
hwangyong-hamnida
환영합니다
ahlan wa sahlan
أهلاً و سهلاً
ยินดีต้อนรับ
yindii ton rap
svāgat
स्वागत
Welcome.
Σας Καλωσοριζω
sas kalosorizo
huānyíng guānglín
歡迎光臨
khosh amadid
خوش آمدید
bienvenue

Agenda

All participants	Social (30 mins.)
Roop Mahajan	Opening remarks (15 minutes)
All scholars	Scholars introduce themselves, their advisor, department head, and dean if present. (2 min. ea.)
Roop Mahajan	Closing remarks (2 minutes)

Innovation Concepts

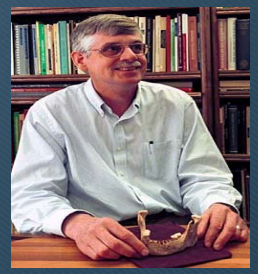
Human Spark

- **Neanderthals and modern humans evolved from the same ancestors.**

- **Neanderthals left Africa and spread to Europe where they lived for about 200, 000 years before they became extinct.**

- **Those left behind successfully evolved to modern humans and occupied the planet.**

DO YOU KNOW WHY?



ICTAS

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Invent the Future®

Innovation

"Just as energy is the basis of life itself, and ideas the source of innovation, so is innovation the vital spark of all human change, improvement and progress."

Ted Levitt; Marketing Guru, Harvard Business School

1. Invention vs. Innovation

Invention vs. Innovation

INVENTION

- an idea made manifest
- the creation/embodiment of something new
- the first occurrence of an idea for a new product or process
- *is the conversion of cash into ideas*

Invention vs. Innovation

INNOVATION

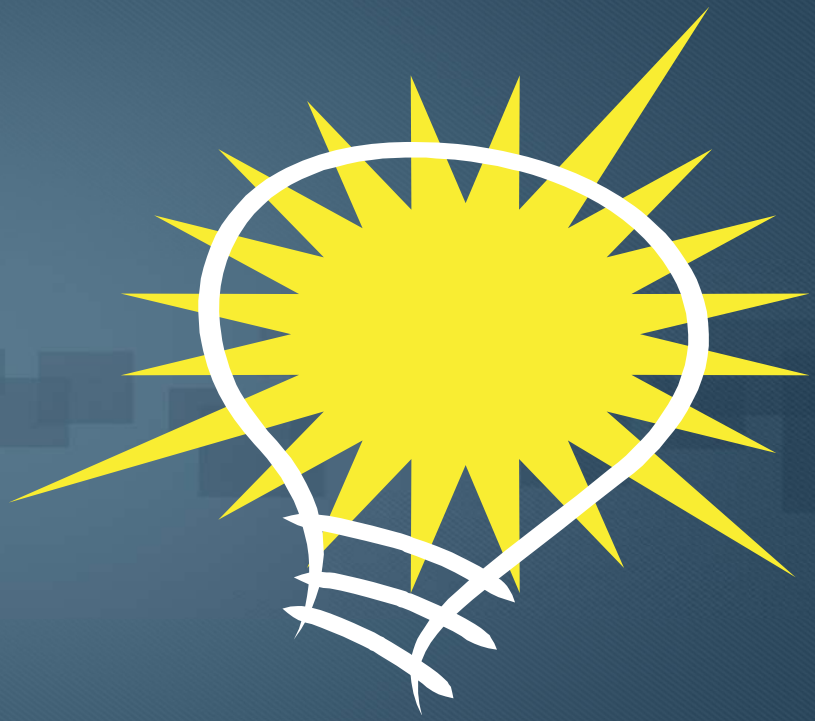
- an idea applied successfully in practice
- is the conversion of ideas into cash

(Etymological origin of word INNOVATION – creation of something new)

Invention vs. Innovation

Innovators produce, market and profit from their innovations

Inventors may or may not profit from their inventions



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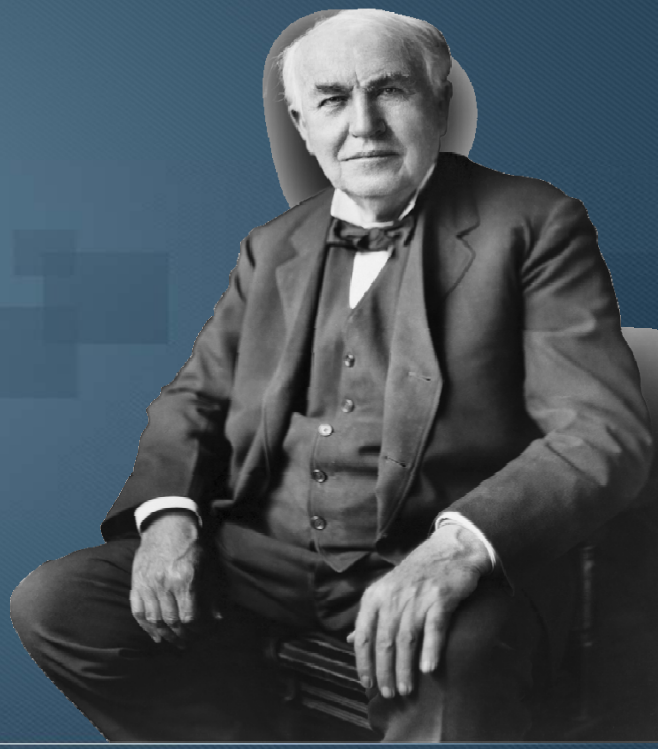
“I never perfected an invention
that I did not think about in terms of the
service it might give others...
I find out what the world needs,
then I proceed to invent.”

– Thomas Edison



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2. Sources of Innovation

Sources of Innovation

- **Inventor(s) –driven**
  - **Recent research suggests that the most successful innovation occurs at the boundaries/interfaces**
- **End- User –Driven**
  - **Need-based**
  - **Increasingly assuming more importance**

