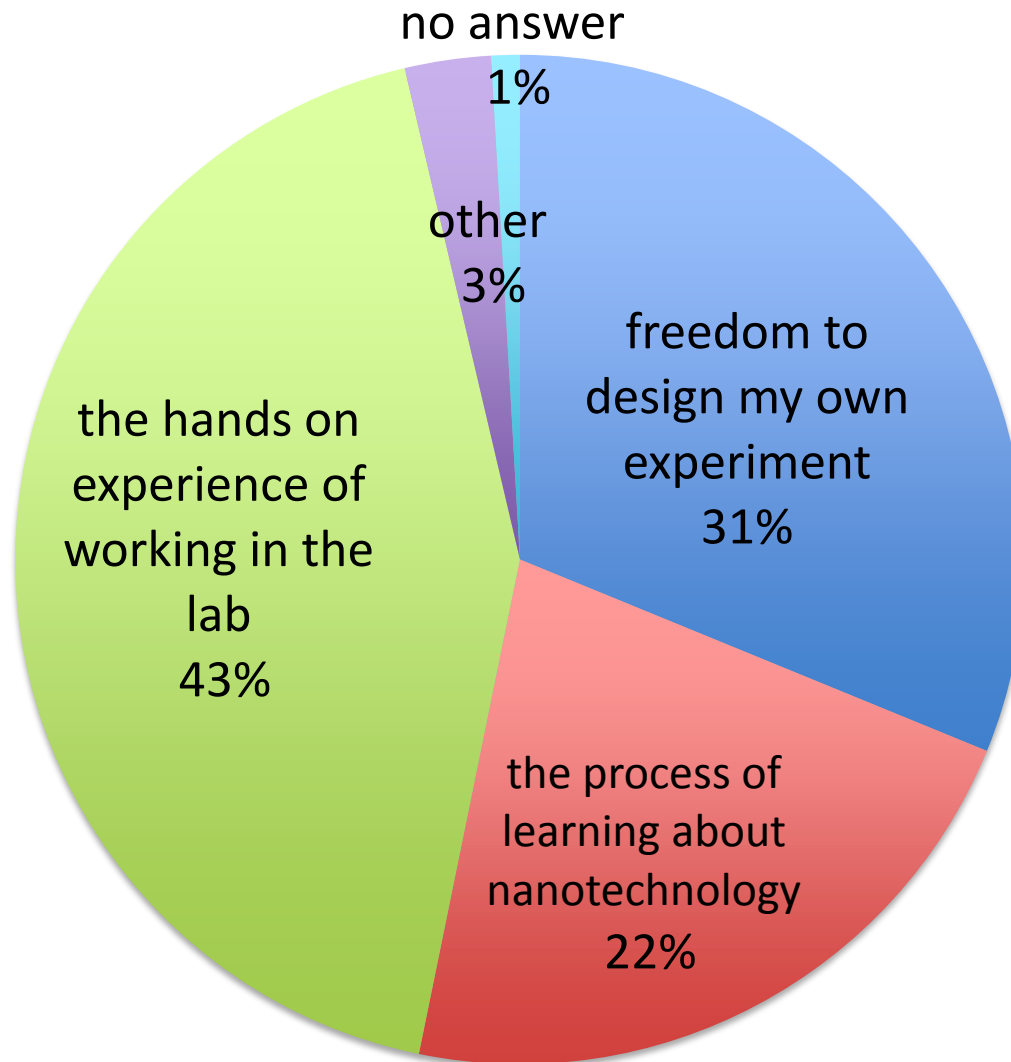
# Lab *play*: Just like a real researcher

- What are they most curious about?
- What if they changed the recipe?
- What would happen if they change it (prediction)?

