



Connective Tissue Networks for Nanotechnology Education

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Jared Ashcroft – PI MNT-EC (NSF-ATE) / Pasadena City College



SDNI-NNCI Annual Educational Symposium 2020

September 13, 2020





Introductions

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Building College-University
Partnerships for Nanotechnology
Workforce Development



Penn State Center for Nanotechnology Education and Utilization (CNEU)

It's NACK

....Plus More:

www.cneu.psu.edu





Some current **focus areas**



- Live-stream **professional development**

- The Nanotechnology Professional Development Partnership (NPDP)
 - NSF ATE Project (2018 > 2020)
 - Transitioned from almost 20 years of MNT F2F workshops at PSU
 - Live stream plus Hands-On-Site
- NPDP Mission:
 - Deliver impactful live stream nanotechnology professional development to **workforce educators** across the country.
- NPDP Targeted Impact:
 - Improved **nano-literacy for students**.
 - Educators incorporate nanotechnology within their curricula.



Some current **focus areas**



- Live-stream **professional development**
- The newly re-funded NACK National Resource Center will **continue** live-stream / hands-on-site **professional development**
- Presently in **evaluation and redesign** stage (MNTeSIG and MNT-EC teams)
- Will begin new evolution of MNT PD in **spring 2021**





Some current **focus areas**



- Nanotechnology **Educational Standards** and Personnel Certificates
 - Suite of **6 standards** are now published covering basic MNT process skill sets
 - To be used as **guides** for MNT workforce educators across the country for the **MNT workforce classes / programs**
 - Promulgated via **ASTM International** - ASTM E-56 (Nanotechnology) Committee
 - Created and vetted by nano-educators and practitioners (industry and government)
 - Consensus process
 - Each standard is reviewed and updated every 5 years
 - Can be **accessed** at:



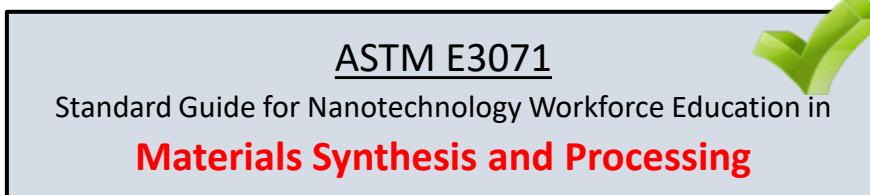
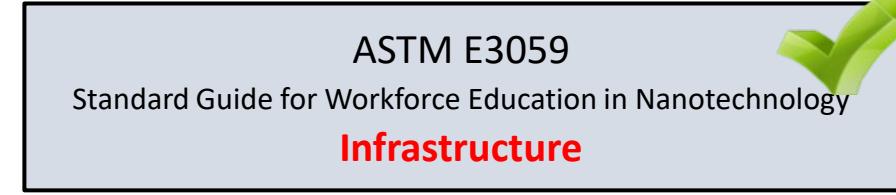
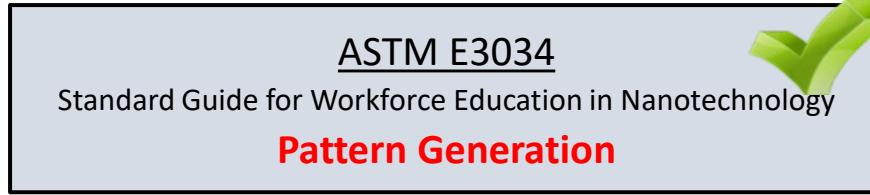
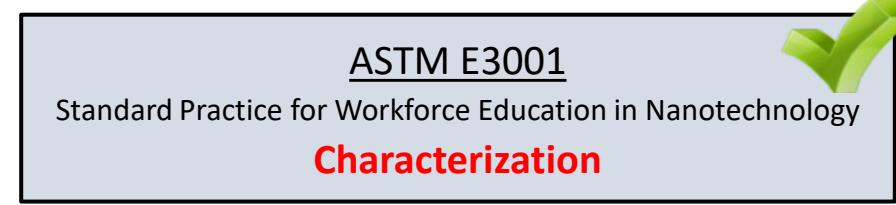
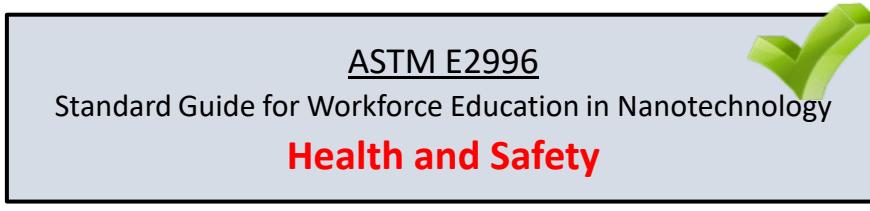
<https://www.astm.org/COMMITTEE/E56.htm>



Some current **focus areas**



- Nanotechnology **Educational Standards** and Personnel Certificates



<https://www.astm.org/COMMITTEE/E56.htm>



Some current **focus areas**



- Nanotechnology Educational Standards and **Personnel Certificates**

Creating **4 certificates** which cover
the 6 ASTM Nanotechnology Workforce
Education Standards