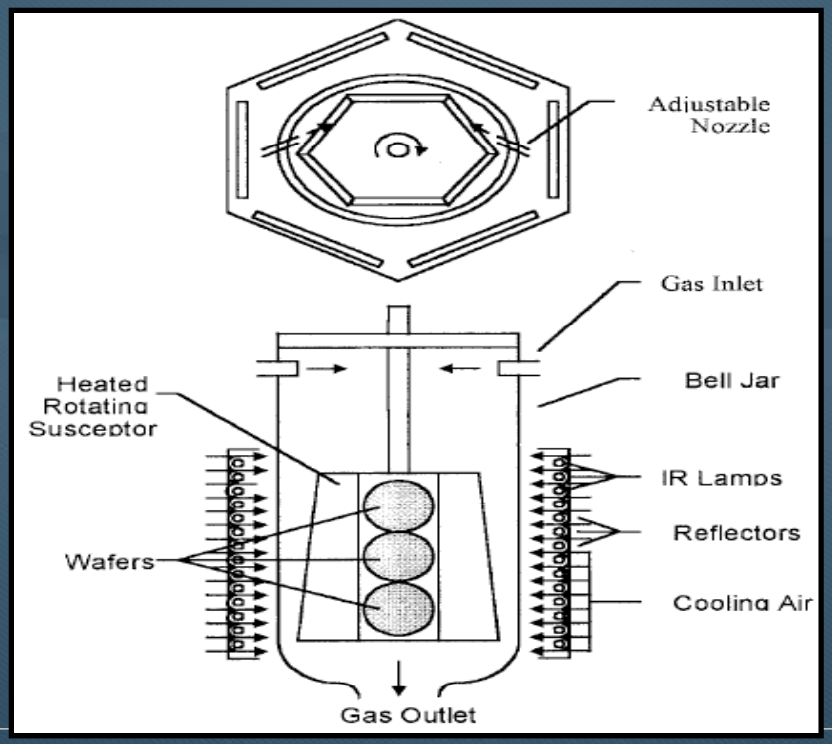
3. Linear vs. disruptive Innovation

3. Linear vs. Disruptive Innovation

- **Linear**
  - **Incremental**
    Ex: Cost reduction

  - **Barrel reactor silicon epitaxy**

CVD: Barrel Reactor



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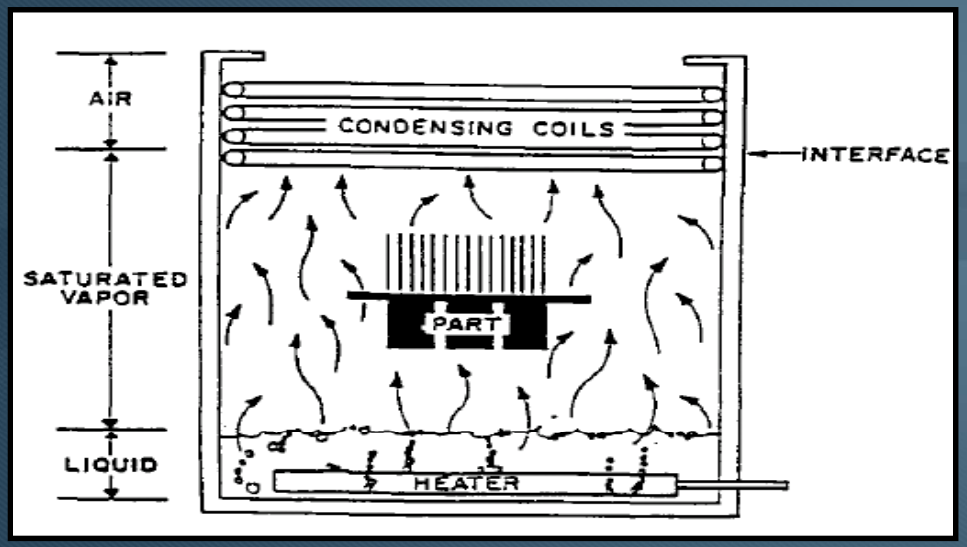
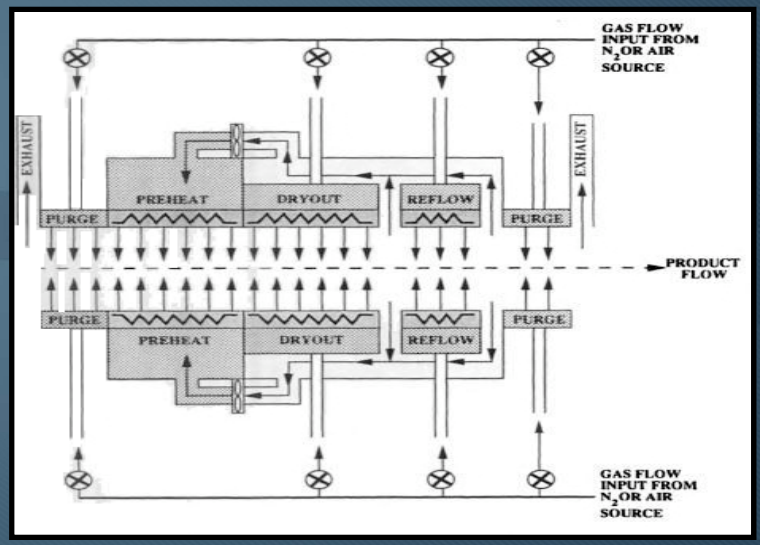
3. Linear vs. Disruptive Innovation

- **Disruptive**
  - **Game-changer**
  - **EX: Digital vs analog watches**

➢ **Condensation Soldering vs IR soldering**

Condensation and IR Reflow Soldering





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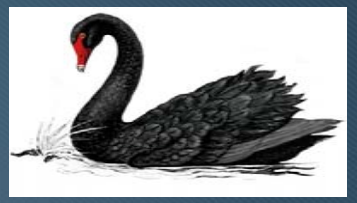
Disruptive Innovation and a Black Swan

A Black Swan is an event that has three characteristics;

- it is an outlier
- it carries an extreme impact
- it has retrospective predictability.

"The Black Swan", by Nassim Nicholas Taleb

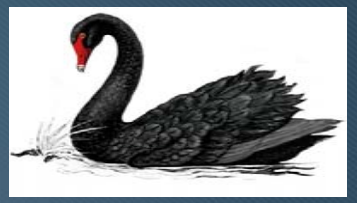


- Our world is dominated by Black Swans.
  - the internet
  - the computer
  - the laser

All three were unplanned, unpredicted, and unappreciated upon their discovery, and remained unappreciated well after initial use.

Disruptive Innovation

A powerful exercise for disruptive innovation



WHAT WILL MAKE YOUR CURRENT WORK IRRELEVANT IN 7 YEARS?

OR

WHAT NEW EXTERNAL EVENT WILL FUNDAMENTALLY CHANGE WHAT YOU DO NOW?

4. Promoting innovation

4. Promoting Innovation

- promoting interdisciplinary research

Buds of creativity bloom at intersections

- encourage risk-taking
  - Celebrate successes and failures
- constantly examine existing paradigms
  - Look for the next **Black Swan**

4. Promoting Innovation

Additional ingredients for success

- **Technical competency**
- **Resources**
- **Recognition**

Innovation Concepts

1. Invention vs. Innovation
2. Sources of Innovation
3. Linear vs. disruptive innovation
4. Promoting innovation

- **ICTAS as an agent of Innovation**

ICTAS

INSTITUTE *for* CRITICAL TECHNOLOGY *and* APPLIED SCIENCE *Virginia Tech*

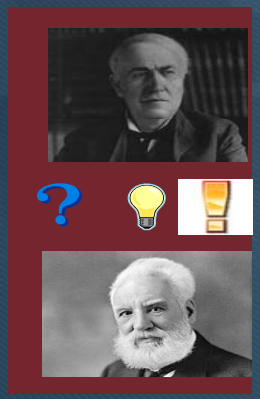
VISION

To be among the top-ranked global institutes in transformative technologies for a sustainable future

Mission

RESEARCH

To stimulate, catalyze and promote interdisciplinary / trans-disciplinary research at the intersection of science, engineering, biology and social sciences.



EDUCATION

Enhance educational experience of students in cutting-edge technologies

OUTREACH

Develop innovative and elegant sustainable solutions to promote economic development and enhance quality of life locally, nationally, and globally.

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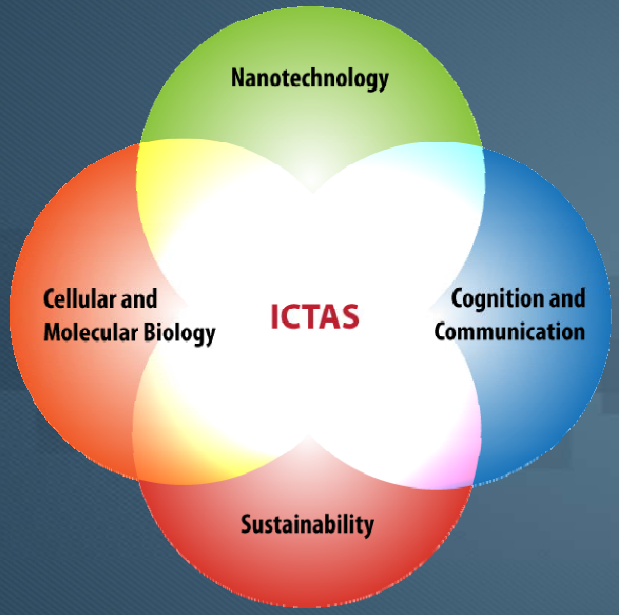
NBIC Tetrahedron: Defining Research Thrusts



ICTAS research is at the NBIC interfaces with a focus on A SUSTAINABLE FUTURE

"The most incomprehensible thing about the world is that it is at all comprehensible."

