

Trends in Nano: Program Development

March 22, 2013

The NACK Network was established at the Pennsylvania State College of Engineering, and is funded in part by a grant from the National Science Foundation.



Who We Are!

Presenters



Alissa D Agnello
Project Director, SHINE
Faculty, North Seattle CC



Josee Vadrine-Pauleus
Faculty, University of Puerto
Rico, Humacao



Mark Hendrickson
Associate Dean of
Manufacturing,
Chippewa Valley Technical
College



Sam Aghdasi
Faculty, Ivy Tech CC

Moderator



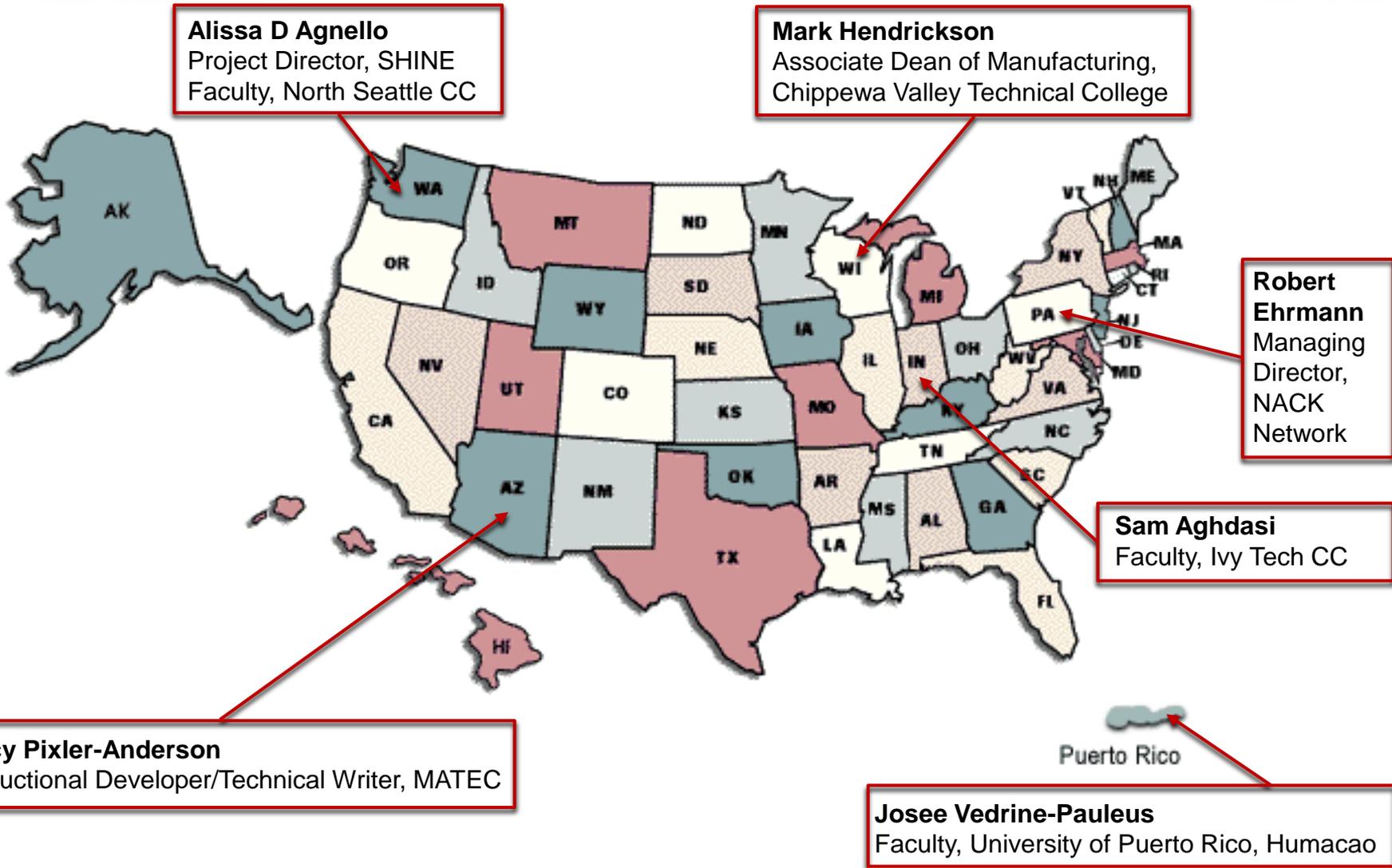
Robert Ehrmann
Managing Director, NACK Network