To be attained **by individuals**
completing course-work / programs and
passing corresponding tests





Some current **focus areas**



- Nanotechnology Educational Standards and **Personnel Certificates**



Creating 4 certificates which cover the 6
ASTM Nanotechnology Workforce
Education Standards

To be attained by individuals
completing course-work / programs and
passing corresponding tests



ASTM Workforce Certificate in
Nanotechnology
Health and Safety



ASTM Workforce Certificate in
Nanotechnology
Characterization



ASTM Workforce Certificate in
Nanotechnology
**Fabrication &
Processing**



ASTM Workforce Certificate in
Nanotechnology
**Material Properties
and Effects of Size**



Some current **focus areas**



- Nanotechnology Educational Standards and **Personnel Certificates**

We could always use SMEs.

If you are interested in serving on the TAC to help create the remaining certificates please contact Bob, Ozgur or Ray Tsui.





Remotely Accessible Instruments for Nanotechnology (RAIN)



Arizona State University (NCI-SW at ASU)
Cattaraugus-Allegany-Erie-Wyoming Board of Cooperative Educational Services (CABOCES)
Colorado Shared Instrumentation in Nanofabrication and Characterization (COSINC)
Coppin State
Erie Community College (ECC)
Forsyth Tech Community College
Georgia Institute of Technology
Georgia Southern University
Nebraska Nanoscale Facility
Norfolk State University (SCENE)
Northcentral Technical College (NTC)
Normandale Community College
Northwest Vista College, Workforce Programs
North Seattle College (NSC - SHINE)
Oakton Community College (O.R.A.N.G.E.)



Pasadena City College (PCC)
Pennsylvania State University (CNEU - NACK Network)
Research Triangle Nanotechnology Network (RTNN)
Salt Lake Community College (SLCC)
Stanford University (nano@Stanford)
SUNY Polytechnic Institute
University of Iowa
University of California San Diego
University of Texas at San Antonio (UTSA)
University of New Mexico (SCME)
Utah Valley University (UVU)



Current RAIN Network Nodes



Currently Available RAIN Equipment

Scanning Electron Microscope (SEM)

A scanning electron microscope (SEM) is a type of electron microscope that uses a beam of electrons to image the surface of a sample. The electrons interact with atoms in the sample, producing various signals that can be detected and thus convey information about the surface topography and composition. The electron beam is usually focused in a raster scan pattern, and the beam's position is combined with the detected signal to produce an image. SEM can achieve resolution better than 1 nm, and can operate at high vacuum, low vacuum, in wet conditions (in environmental SEM), and at a wide range of cryogenic or elevated temperatures. [Read more](#)

Energy Dispersive Spectroscopy (EDS)

Energy-dispersive X-ray spectroscopy (EDS, or EDX), sometimes called energy-dispersive X-ray analysis (EDXA) or energy-dispersive X-ray microanalysis (EDXMA), is an analytical technique used for elemental analysis or chemical characterization of a sample. It relies on an interaction of some source of X-ray excitation and a sample. Its characteristic capabilities are due in large part to the fact that each element has a different atomic structure allowing unique sets of peaks on its X-ray emission spectrum. [Read more](#)

Atomic Force Microscope (AFM)

Atomic-force microscopy (AFM) is a scanning-probe microscopy (SPM) type of scanning probe microscopy (SPM), with demonstrated resolution on the order of fractions of a nanometer, more than 1000 times better than the optical diffraction limit. [Read more](#)

Profilometer

Profilometer is a measuring instrument used to measure a surface's profile, in order to quantify its roughness. [Read more](#)

Ultraviolet-visible Spectrophotometer

Ultraviolet-visible spectrometry or ultraviolet-visible spectrophotometry (UV-VIS or UV-Vis) refers to absorption spectroscopy or reflectance spectrometry in the ultraviolet-light spectral region (190–400 nm) and visible light region (400–700 nm). The absorption or reflectance in the visible range directly affects the perceived color of the chemicals involved. [Read more](#)

Remote Accessibility:

- NC State at Arizona State University - (Phenom Pro)
- CARDOES - (Phenom ProXL, JCOL-JSM-001PLUSA)
- Colle Community College - (JCOL-JSM-0010LA)
- Northcentral Technical College - (Hitachi TM 2030)
- Northwest Vista College - (Hitachi TM 2030 Plus)
- Oakton Community College - (Hitachi TM 2030)
- North Seattle College - (Aperio Explore)
- Pasadena City College - (Phenom ProX)
- Pennsylvania State University - (25KV 20 Ultra FCSEM)
- Research Triangle Nanotechnology Network - (FEI Quanta 200 Field Emission Gun)
- Salt Lake Community College - (Hitachi TM2030)
- SUNY Polytechnic Institute - (Hitachi TM3000 w/ x-ray (EDS))
- University of California San Diego - (Zesis Sigma 500 SEM)
- University of Texas at San Antonio - (Hitachi 20300 STEM)
- SCME at University of New Mexico - (Phenom ProX)