Albert Einstein

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ICTAS Thrust Areas

Nanoscale Science and Engineering

Nano-Bio Interface

Sustainable Energy

Renewable Materials

Sustainable Water

Cognition & Communication

Emerging Research

National Security

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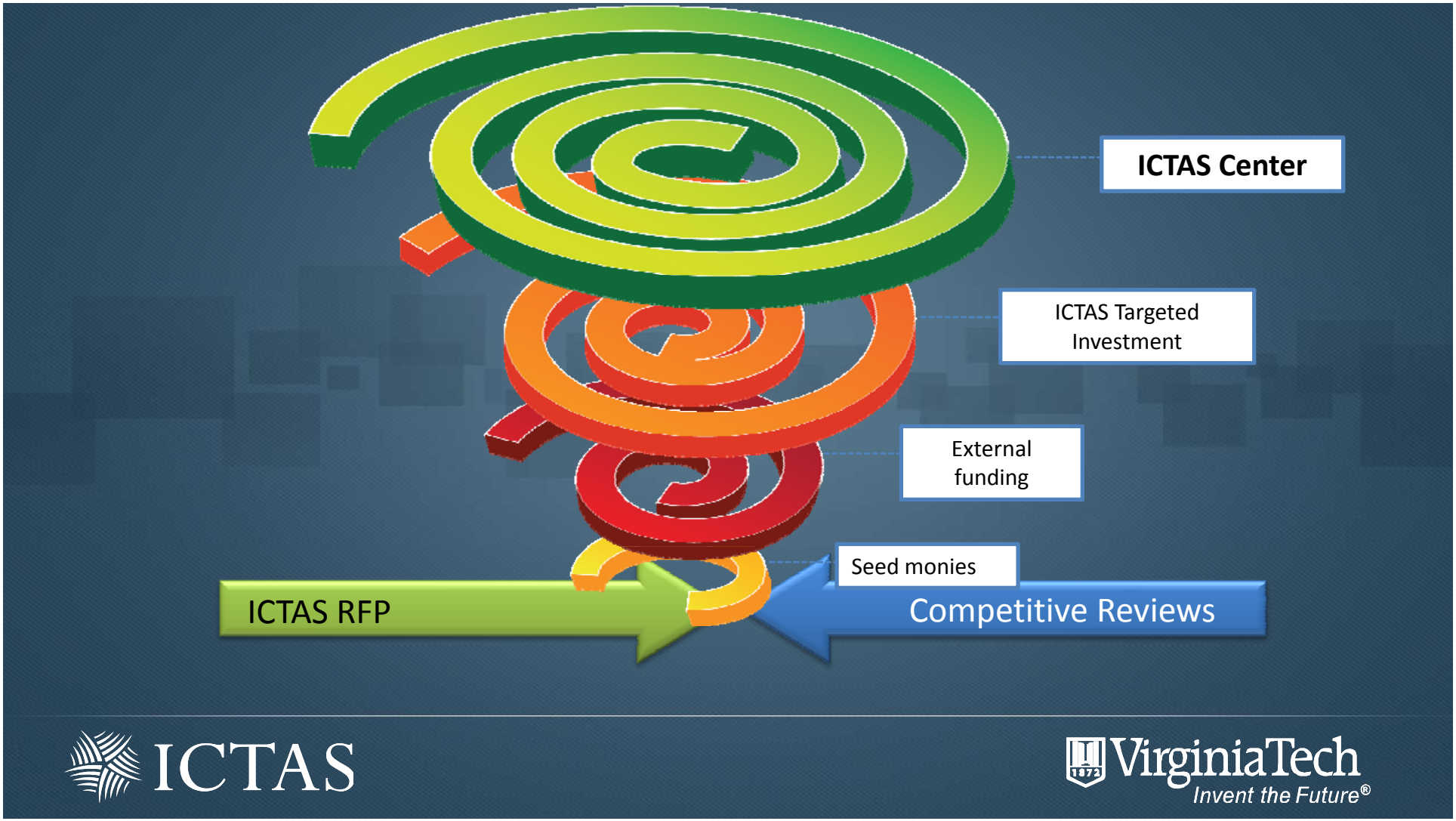
Thrust Areas Populated

Nanoscale Science and Engineering	Environmental Nanoscience and Technology | Nanomaterials including carbonaceous materials | Nanosensors
Nano-Bio Interface	Targeted Delivery of Nano-medicine | Cellular Engineering Microsystems |Non-invasive Sensing and Diagnosis | Inflammation | Bio-Imaging
Sustainable Energy	Fuel Cells | Organic Photovoltaics | Biologically Derived Fuels | Energy Harvesting | Clean Coal Energy
Renewable Materials	Bio-based Materials: Design and Processing
Sustainable Water	Water Infrastructure Management | Sustainable Ecosystems and Urban Infrastructure | Water & Health
Cognition and Communication	Cognitive Radio Networks | Autonomous Secure Communications | Human Computer Interface
Homeland Security	Naval Surface Warfare Center Dahlgren Division (NSWCDD) | DARPA, NASA
Emerging Research	Complex Network Systems | Accelerating Scientific Discovery through Data Mining | Personal Health Informatics | Humanoid Hospital


ICTAS Center
ICTAS Targeted Investment
External funding
Seed monies
ICTAS RFP
Competitive Reviews
ICTAS
VirginiaTech
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Laboratories *and* Collaborative Space

Bill Reynolds,
NCFL Director

Laboratories and Infrastructure: Collaborative Research Space

ICTAS A

Nanoscale Characterization and Fabrication Laboratory (9/2007). 31,496 sq. ft. that currently has 18 industrial collaborators and state of the art analytical equipment.

ICTAS HQ

Opening 04/2009 with 99,411 sq. ft. of research space to promote collaborations in Sustainable Energy and Water, Renewable Materials, Nano-bio Interface, Nanoscale Science and Engineering, and Human Cognition and Communication.

Laboratories and Infrastructure: Collaborative Research Space

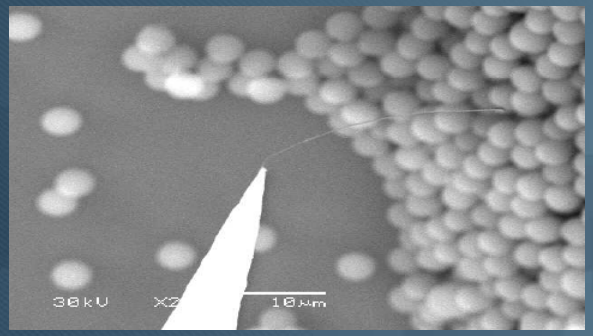
ICTAS- LSC

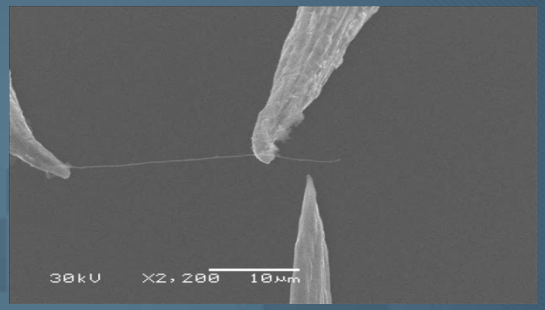
Due to open 1/2011 with 42,190 sq. ft. of research space to promote extended collaborations within Sustainable Water and Nano-bio Interface research.

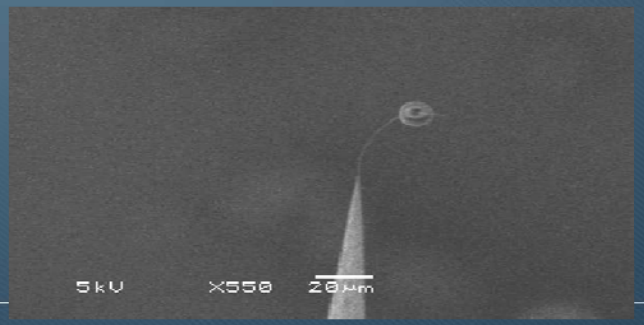
ICTAS – NCR

ICTAS will be expanding into the National Capital Region facility in the Ballston, Virginia area. The seven-floor, 144,000 square foot building, designed by Cooper Carry to meet the Silver U. S. Green Building Council's LEED™ Building Rating Systems, will be located on the 800-900 block of North Glebe Road. ICTAS is committed to approximately 6,000 square feet in this facility. The anticipated construction completion date is 2011.