Host



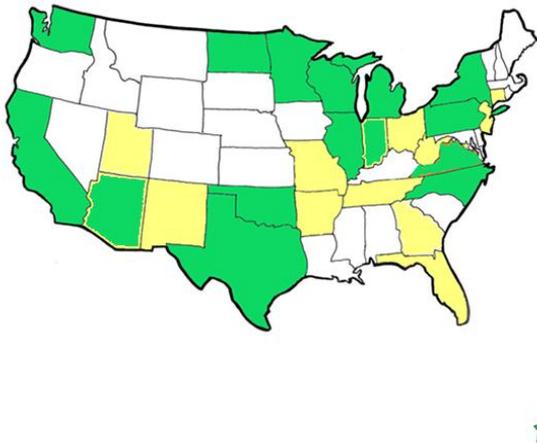
Tracy Pixler-Anderson
Instructional Developer/Technical Writer, MATEC

Where We Are!



The NACK Network

The mission of the NACK Network is to enable Nanotechnology Education at:



- 2-year Community & Technical Colleges
- 4-year Universities and Colleges in Partnership with Community & Technical Colleges



NACK Network Nanotechnology Education Hub Areas

A working, productive nanotechnology workforce development network involving research universities and community and technical colleges across the U.S.



MN
Dakota County Technical College
University of Minnesota



Puerto Rico

University of Puerto Rico,
Humacao



AZ
Central Arizona Community College
Maricopa Community Colleges
Arizona State University
MATEC - ATE Center in AZ



NY
NEATEC - ATE Center in NY
University at Albany (SUNY)



TX

Northwest Vista College
University of Texas



IN
Ivy Tech Community College
University of Notre Dame



PA

NACK - ATE Center in PA
PA Community Colleges
Penn State University



WA

North Seattle Community College
University of Washington

Our Next Speaker

Alissa D Agnello

Project Director, SHINE
(Seattle Hub for Industry-Driven Nanotechnology Education)

Faculty, North Seattle Community College



Nanotechnology at North Seattle Community College



Alissa Agnello
Nanotech Faculty & SHINE PI

Nanotech Programs at NSCC

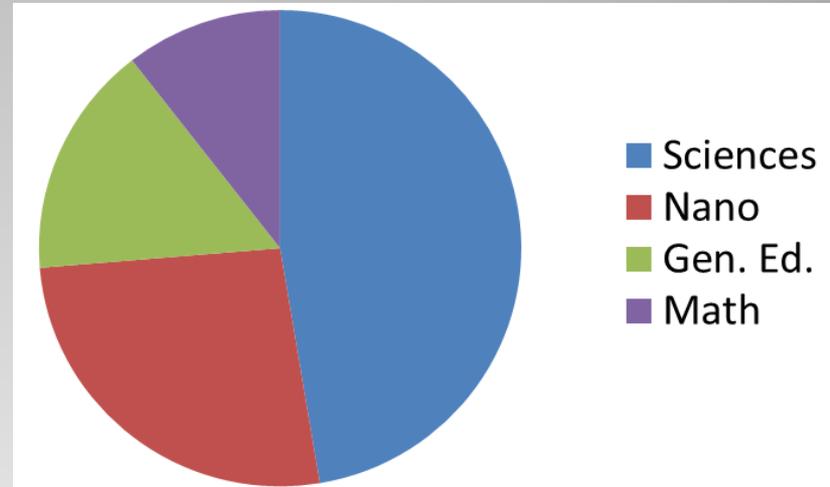
AAS-T

Interdisciplinary 2-year degree

Certificate

Geared to students with a background in science or related manufacturing

Transfer Pathways



- Intro to Nano
- Intro to Materials
- Nano Characterization
- Nano Fabrication
- Internship



Nanotech at NSCC: Outside the classroom

- Embedded career services
 - Soft skills development
 - Internship / Job search support
 - Dedicated specialist
- Networking opportunities
- Outreach



Photography by Lisa Merrill



Photography by NWABR



How Nanotech at NSCC developed

- Focus groups – what *is* the local industry?
- Support (NSF, state, school) – what do we need?
- Campus Resources – who can help with:
 - recruiting?
 - internship development?
 - career services?
 - collaboration across disciplines?
- External stakeholders
 - What services do we provide?
 - What resources can we share?