# Lab *play*: Just like a real researcher

- *Play* in the lab → i.e. test it
- They get a “brain cookie” if they guessed correctly
- Brain cookies are great motivators for learning

# What students enjoyed most





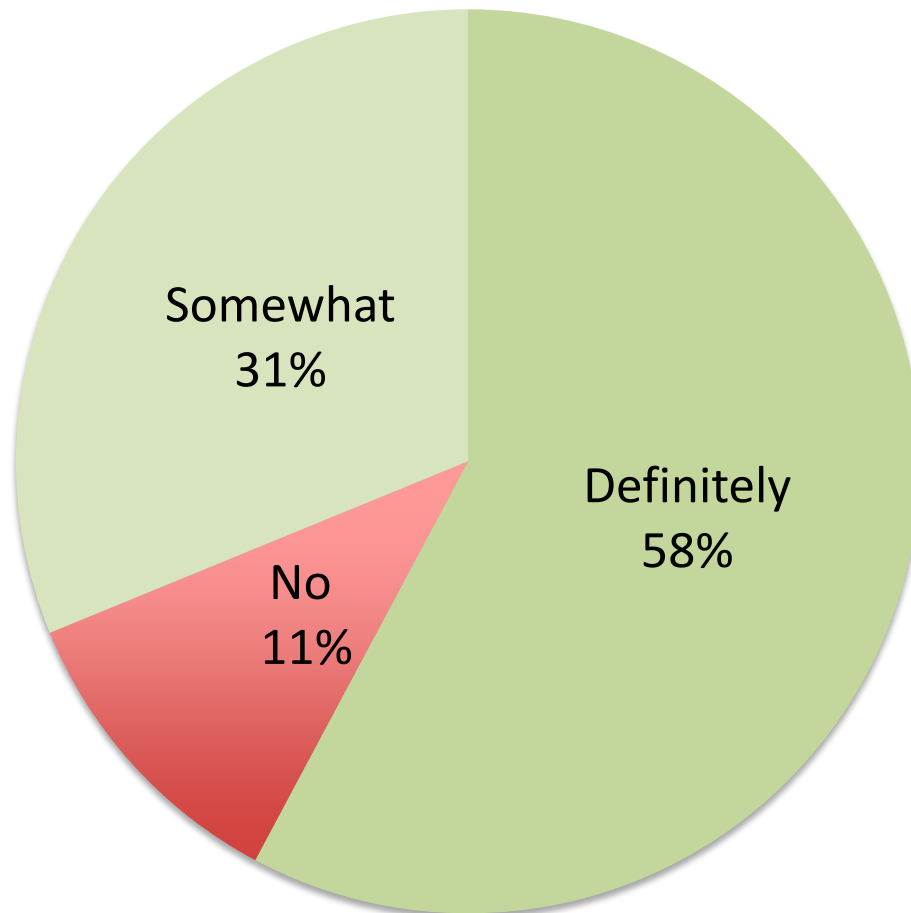
# What students enjoyed most



*“The whole experience was great. I enjoyed it and found it helpful talking one-on-one with Angela after doing the whole project. I felt I understood it more when I was going over it. Using the equipment was a great experience for me. I’ve never used anything like it. Thank you for this. I’ve learned so much from it all!”*