Nanoscale Fabrication: NT/Sphere Device







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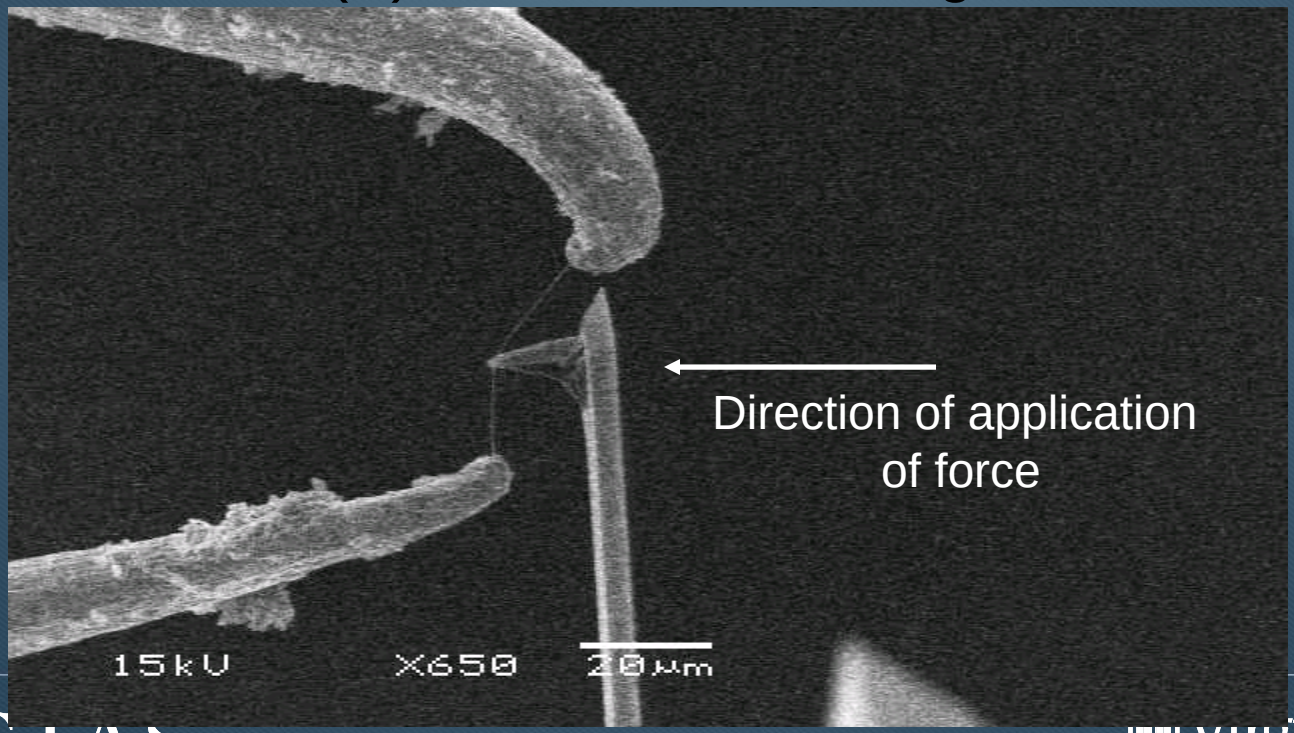
Mechanical Characterization

(B) Mechanical Testing



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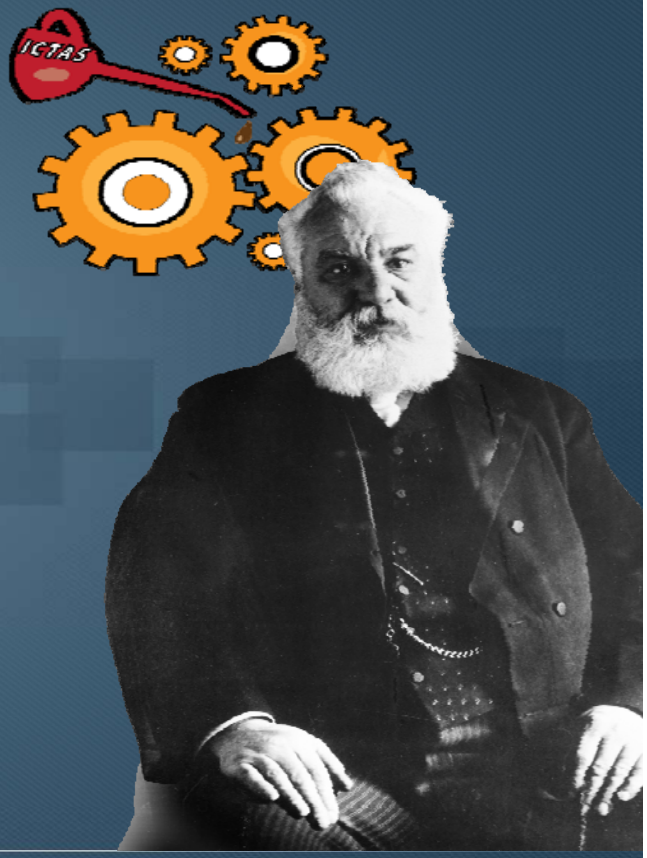
ICTAS –An agent of Innovation

- **Interdisciplinary research**
  - Recall "Buds of creativity bloom at intersections"
- **Identify/ Recognize need**
  - NBIC for sustainable growth
  - Thrust areas
- **Match need with technical expertise**
  - Interdisciplinary teams; 227 faculty
- **Provide resources**
  - NCFL, Collaborative space, financial resources
- **Promote transformative thinking**
  - The Black Swan Seminar Series

Results have far exceeded our expectations



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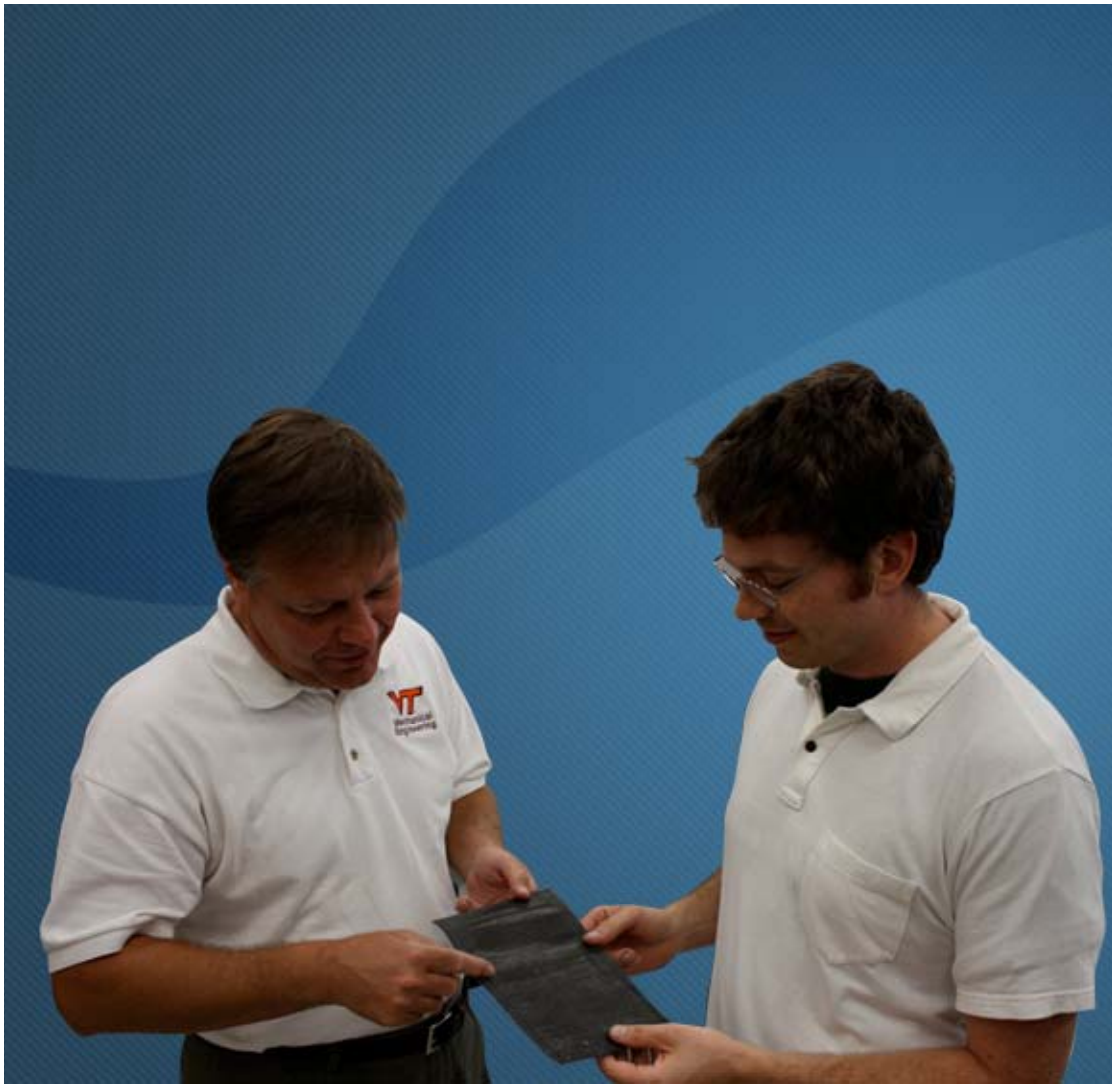
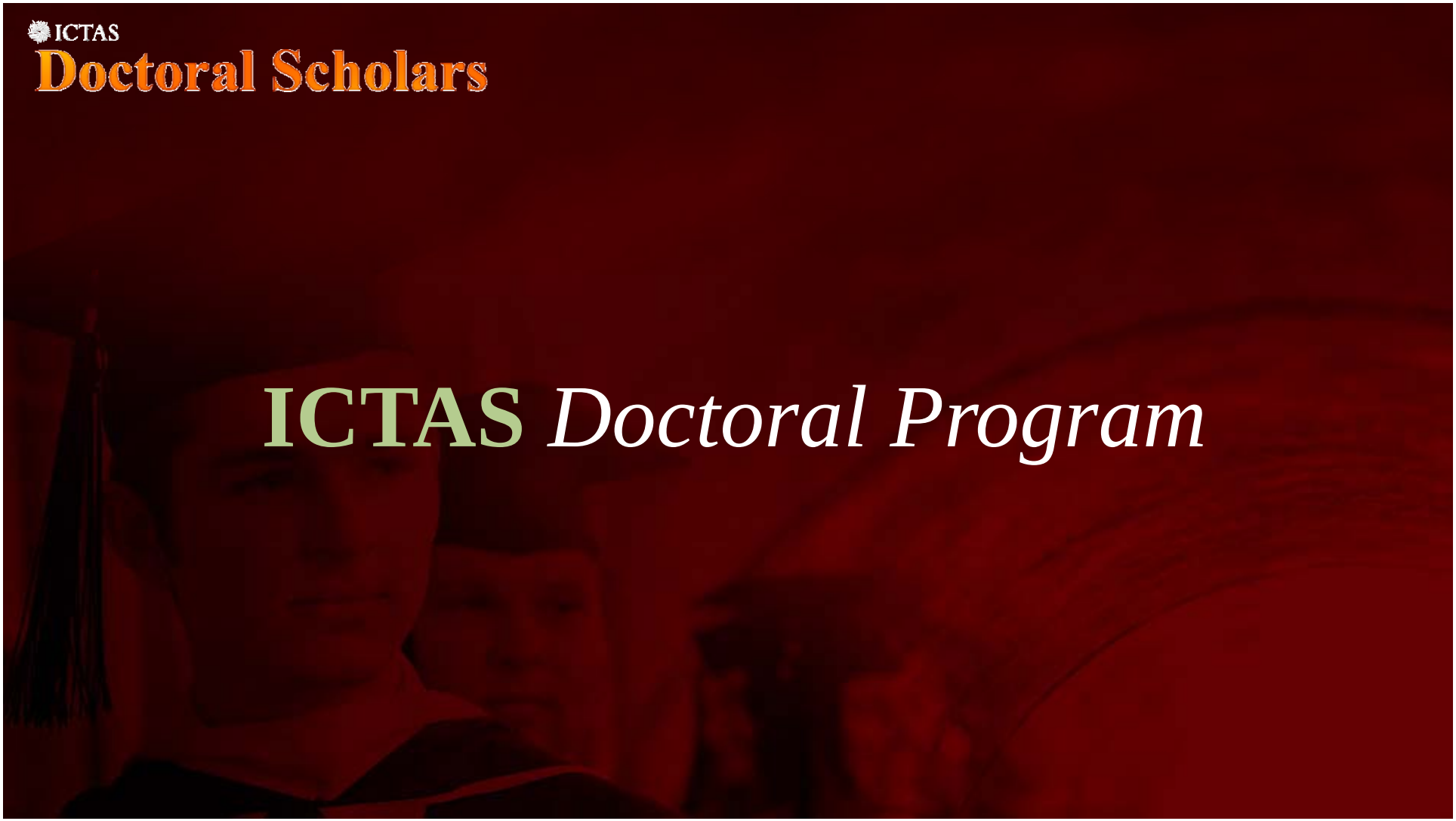