Some success stories

- Continual input from Advisory Committee
 - Curriculum changes
- Leveraged on-campus resources
 - Advisors sending students our way
 - More students finding own internships
 - Other science classes using nano instruments
- Strong relationships with external stakeholders
 - Outreach helps build community
 - NSCC uses UW cleanroom for labs
 - Industry hires interns to run tests using our instruments



Contact Information

Alissa D Agnello
Faculty

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Our Next Speaker

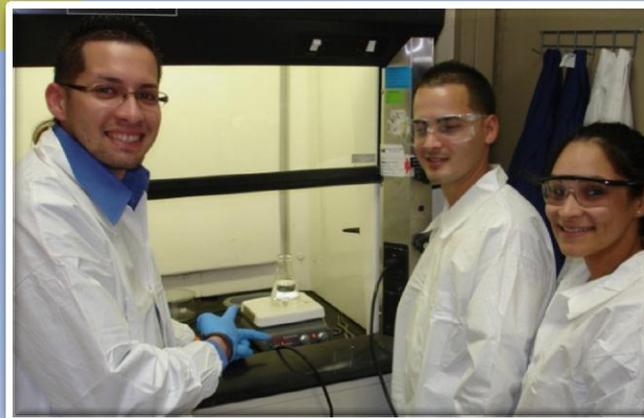
Josee Vedrine-Pauleus

Faculty, University of Puerto Rico, Humacao





- Implement PSU's nanofabrication capstone
- Adopt PSU's teaching cleanroom site model
- Establish partnerships with local governmental agencies and other parties interested in developing a skilled nanotechnology workforce in Puerto Rico



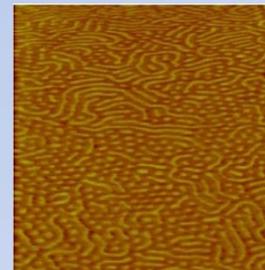
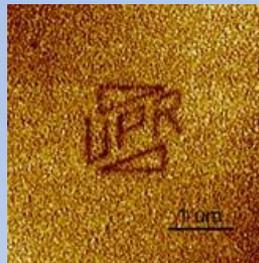
Program Offering

Workshops (www.nano4me.org)	Semester
Materials, Safety, and Equipment Overview for Nanotechnology	1
Basic Nanotechnology Processes	2
Materials in Nanotechnology	3
Patterning for Nanotechnology	4
Materials Modification in Nanotechnology	5
Characterization, Testing of Nanotechnology Structures and Materials	6

Curriculum Adaptation

Offered workshops without a cleanroom

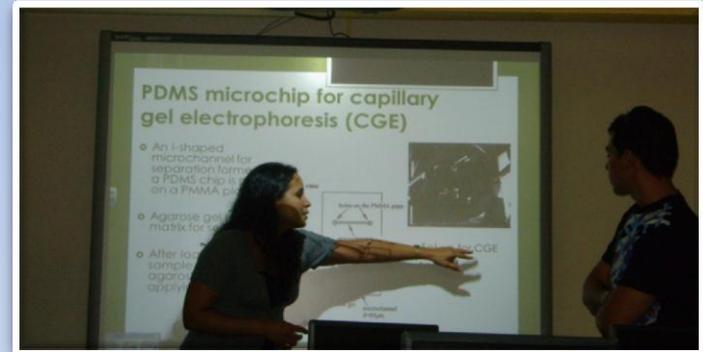
- No problem with the two first courses (were designed to be offered without the need of a cleanroom) – require characterization equipment that was available or was acquired
- Use of kits (nanoparticles, solar cells, GeneChip)
- Use of movies (Silicon Run)
- Inclusion of experiments related to local research (*i.e.* electrospinning, dip-pen nanolithography, block copolymers)



Curriculum Adaptation

Offered workshops without having all equipment

- Use of samples prepared by PSU (exposed photoresist, patterned photoresist, PDMS stamps)
- Simplified experiments (RIE via etching of photoresist)
- Use of Auger system for vacuum training instead of a specific vacuum training system
- Use of UV lamp to expose a wafer with a mask in contact with photoresist (mask aligner is not installed)