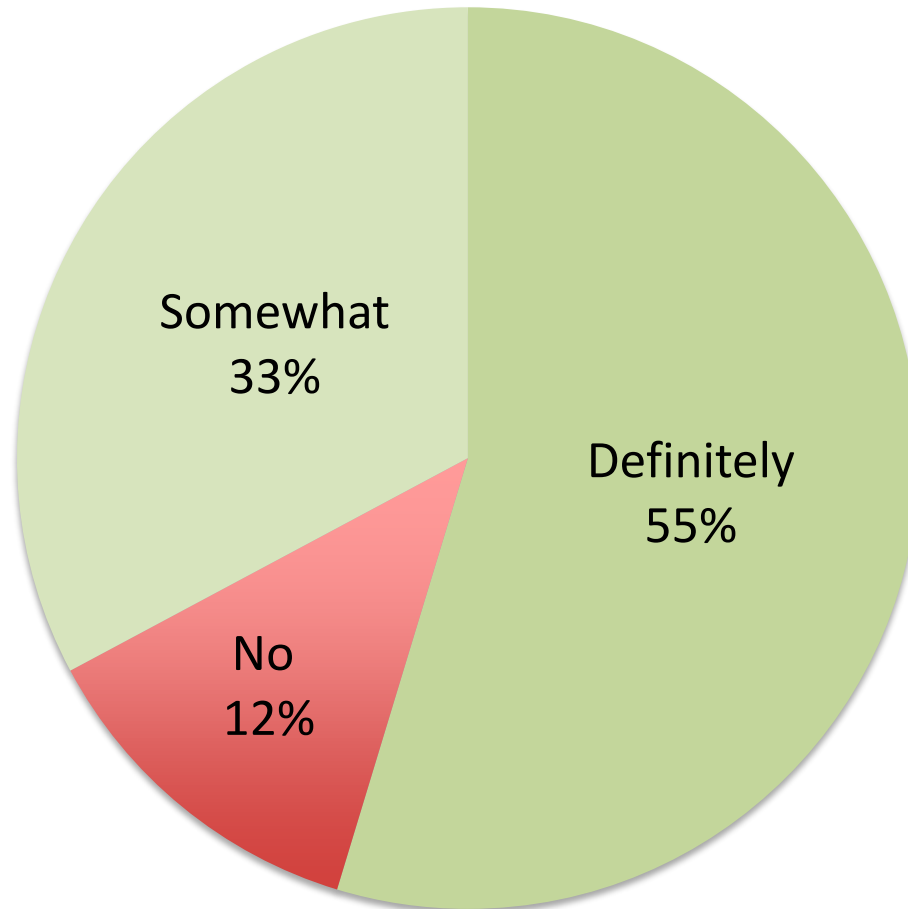
—Elena Quintanilla, Santa Maria High

# Has the Nano-Camp affected your career choice towards a science-related field?



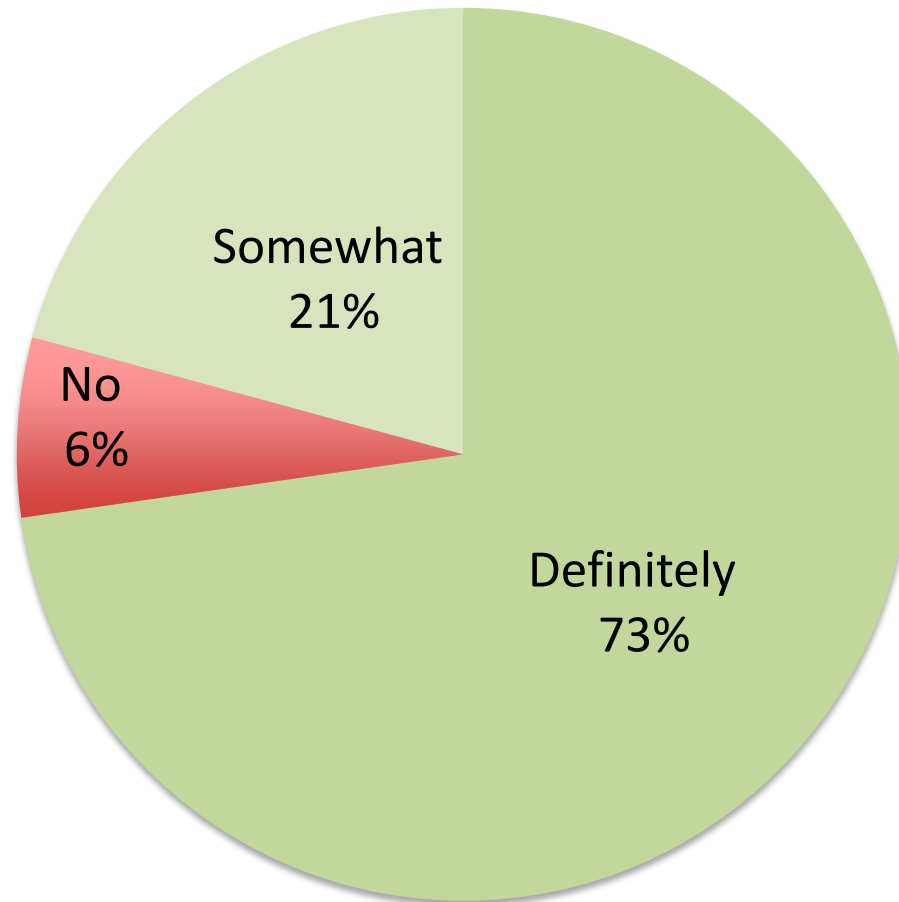
## Females responded:

Has the Nano-Camp affected your career choice towards a science-related field?