Confocal Microscope

Confocal microscopy is an optical imaging technique for increasing optical resolution and contrast of a microscope by means of adding a spatial pinhole placed at the focal plane of the lens to eliminate out-of-focus light. It enables the reconstruction of three-dimensional structures from the obtained images. [Read more](#)

Optical Microscope

The optical microscope, often referred to as light microscope, is a type of microscope which uses visible light and a system of lenses to magnify the image of a small object. Microscopes were the earliest form of microscope and were possibly invented in their present compound form in the 17th century. Basic optical microscopes can be very simple, although there are many complex designs which aim to improve resolution and sample contrast. [Read more](#)

Molecular Analyzer

The molecular analyzer is used for the measurement of the size, viscometric mobility and protein size, as well as of conformational properties, and optionally the measurement of protein mobility and rheology of proteins and polymer solutions.

Fourier Transform Infrared Spectroscopy (FTIR)

Fourier transform infrared spectroscopy (FTIR) is a technique which is used to obtain an infrared spectrum of absorption or emission of a solid, liquid or gas. An FTIR spectrometer simultaneously collects high-spectral-resolution data over a wide spectral range. This confers significant advantage over a dispersive spectrometer which measures intensity over a narrow range of wavelengths at a time. [Read more](#)

X-ray fluorescence (XRF)

X-ray fluorescence (XRF) is the emission of characteristic "secondary" (or "fluorescent") X-rays from a material that has been excited by bombardment with high-energy X-rays or gamma rays. The phenomenon is widely used for elemental analysis and chemical analysis, particularly in the investigation of metals, glass, ceramics and building materials, and for research in geochemistry, forensic science, archaeology and art objects such as paintings and manuscripts. [Read more](#)

Fabrication Tools

The following fabrication tools are available:

- Ruth Voyager Electron Beam Lithography tool
- Electron Beam Deposition, Angstrom Engineering, Model 450
- Reactive Ion Etching tool, NGP90, Oxford Instruments

Remote Accessibility:

- Stanford University - (Keyence 3D Laser Confocal Scanning Microscope)
- North Seattle College - (Olympus Fluoview FV100)
- Pennsylvania State University - (Leitz Ergolux)
- Georgia Institute of Technology - (Malvern ZetaMaster Nano 25)
- Georgia Institute of Technology - (Thermo Scientific Nicolet FT-IR Spectrometer)
- Nebraska Nanocleve Facility - (Rigaku Supermini300 X)
- University of Iowa



Some current **focus areas**



- Nano education **connective tissue** and **tool access** – RAIN Network

RAIN



- Available for **your use @**
www.nano4me.org/remoteaccess
- Tell a colleague
- Network **membership is open** to all providers
- Infrastructure is created
- Team meets ~ every 6 weeks to share / make forward progress
- **Contact Bob or Ozgur**