Students *and* Faculty

- **ICTAS Doctoral Scholars**
- **New Faculty Hires**
- **ICTAS Faculty Fellows**

ICTAS
Doctoral Scholars



ICTAS *Doctoral Program*

ICTAS
Doctoral Scholars

ICTAS Doctoral Scholars *Program Profile*

- The ICTAS Doctoral Scholars Program was established in 2007.
- The program honors exceptional Ph.D. applicants through award of full financial support for the Ph.D. qualifying period (maximum of four years).
- Successful candidates of the highest caliber are selected for this honor.

ICTAS
Doctoral Scholars

ICTAS Doctoral Scholars *Program Profile*

- This program led and managed by ICTAS is a cooperative effort among participating departments, colleges, the Graduate School and ICTAS.
- The initial goal for the program is to establish a steady state of 40 ICTAS fellows by 2011 ad infinitum.

ICTAS

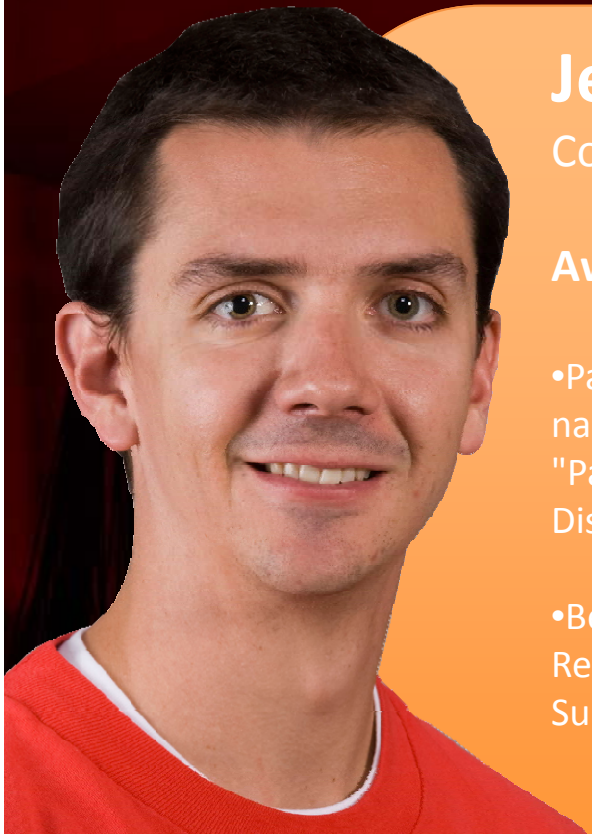
Doctoral Scholars

Current Status

Year	COE	COS	CALS	CNR	Vet Med	Total
2007	3	2	2	2	2	11
2008	3	2	2	1	1	9
2009	2	3	1			6
2010	2	3	2	1	1	9
						35

ICTAS

Doctoral Scholars



Jeremy Archuleta

Computer Science

Awards:

•Participant in Virginia Tech Synergy Lab team, named winner of the Storage Challenge award for "ParaMEDIC: Parallel Metadata Environment for Distributed I/O and Computing"

•Best undergraduate poster in the ACM Student Research Competition during the Supercomputing Conference 2009

2007
2008
2009
2010

ICTAS

Doctoral Scholars

S. Carter Fox

Wood Science and Forest Products

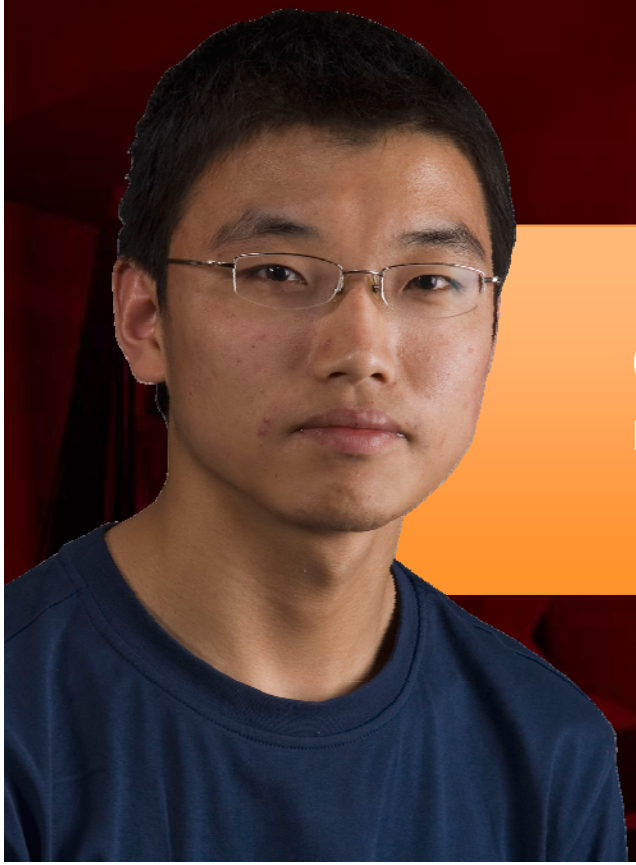
Awards:

•1st place presentation during the 2009 Eastman Chemical Virginia Tech Graduate Student Research Symposium entitled, "Completely Regioselective Synthesis of a Novel Cellulose Derivatives," November 2009.