## Hispanics responded:

Has the Nano-Camp affected your career choice towards a science-related field?



What happens to them?

Do they really pursue science in college?



# Yes! They do pursue science in college!





# Dovi Patino: now doing Engineering at Berkley

*“I learned so many new things in this program. I honestly had no clue how chips were made, but because of this program, that changed. I feel very educated about the process of making chips now. Also, I feel that I’ve learned a lot about lab protocol. I had a great time! Thank you! It was a really good experience and helped me think about pursuing a career in science!”*

—Dovi Patino, from Pioneer Valley High who is now pursuing an engineering degree at Berkeley. She recently told her teacher, Manuel Casillas, that the chip camp was crucial to deciding to pursue an engineering degree.

# Learning Outcomes

- Using a Socratic method (asking questions) combined with hands-on labs and the freedom to design their own experiment is a highly effective way to teach nanotechnology
- The camp encouraged women and Hispanics to pursue science and engineering as a career.

# Learning Outcomes: from the teachers

- Enthusiasm in class after camp
- After camp, students apply themselves
- grades move from C → B+
- Also impacted their their other classes
- ESL students gain more confidence
- ESL students setting goals to be scientists/engineers

# Questions?



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# Poll Time

Yes, I had the opportunity to go to a STEM related camp when I was a student.

No, I never attended a STEM related camp when I was a student.



# GUESS What? “This Experiment is Sick!”

Girls Understanding and Exploring STEM Stuff



**Dr. Kristi Jean**  
Nanoscience Program  
Coordinator



**Carrie Leopold**  
Outreach Coordinator

Center for Nanoscience Technology Training  
*North Dakota State College of Science*

[www.NDSCSnano.com](http://www.NDSCSnano.com)

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# About NDSCS

## North Dakota State College of Science

Yes, North Dakota!

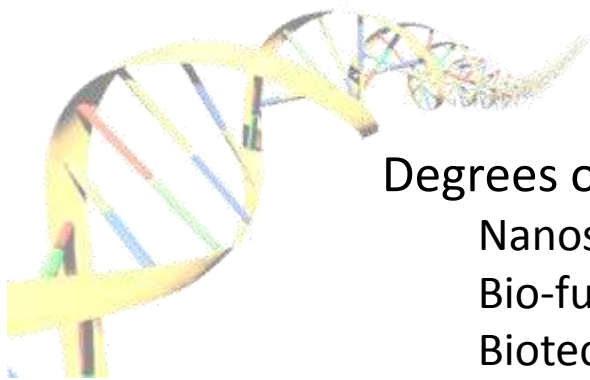
Yes, a 2-year college!

Small class sizes

Cost effective option

Students not ready *yet*

Not every student is 4-year bound



Degrees offered within Applied Science & Technologies:

Nanoscience – the study of really, really, really small things

Bio-fuels – alternative energy

Biotechnology – anything bio-related including agriculture and genetic engineering (female connection)

Microelectronics – the study of tiny electronic devices

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# Statistics from NGCP (National Girls Collaborative Project)

Women make up:

- 53% of biological scientists
- 31% of physicians and surgeons
- 33% chemists
- 29% geoscientists
- 10% civil engineers
- 8% electrical engineers
- 10% aerospace engineers



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# 5 E's of Hands-On Learning

Engage

Explore

Explain

Elaborate

Evaluate



# GUESS Project

## Girls Understanding and Exploring STEM Stuff

Promoting girls to enter a STEM field:

- Girls (8<sup>th</sup> and 9<sup>th</sup> grade) spend a day in our Fargo lab
- Hands-on STEM activities
- Led by women professionals
- No boys allowed!