www.nano4me.org/remoteaccess

MNT^eSIG

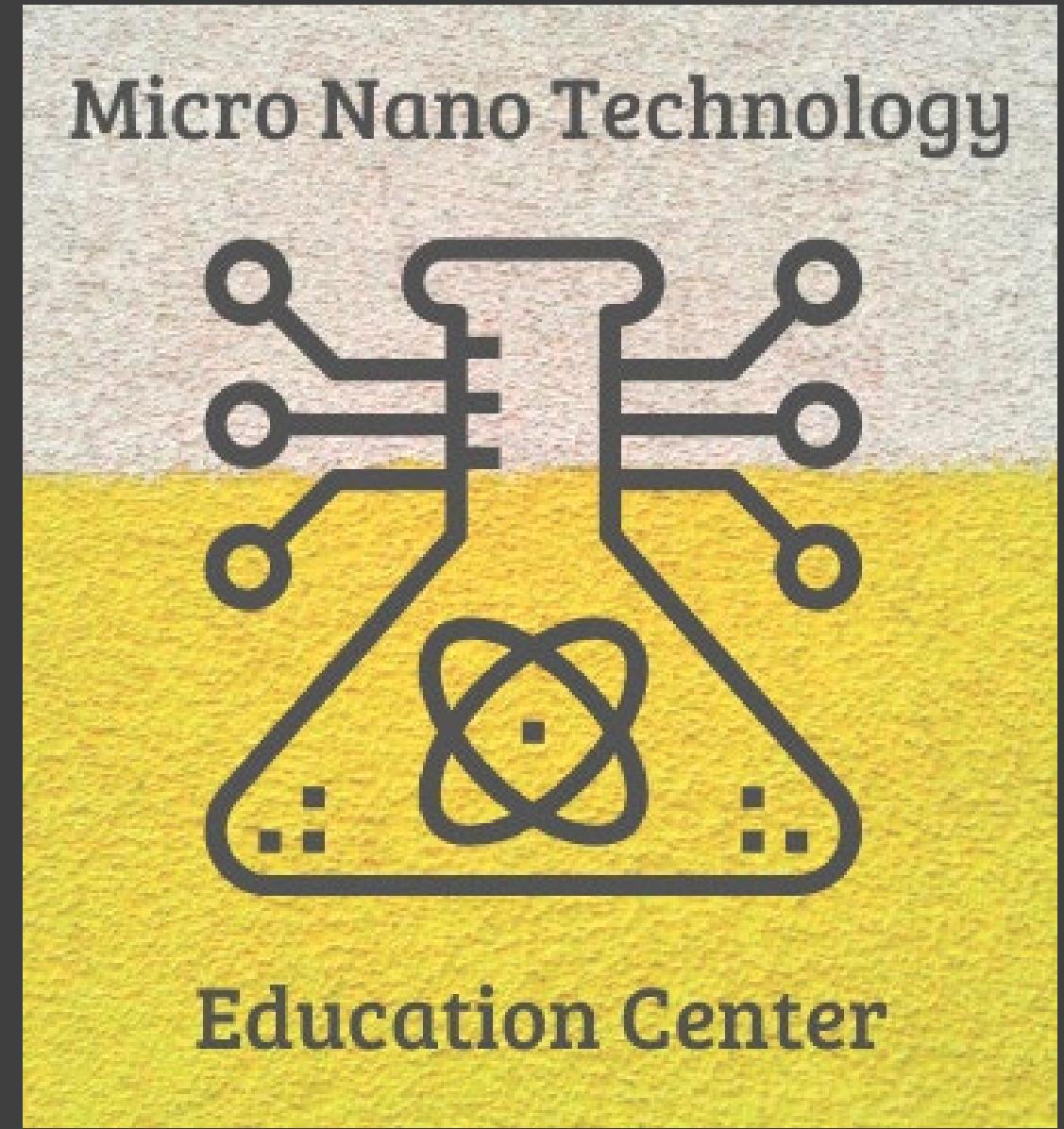
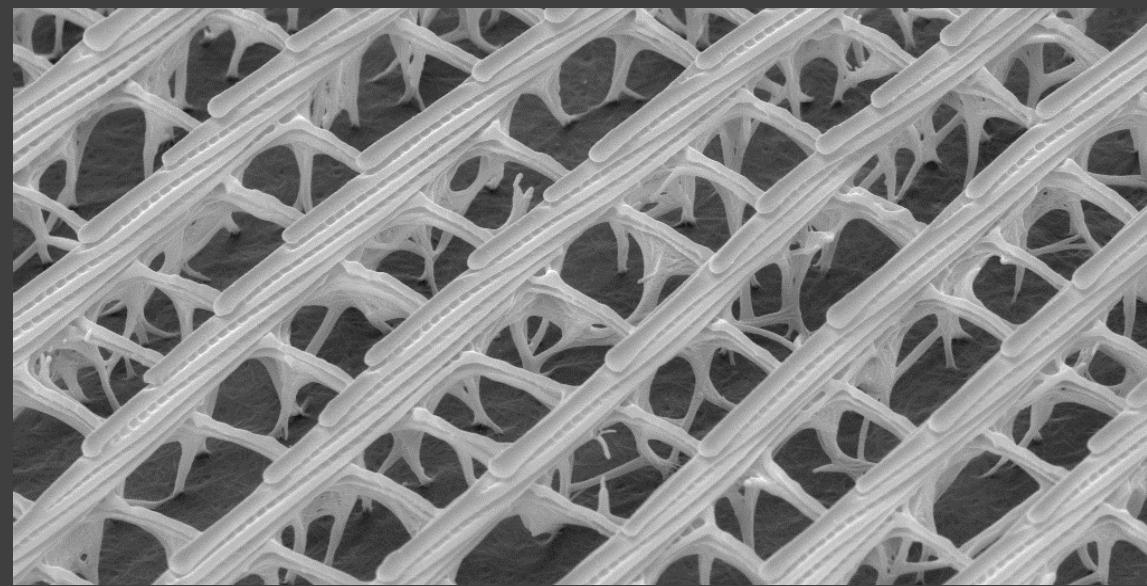
MICRO NANO TECHNOLOGY
education
SPECIAL INTEREST GROUP

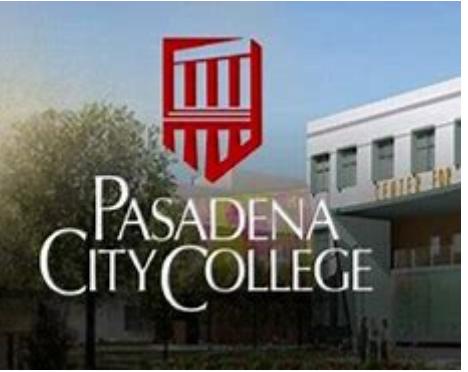
Mission:

*Foster collaboration between educators
at all levels, industry, and agencies for
relentless improvement of the micro
and nano technology workforce.*