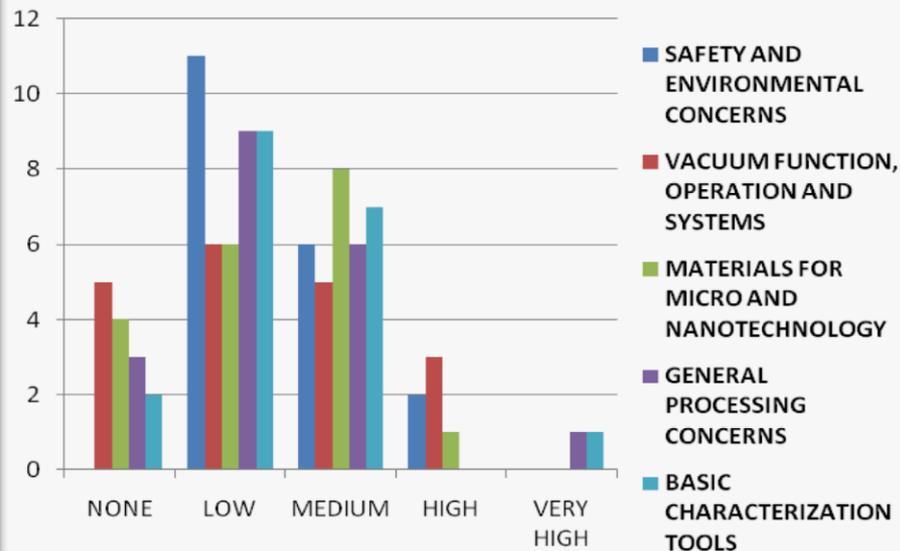


Pre & Post Evaluation Results

Materials, Safety, and Equipment Overview for Nanotechnology

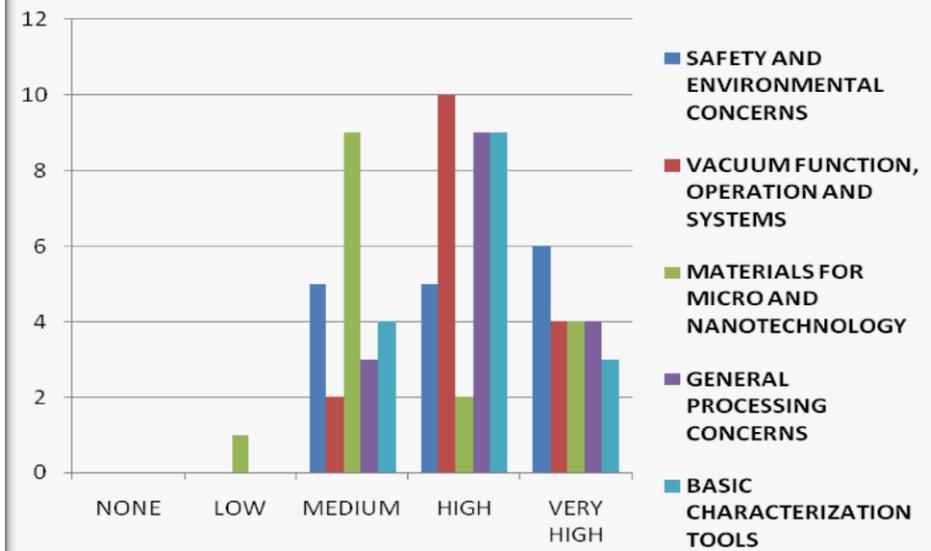
Pre Evaluation

Pre Evaluation Results



Post Evaluation

Post Evaluation Results



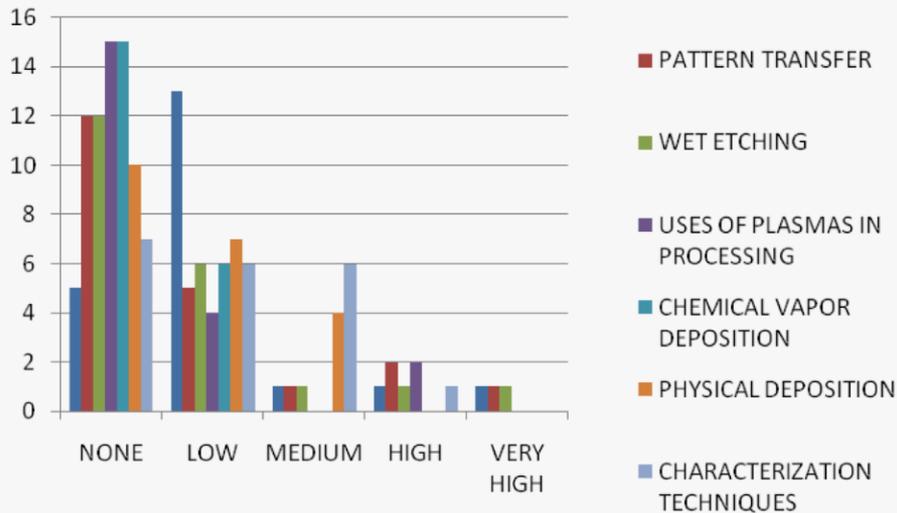
Pre & Post Evaluation Results

Basic Nanotechnology Processes

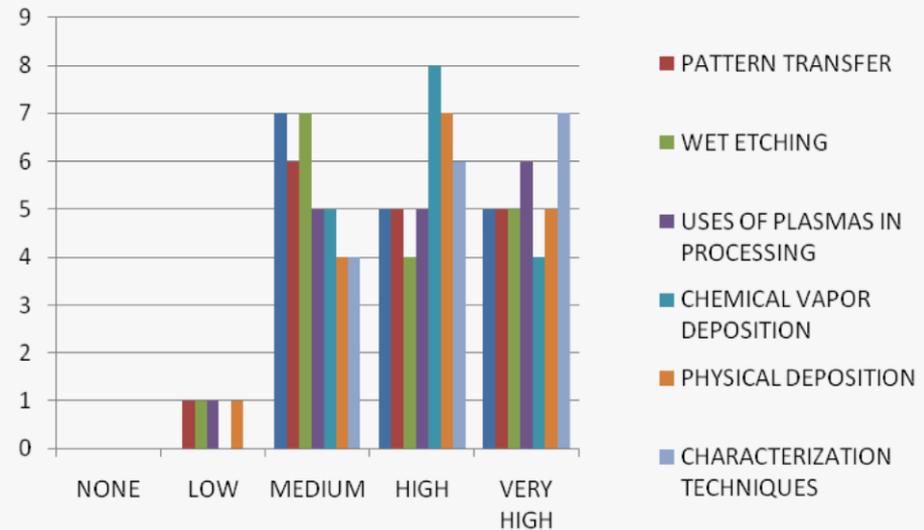
Pre Evaluation

Post Evaluation

Pre Evaluation



Post Evaluation



Contact Information

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Our Next Speaker

Mark Hendrickson

Associate Dean of Manufacturing, Chippewa
Valley Technical College



CVTC Counties and Campuses



Nano Engineering Technology: A 3-Program Model
Industrial (food) – Nano – Manufacturing