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# Girls

Promoting

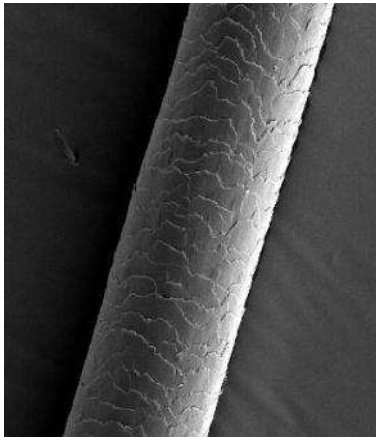
- Girls (8<sup>th</sup>)
- Hands-on
- Led by
- No boys





# Activities Designed for Girls' Interest

- DNA extraction – necklaces
- Alternative energy – engineering focused
- Scanning electron microscopy – hair (cost of beauty)



<http://www.ualberta.ca/~mingchen/thair.htm>



<http://community.livejournal.com/craftgrrl/10836020.html>



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# Activities Designed for Girls' Interest

- Photolithography – art wafers
- LEGO robotics – don't hit Buzz
- Pizza Hut for lunch – very social!



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# Keys to Our Success

- Carrie is our Outreach Coordinator!
  - Makes a personal connection
  - Engages and inspires
  - Keeps it fun while they learn
    - *You need to find a Carrie*
- Invite schools to send four girls
  - Pre-selection by the school
  - Four girls fit into a car
- Schedule for a school day



*Kristi & Carrie*





# Keys to Our Success

- Challenges:
  - Roster is full
  - Lack of women mentors
    - College students
    - Science teachers
  - Money for travel
    - ND is very rural
  - Staying connected
    - NanoNick's Facebook



# The Launch of GUESS Again

- For girls who have attended GUESS What?
- More non-traditional focused areas
  - welding, soldering, and electronics



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# Scaling – the Launch of GUESS Where

- In conjunction with a medical facility in South Dakota
- Biomedical focused
- Launching this spring



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# GUESS Project - Results

***Did this change your attitude towards Science, Technology, Engineering and Math (STEM)? What is your attitude towards STEM?***

- I definitely now don't think of science as hard and too complicated, but more fun and interesting.
- I really liked it, and I had a lot of fun. Maybe someday I will go into a career that involves STEM.
- Yes, I really like it now. It opens the mind for so much.
- Yes, my attitude changed a lot about it, because I actually got to see what the teachers are talking about.
- Yes it did! I love this place and I want to come back. (hint-next year 😊) very interesting!



# GUESS Project - Results

*If there are hands-on activities and “boys” in the group, do you make sure that you are one of them that (1) gets the experiment underway or (2) watches others in action? If you are a #(2), why? Does it make a difference if boys are part of the group?*

- 1, it doesn't make a difference for me if boys are part or not, but there is something fun about just having girls.
- 2, because they seem to take it over.
- 1, kind of, they can be kind of distracting with their obnoxious behavior, but other than that, they would be fun.
- 1, because I love science and am pretty good at it. I like it just girls because most of the time the girls will be too busy drooling over guys to listen and learn.



# GUESS Project - Results

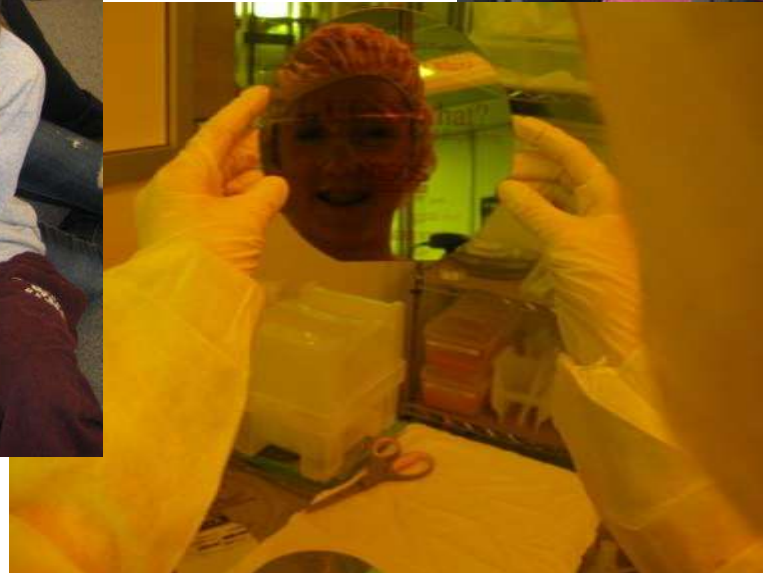
*If there are hands-on activities and “boys” in the group, do you make sure that you are one of them that (1) gets the experiment underway or (2) watches others in action? If you are a #(2), why? Does it make a difference if boys are part of the group?*

- 2, mostly because if there are a lot of guys, they like to take control. I do try to get the experiment underway, but depending on who you're with it can be difficult.
- 1, Yes, boys would probably make it harder to concentrate and harder to work, and girls need a chance to have fun.
- 1, yes the boys mess around.