2007
2008
2009
2010

ICTAS

Doctoral Scholars



Qian He

Physics

2007
2008
2009
2010

ICTAS

Doctoral Scholars

M. Amin Karami

Engineering Science and Mechanics

Conferences and Workshops

•Presentation during Annual AIAA Structures and Structural Dynamics Conference 2009, May 3-8-2009, Palm Springs, CA

•Presentation during Power MEMS 2009, December 1-4, 2009, Silver Spring, MD

•Presentation during IMAC-XXVIII, February 1-4-2010, Jacksonville, FLA

2007
2008
2009
2010

ICTAS

Doctoral Scholars

Tila Khan

Biomedical Sciences and Pathobiology

Conferences and Workshops:

•Poster presentation during VMRCVM Research Symposium, November 20, 2009

2007
2008
2009
2010

ICTAS

Doctoral Scholars

Justin Lemkul

Biochemistry

Awards:

•2009 - First place poster (student biomedical category), VCOM 6th Annual Research Recognition Day

•2008 - Bruce M. Anderson award, outstanding first-year graduate student in Biochemistry

2007
2008
2009
2010

ICTAS

Doctoral Scholars

Qingqing Li

Wood Science and Forest Products

Publications:

•Layer-by-layer Nanoscale Bondlines for Macroscale Adhesion. Submitted to Bioresources, under revision for publication.

•Molecularly thin nanoparticles from cellulose: isolation of sub-microfibrillar structures. Cellulose, 16 (6): 1025-2032.

2007
2008
2009
2010

ICTAS

Doctoral Scholars

Marcel Remillieux

Mechanical Engineering

Awards:

•2nd place at the Acoustical Society of America Student Poster competition, Raleigh, NC, March 30, 2007.

•3rd place at the 2006 Young Engineer Paper contest organized by the ASME Fluids Division, Chicago, IL, November 5-10, 2006.

2007
2008
2009
2010

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Doctoral Scholars

Jon Weekley

Horticulture

2007
2008
2009
2010

ICTAS

Doctoral Scholars

Matthew Williams

Statistics

Presentations:

•Williams, M. and Kim, D.-Y. 2009. "Testing for a Changepoint in the Linear Hazard Rate Under Staggered Entry and Type I Censoring." Joint Statistical Meeting for the American Statistical Association. Washington, DC.

•Williams, M. and Kim, D.-Y. 2008. "Statistical Analysis of Climate Changes in East Africa." Sigma Xi Annual Meeting and Student Research Conference. Washington, DC. (poster)

2007
2008
2009
2010

ICTAS

Doctoral Scholars

Sihui Zhang

Biological Sciences

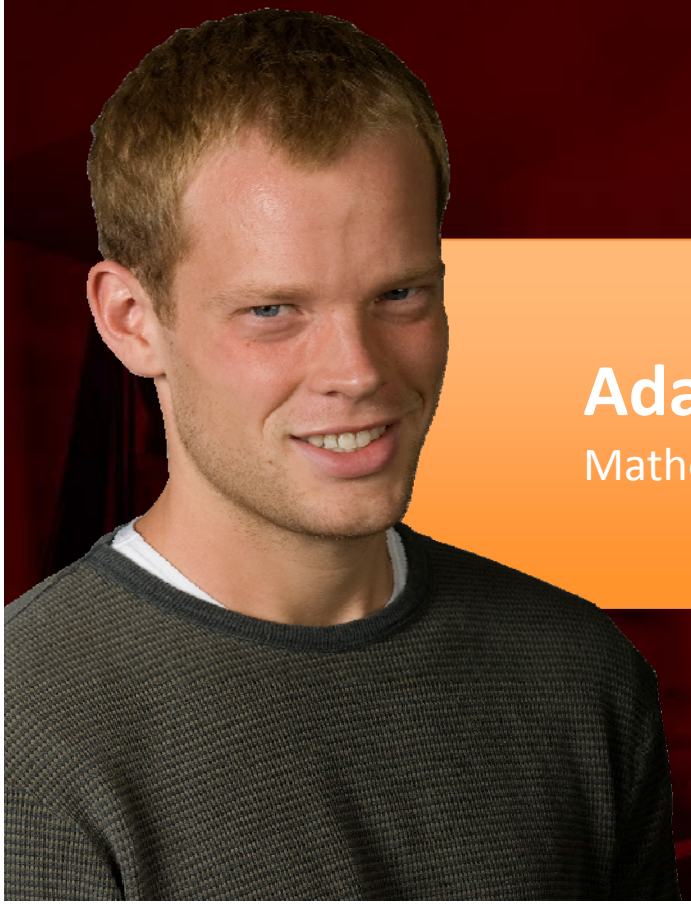
Awards:

1st place in poster award competition during 17th International C. elegans Meeting 2009, in the category of Morphogenesis for poster entitled "Isolation and Culture of Motile C. elegans Sex Myoblast Cells for High-resolution Microscopy"

2007
2008
2009
2010

ICTAS

Doctoral Scholars



Adam Bowman

Mathematics

2007
2008
2009
2010

ICTAS

Doctoral Scholars

Mehdi Ghommem

Engineering Science and Mechanics

Presentations:

- "Modeling Gust in Model Reduction Framework," 62nd Annual Meeting of the APS Division of Fluid Dynamics, Minneapolis, Minnesota, 22-24 November

- "Modeling and Performance Study of a Beam Microgyroscope," The 2009 Joint ASCE-ASME-SES Conference on Mechanics and Materials, Blacksburg, VA, 24-27 June 2009.

2007
2008
2009
2010

ICTAS

Doctoral Scholars

Matthew Steele-Macinnis

Geosciences

Presentations:

•Presentation during European Current Research on Fluid Inclusions 2009, September 20-October 1, 2009 in Granada, Spain

•Presentation during American Geophysical Union 2009 Joint Assembly, May 22-28, 2009, Toronto, CANADA

2007
2008
2009
2010

ICTAS

Doctoral Scholars

Syed Mazahir

Chemical Engineering

Publications:

- "Effect of Sparse Long-Chain Branching on the Step-Strain Behavior of a Series of Well-Defined Polyethylenes." Polymer Engineering Science

- "Evaluation of the use of a Semi-Hyperbolic Die for Measuring Elongational Viscosity of Polymer Melts Donald G. Baird,"

2007
2008
2009
2010

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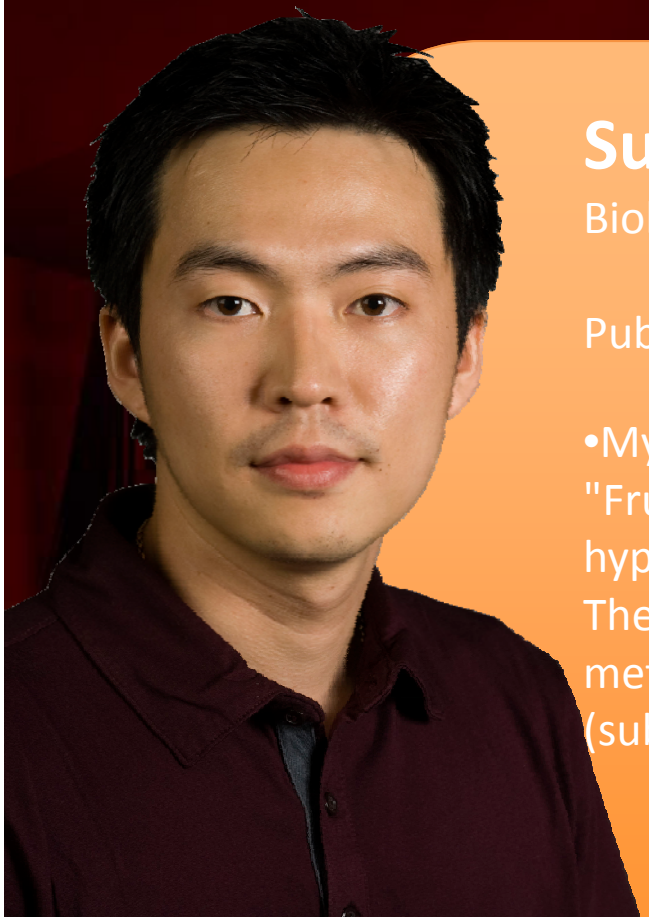
Doctoral Scholars