<https://www.mntesig.net/>

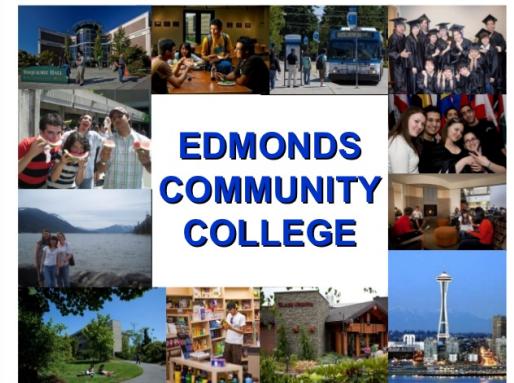
Become a part
of the MNT
Community





Community College Leadership

Edmonds Community College

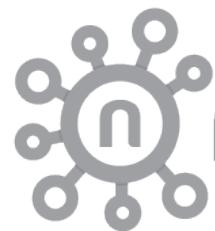


EDMONDS COMMUNITY COLLEGE
Every Step of the Way...



SCME
Support Center for
Microsystems Education

NEATEC

 **nanoHUB**


**MENTOR
CONNECT**

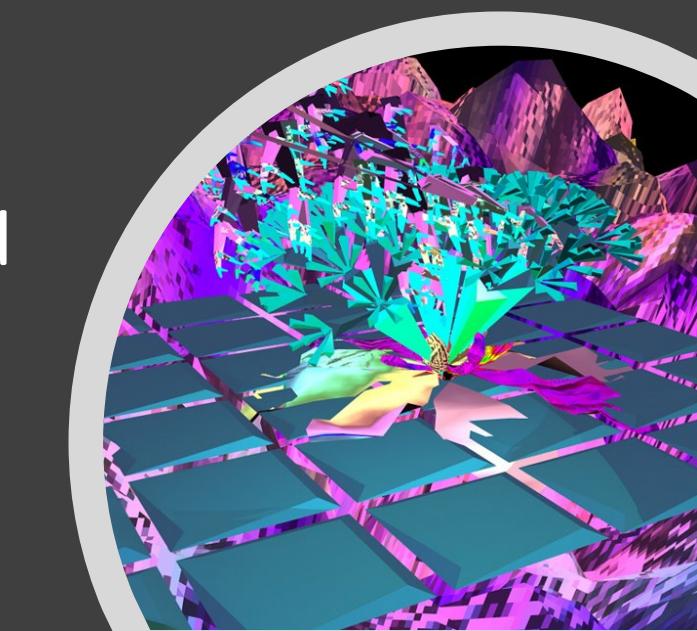
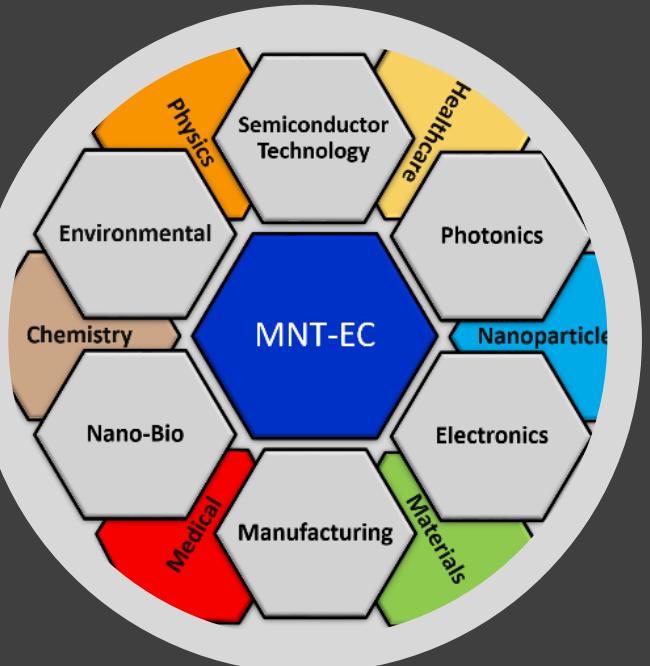
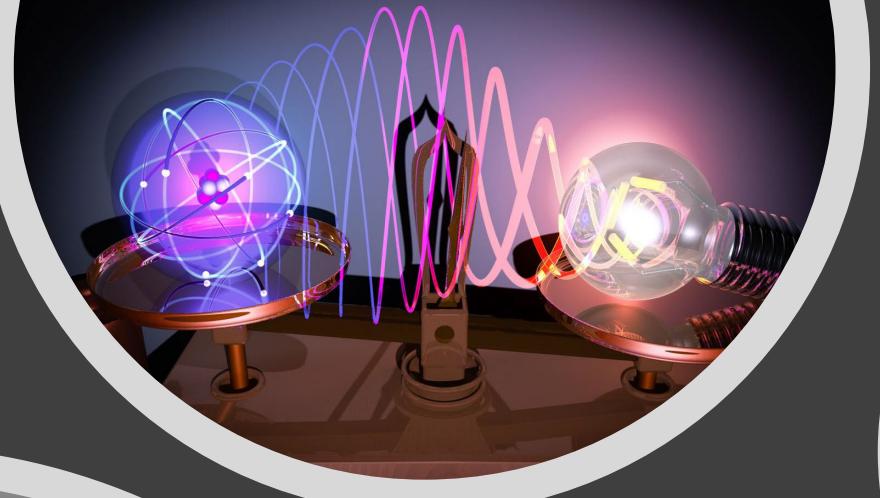
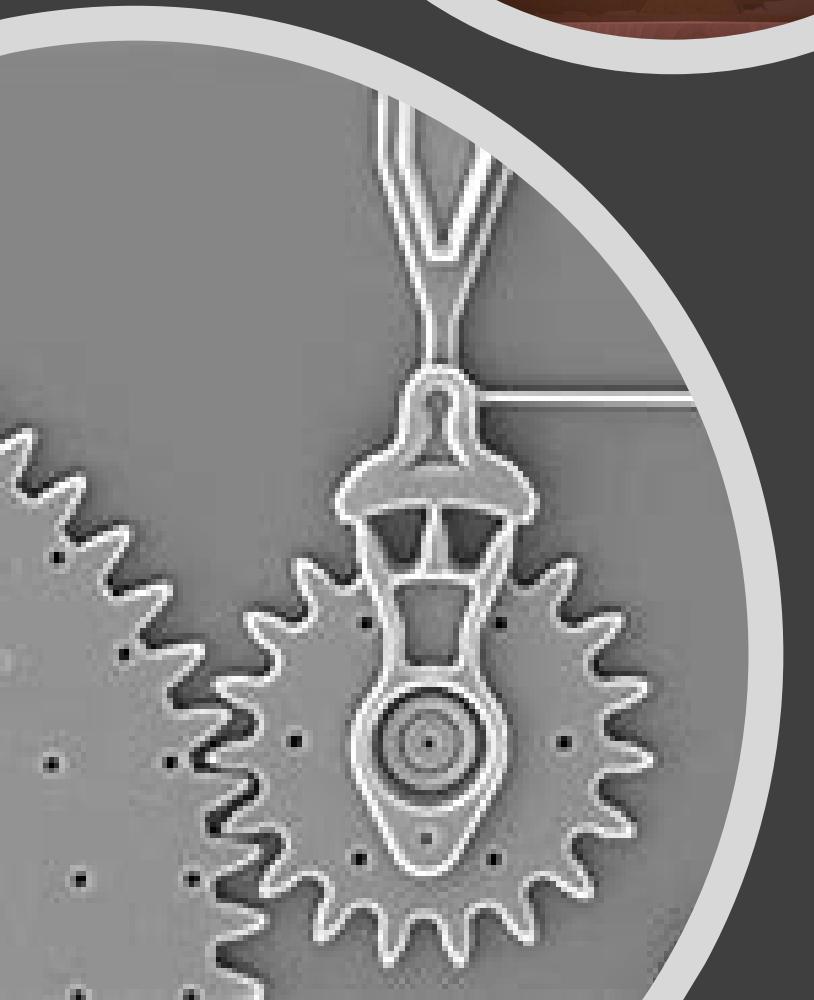