# Science Geeks or Gymnasts from Boise?



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# Presentation Made Possible By:



*100% of the funding for this project was provided by the Carl Perkins Career and Technical Education act of 2006.*



# Questions?



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# Quiz Time

- Do you think societal stereotypes and unconscious biases impact the self efficacy of minorities and their probability of pursuing STEM related careers?

Yes

No





- One study showed that the gender implication of the name impacted how harshly resumes were evaluated.
- Research also found that triggering stereotype recognition by asking students to indicate gender prior to math tests impacted scores.



# G.W. Carver High School of Engineering and Science



**Shannon Hogan**

Penn State Nanotechnology Camp  
Recruitment and Results

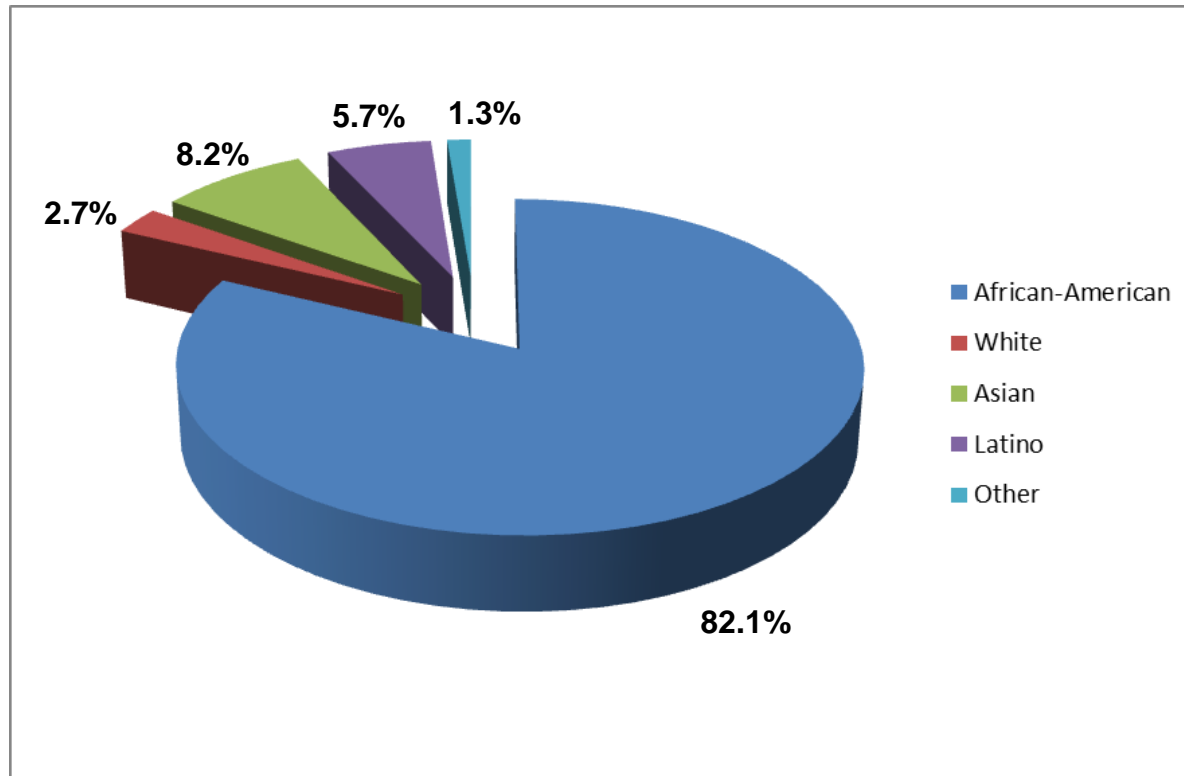


# School Information

- Who are we?
  - School District of Philadelphia
  - Blue Ribbon School
  - STEM Curriculum
- Requirements for admission
  - Grades
  - Standardized Tests
  - Citizenship
- Student enrollment