Suwan Myung

Biological Systems Engineering

Publications:

•Myung S, Wang Y, and Zhang YHP. 2010, "Fructose-1,6-bisphosphatase from a hyper-thermophilic bacterium Thermotoga maritima: Characterization, metabolite stability, and its implications" (submitted/ revised)

2007
2008
2009
2010

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Doctoral Scholars

Karthik Pillai

Wood Science and Forest Products

2007
2008
2009
2010

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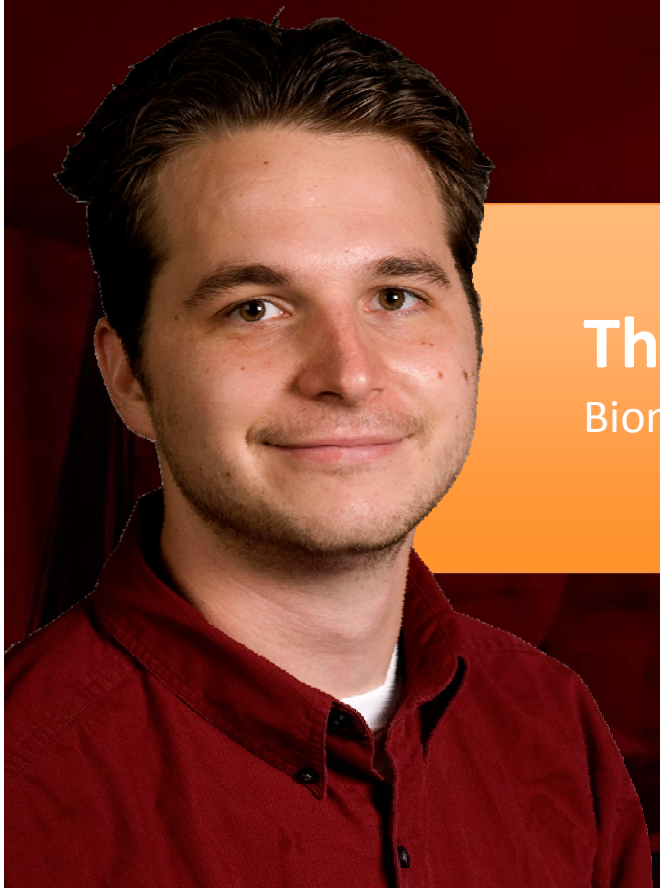
Doctoral Scholars



Thomas Rogers-Cotrone

Biomedicine and Veterinary Science

2007
2008
2009
2010

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Doctoral Scholars

Noppadon Sathitsuksanoh

Biological Systems Engineering

Conferences:

•AIChE 2009 Annual Meeting. “Bamboo Saccharification by Cellulose Solvent- and Organic Solvent-Based Lignocellulose Fractionation Followed by Ultra Low Enzyme Concentration”.

•AIChE 2009 Annual Meeting. “Increasing Cellulose
•Accessibility Is More Important Than Lignin
Removal: A Comparison of Cellulose Solvent-Based
ignocellulose Fractionation and Soaking in Aqueous
mmonia”

2007
2008
2009
2010

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Doctoral Scholars

Xiaoyue (Selina) Zhang

Industrial Systems Engineering

Conferences:

•Presentation during the HFES 53rd Annual Meeting, October 18-23, 2009, San Antonio, TX

•Presentation during the 17th Congress of the International Ergonomics Society, August 8-15, 2009, Beijing, China

•Presentation during the 21st Annual Conference of the International Society for Occupational Ergonomics and Safety, June 2009, Dallas, TX