Presented by: **Mark Hendrickson**

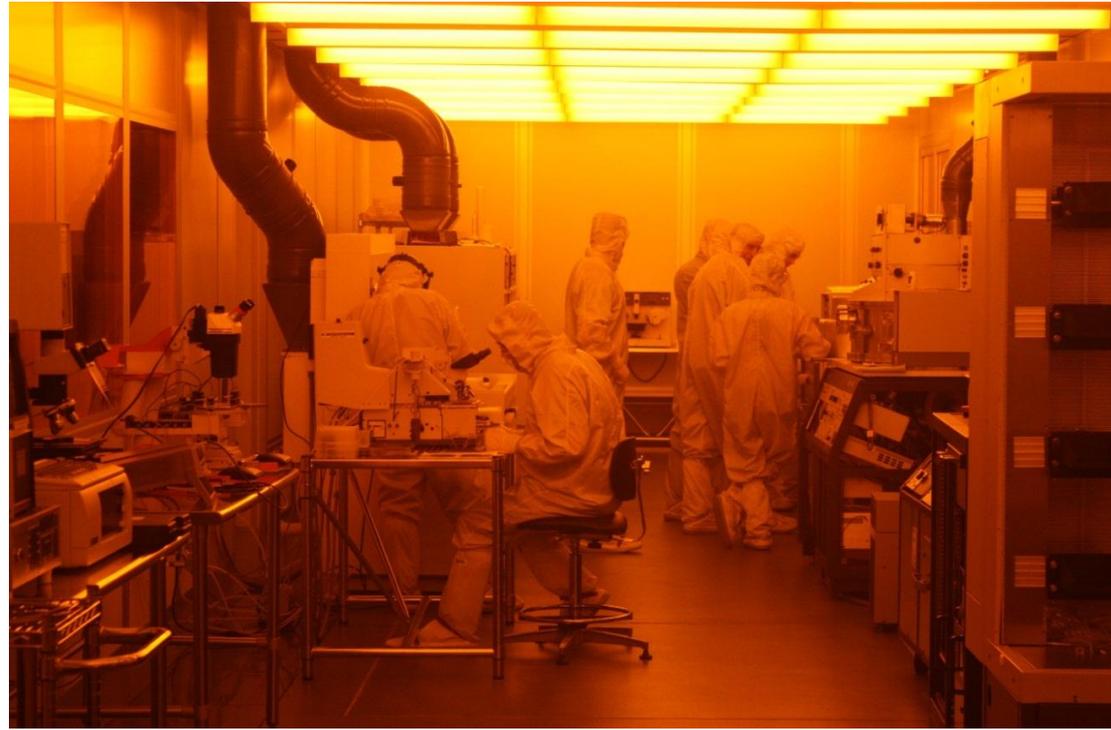


1000 sq. ft. Class 100 Cleanroom

Known:

- Capacity 28
- August start
- Completion 79%-94%
- Retention 67% -82%
- Placement 0% - 83%
- **40% transfer to 4 year degrees ***

(* Applied Science /
Engineering Technology,
Management, Engineering)



Challenges:

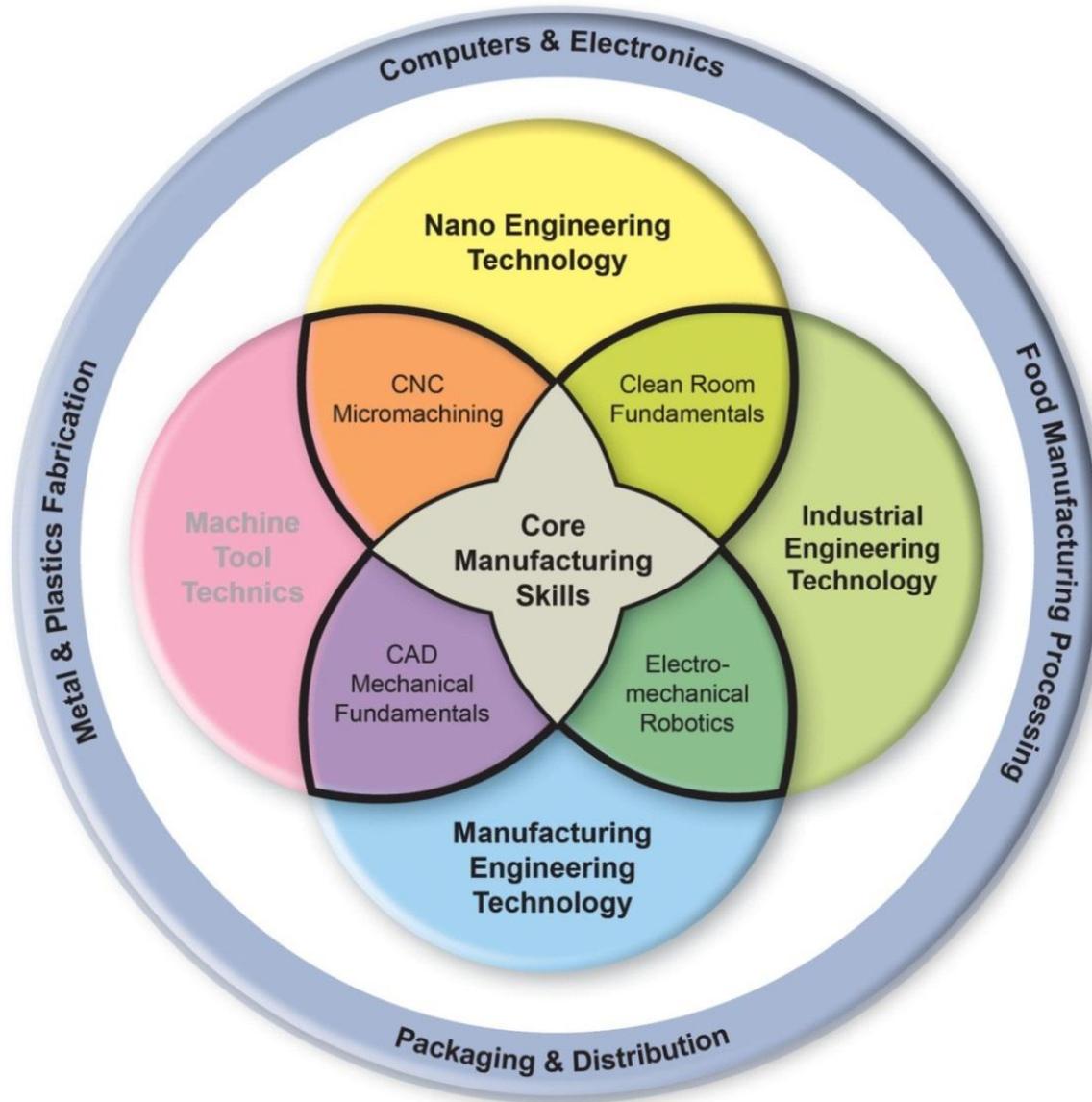
- Student expectations unclear
- **Student readiness**
- Student retention variable
- Student program completion rates low
- **Industry identity - Jobs**
- Employer recognition
- Internship