# School Racial Demographics



# Penn State Nanotechnology Camp

- Years of participation
- Student enrollment (20 - 25 students)
- Opportunities
  - Clean room
  - Hands-on science
  - Realistic collegiate experience



# The Selection Process

- Early mistakes
- Evolution of standards
  - Grades
  - Interest
  - Essay
- Incorporating families
- Investments in students' futures



# Activities

- GPS scavenger hunt
- Cleanroom tour
- NMT program details
- Consumer products/  
testing
- Surface properties
- Liquid nitrogen
- Non-Newtonian fluids
- Photolithography
- Nano house
- Bio-mimetics
- SEM/AFM operation
- Deposition techniques
- Careers game
- Campus tour
- Stay in the dorms



# Funding

- Grants
- School backing
  - Transportation
  - Chaperones





# Follow-up: Activities and Opportunities

- Robotics Club
- Mathletes (AMC and PAML)
- Envirothon
- Science Fair
- Science Research Course
- Medical Program



# Collegiate Statistics

- Of the 32 students contacted/surveyed:
  - 31 are currently enrolled in college
  - 16 are pursuing degrees in STEM majors
  - 4 are working towards either pre-med or nursing degrees
  - 3 are enrolled at Penn State
- An additional 14 students were not available for comment but are enrolled in various colleges (6 at Penn State)



# Where Do We Go from Here?

- Since 2008
  - Engineering Curriculum
  - Project LEAD the Way
  - Gateway Engineering Program
  - Ninth Grade Institute/Recruitment
    - Liquid Nitrogen
    - Hands on Science
- College Credit
  - Dual Enrollment
  - Advanced Placement courses



# Conclusion: Nanotech Success

- Enrollment at Penn State
- Decreased drop-out rates
- Majors in STEM or STEM-related fields



# Questions?



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# Poll

- Which of these factors has the greatest impact on career selection by students?
  - A. Projected Salary
  - B. Parent's Occupation
  - C. Counseling or Aptitude tests
  - D. Extracurricular Experiences



# Objectives

- Discuss recruitment strategies
- Share resources
- Gauge the impact
- Identify ways to overcome obstacles



# Ways to Overcome Obstacles

## Resources:

- Obstacles and Solutions for Underrepresented Minorities in Technology
- *Why So Few? Women in Science, Technology, Engineering, and Mathematics*
- Journal of African American Males in Education (JAAME) Vol. 2, No. 1





# Summary

- Three great initiatives
- New ways to continue the positive work
- Long term tracking
- Continued relations and shared resources



# How Can We Better Serve You?

Whether you are joining us live or watching the recorded version of this webinar, please take 1 minute to provide your feedback and suggestions.

<http://www.questionpro.com/t/ABkVkZIOXX>



# Upcoming NACK Workshops

- Aug 8-11 Nanotechnology Course Resources II:  
Patterning, Characterization, and  
Applications
- Sept 19-22 Nanotechnology Course Resources I:  
Safety, Processing, and Materials
- Nov 15-17 Hands On Introduction to Nanotechnology  
for Educators

Go to [nano4me.org/educators](http://nano4me.org/educators) for further information.





Join Us in San Francisco, CA  
July 25-28, 2011

[www.highimpact-tec.org](http://www.highimpact-tec.org)

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[www.matecnetworks.org](http://www.matecnetworks.org)

Keyword Search:

**“NACK webinar  
recruiting underrepresented minorities”**

You may also find over 100 nanotechnology resources in the NetWorks Digital Library by using the Keyword Search: **“nanotechnology”**

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# NACK Upcoming Webinars

**Sept 30: Introduction to Nanotechnology**

**Nov 4: Tech Intersection: Understanding the Bio and Nano Link**

Visit [www.nano4me.org/educators](http://www.nano4me.org/educators), select the Webinar tab for more details about upcoming webinars.



# Thank You for Attending

## NACK's Webinar

# Recruiting Underrepresented Minorities

You may find additional free resources and nanotechnology at  
[www.nano4me.org](http://www.nano4me.org).

Click on "Educators"

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