Building College-University
Partnerships for Nanotechnology
Workforce Development

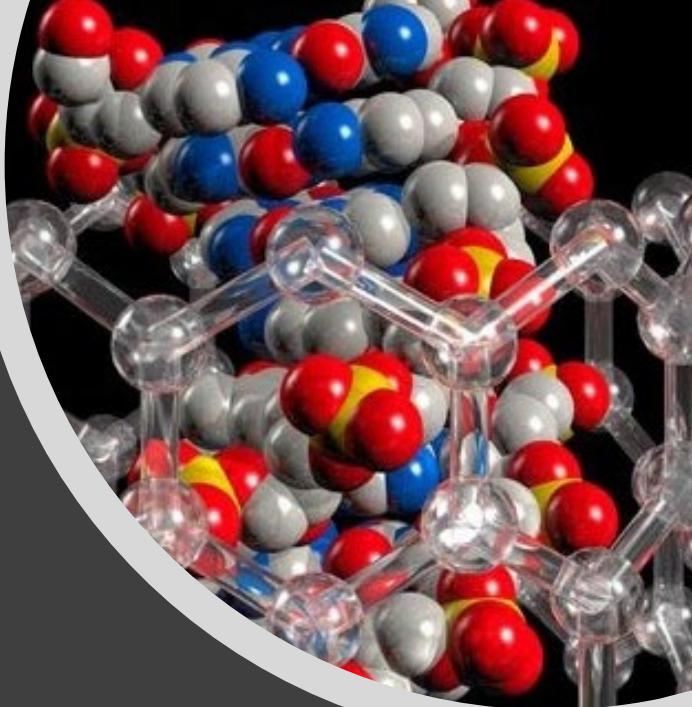
METPHAST

Midwest Emerging
Technologies
Public Health & Safety
Training Program

Advanced
Technological
Education
Partners



Build Bridges to Converging
MNT Industries, Universities and
Technical Education MNT
Programs



MNT-EC Mission:

Grow the MNT technician workforce by fostering academic and industry mentorship between existing MNT partners and educators developing prospective community college MNT programs.