DACUM Process



Manufacturing and Engineering Career Pathway Model



Program design criteria

Transcribed / Dual Credits with HS

Common First Year Courses

Shared Courses

Algebra

Courses Aligned with Employers

Calculus

Courses Aligned with BS Degree Institutions

Chemistry

Articulations



Contact Information

- <http://www.cvtc.edu>
 - Chippewa Valley Technical College home page
 - Search under program catalog/engineering programs
- Aliesha Crowe – Dean of Industry, Agriculture, and Energy
 - acrowe3@cvtc.edu
- Mark Hendrickson – Special Projects Coordinator
 - mhendrickson1@cvtc.edu

Our Next Speaker

Sam Agdasi

Chair, Nanotechnology Program

School of Applied Science and Engineering Technology
Ivy Tech Community College of Indiana



How Did Ivy Tech Develop Nanotechnology Program?

- Adopted NACK Curriculum : You don't need to reinvent the wheel!
- Partnered with University of Notre Dame to use its cleanroom
- Hired a full-time faculty member for nanotechnology
- Started its own nanotech lab with an AFM, SEM, and Thermal Evaporator/ Sputtering
- Gradually added Vacuum Training systems, Spin Coater, Mask Aligner, Profilometer, Ellipsometer, Optical Microscope

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Nanotechnology at Ivy Tech

2 Educational Pathways

Pathway 1: Associate of Science in Nanotechnology Degree: 60 credit hours

- Consists of 6 nanotechnology courses developed by NACK: ESC 211-216
- 2 additional nanotechnology courses:
 - Fundamentals of Nanotechnology - Developed by using Introductory Modules of NACK
 - Solid State Devices in Nanotechnology
- The rest of the curriculum consists of general education courses (math, sciences and humanities), an internship, and a nanotechnology research

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Sequence of Nano Courses in Associate Degree Program

Semester 1

NANO 101: Fundamentals of Nanotechnology

NANO 102: Materials, Safety, & Equipment Overview for Nanotechnology

Semester 2

NANO 201: Basic Nanotechnology Processes

NANO 211: Materials in Nanotechnology

Semester 3

NANO 221: Patterning for Nanotechnology

NANO 231: Materials Modification in Nanotechnology

Semester 4

NANO 241: Characterization and Testing of Nanotechnology Structures & Materials

NANO 251: Solid State Devices in Nanotechnology

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Nanotechnology Immersion Semester

Pathway 2: Certificate in Nanotechnology

- Offers all NACK Courses in one semester
- 6 courses, ESC 211-216, 18 credit hours
- Certificate in Nanotechnology, upon completion

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Contact Information

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Ivy Tech Community College of Indiana

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Webinar Recordings

To access this recording, slides and handout
visit

nano4me.org/webinars.php

2013 Events Calendar

- April 15-18:** Course Resource Workshop I:
Workshop Safety, Processing & Materials
- April 26:** Successful Models for Nano Outreach
Webinar
- May 7-9:** Hands-On Introduction to Nanotechnology
Workshop for Educators
- May 16:** (Three part series) Trends in Nano:
Webinar Careers and Workforce Needs

Visit www.nano4me.org/webinars for more details about these and other upcoming webinars.

JOIN US IN MINNEAPOLIS, MN

May 21-23, 2013



www.mnt-conference.net

Thanks!

Thank you for attending the
NACK Network webinar

**Trends in Nano:
Program Development**