2007
2008
2009
2010

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Doctoral Scholars

Sarah Foltz

Biological Sciences

2007
2008
2009
2010

ICTAS

Doctoral Scholars

2007
2008
2009
2010

Benjamin Freedman

Biological Systems Engineering

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Doctoral Scholars

Gregory James

Chemical Engineering

2007
2008
2009
2010

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Doctoral Scholars

2007
2008
2009
2010

Jeong-ah Lee

Physics

ICTAS

Doctoral Scholars

2007
2008
2009
2010

Taylor Mach

Chemistry

ICTAS

Doctoral Scholars

2007
2008
2009
2010

Bill Vogt

SBES

ICTAS

Doctoral Scholars

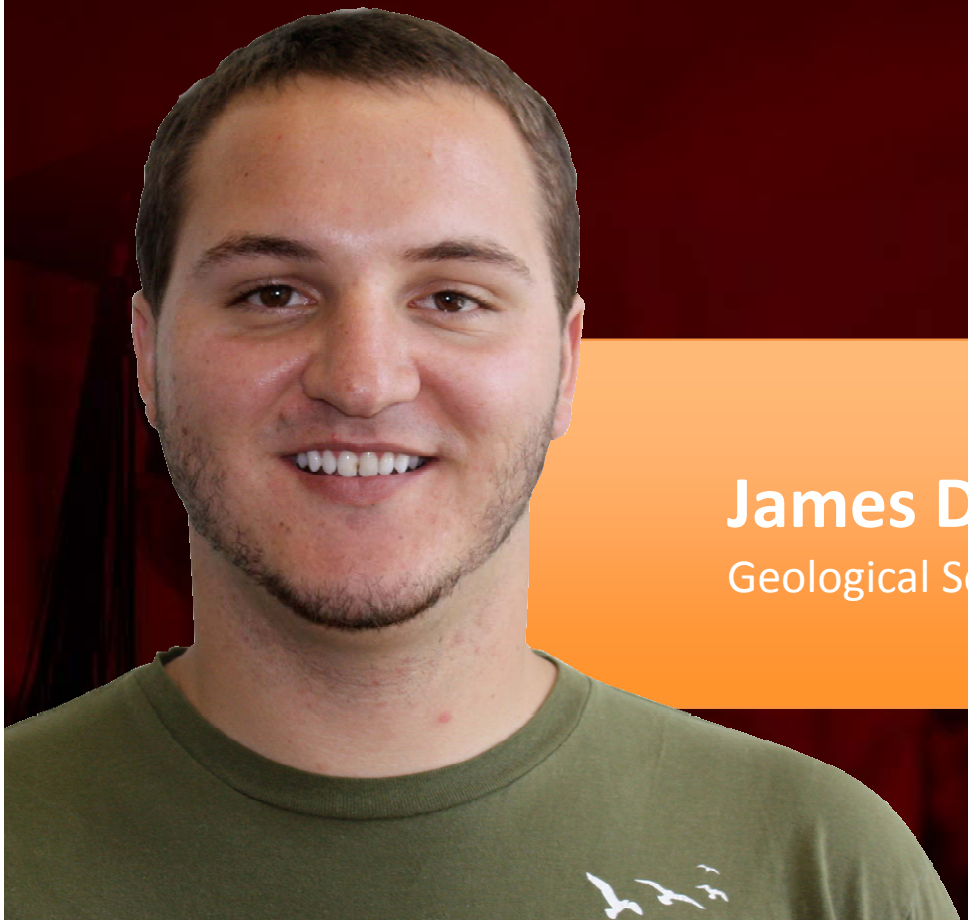
2007
2008
2009
2010

Zhe Bao

Biological Sciences

ICTAS

Doctoral Scholars



James Dale

Geological Sciences

2007
2008
2009
2010

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2007
2008
2009
2010

Jung Ki Hong

Wood Science and Forest Products

ICTAS

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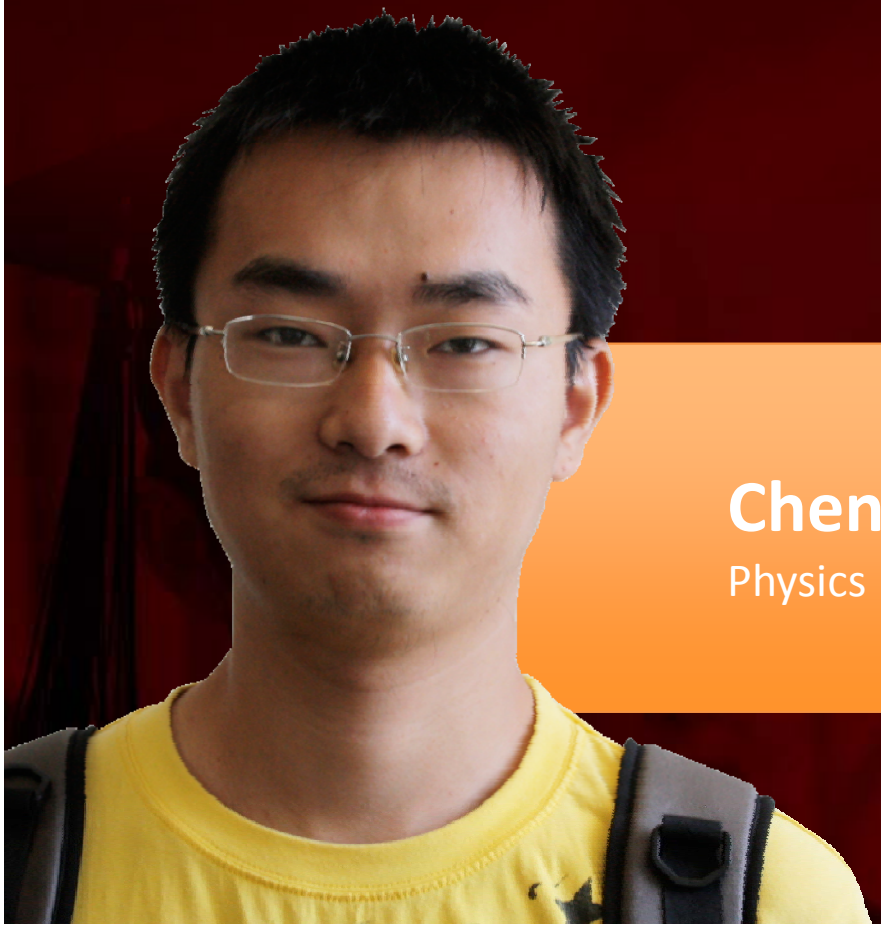

Chennan Hu

Physics

2007
2008
2009
2010

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Doctoral Scholars

2007
2008
2009
2010

Nathan Jones

Biological Systems Engineering

ICTAS

Doctoral Scholars

2007
2008
2009
2010

Konstantinos Krommydas

Computer Science

ICTAS

Doctoral Scholars

Daniel Vanden Berge

Civil Engineering

2007
2008
2009
2010

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2007
2008
2009
2010

Sarah Phoebe Williams

Plant Physiology

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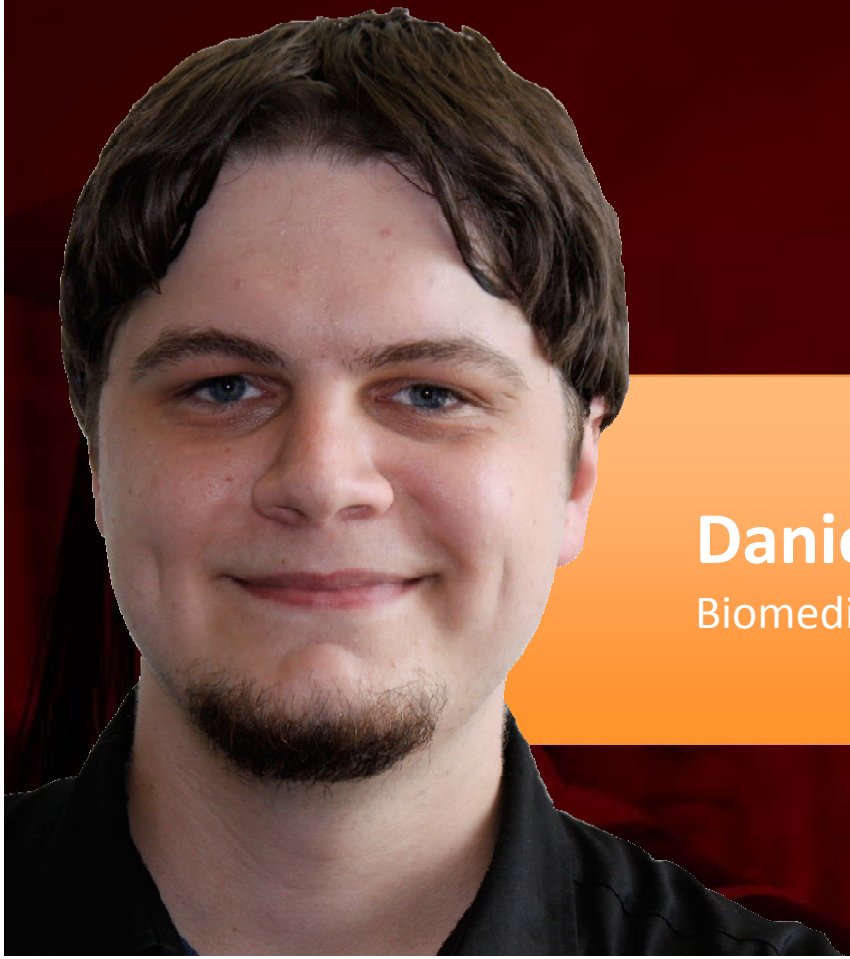
Doctoral Scholars



Daniel Youngstrom

Biomedical and Veterinary Sciences

2007
2008
2009
2010

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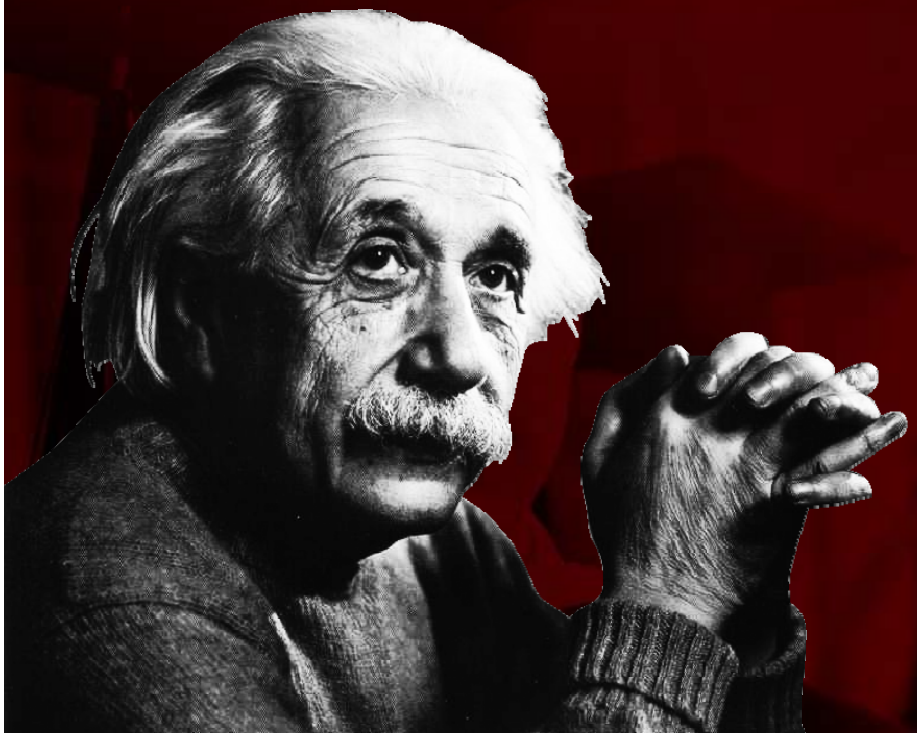
Doctoral Scholars

Concluding remarks

ICTAS

Doctoral Scholars

ICTAS is about satisfying our thirst for *curiosity*.



"The important thing is not to stop questioning. Curiosity has its own reason for existing."

"The most incomprehensible thing about the world is that it is comprehensible."

ICTAS
Doctoral Scholars

Dreams can *transform.*

- ICTAS is about creating and fulfilling dreams
  - a creative home for our faculty, staff, and students; a place where individuals can dream big and actually transform dreams to realize goals

- "Proceed in the direction of your dreams and you come across unprecedented happiness."

--Emerson

ICTAS

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"We can't solve problems by using the same kind of thinking we used when we created them."

-- Einstein

- Be creative
- Don't be discouraged by the enormity of the task at hand
- Rome was not built in a day
- Build a chain- one link at a time or a bridge- one brick one at a time