Objective 1:

Develop a coordinated national approach to advance MNT education.

Objective 2:

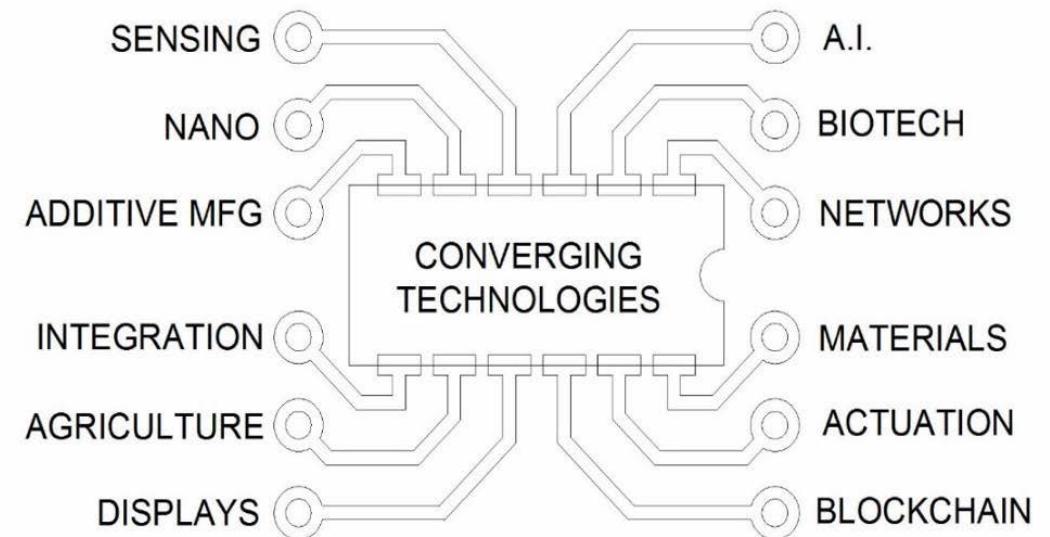
Deliver professional development to enhance knowledge, skills and abilities.

Objective 3:

Conduct strategic outreach, recruitment, and retention of traditional and underrepresented faculty/students.

Objective 4:

Create a deep Industry/Education Alliance that supports student success



Opportunities Through the MNT-EC

PCC ONLINE



RESOURCES TO HELP
YOU
WRITE GRANTS



Available Participant Support from MNT-EC

- Summer Workshops: \$65,000 (\$500 per workshop)
- Writing Group: \$25,000 (\$2,500)
- Attending Conferences: \$25,000
- Work-based Learning: \$10,000

1. Professional Development

2. Curriculum

3. Outreach and Recruitment

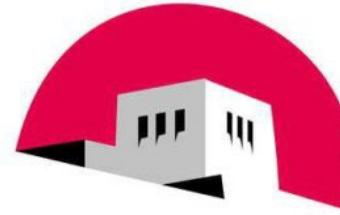
4. Industry

5. Distance Education



Join a Focus Group

Undergraduate Research in Technical Education



The University of New Mexico



PRINCETON
UNIVERSITY



ALAMO COLLEGES DISTRICT
Northwest Vista College



PASADENA
CITY COLLEGE

Summer Seminar Series

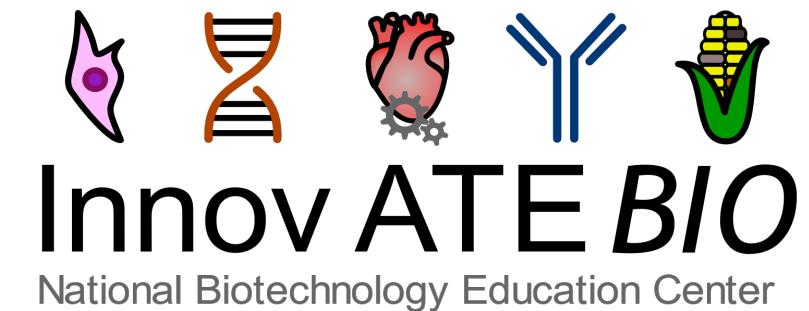
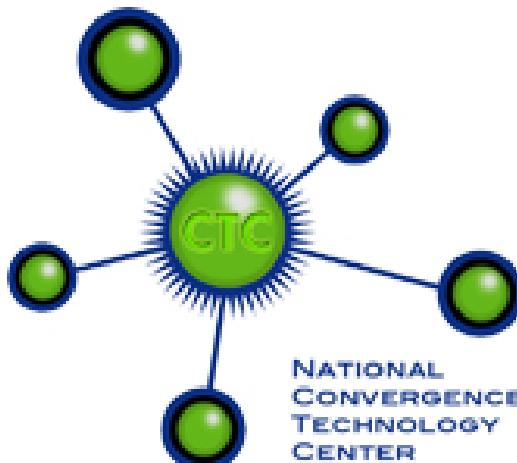
August thru October

Wednesday 9 AM PT

Zoom Registration



Collaborate
With ATE
Centers and
Programs





NORMANDALE
COMMUNITY COLLEGE



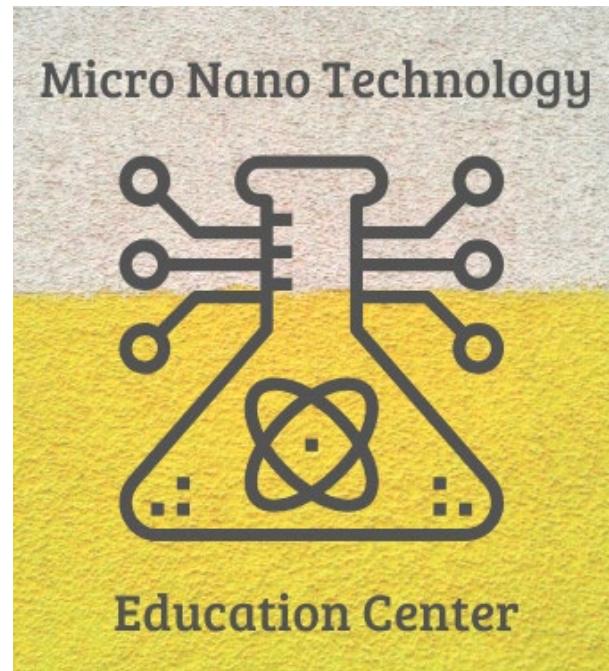
ALAMO COLLEGES DISTRICT
Northwest Vista College



Rio Salado
College



PASADENA
CITY COLLEGE



NM THE UNIVERSITY OF
NEW MEXICO

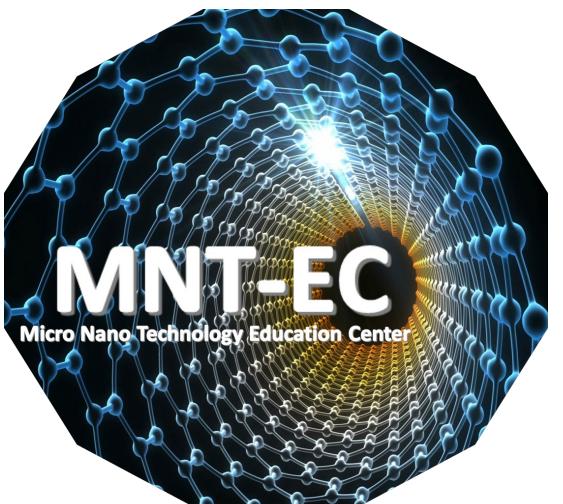


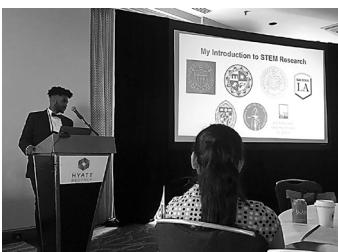
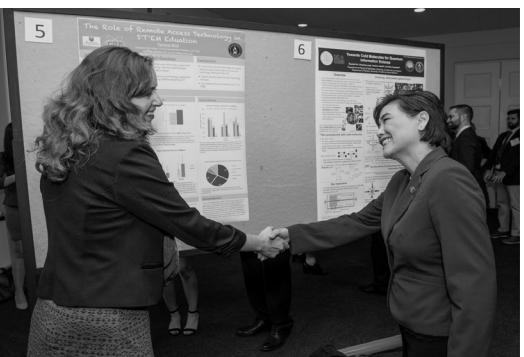
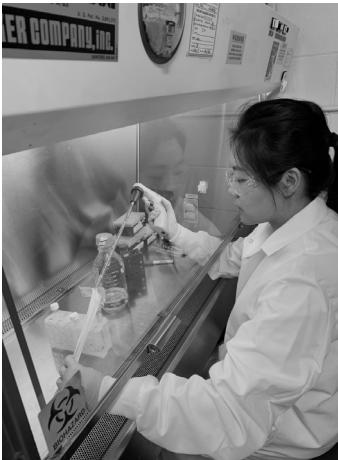
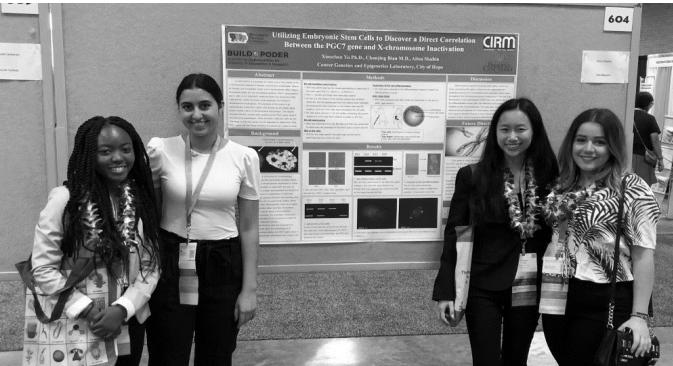
PRINCETON
UNIVERSITY





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