

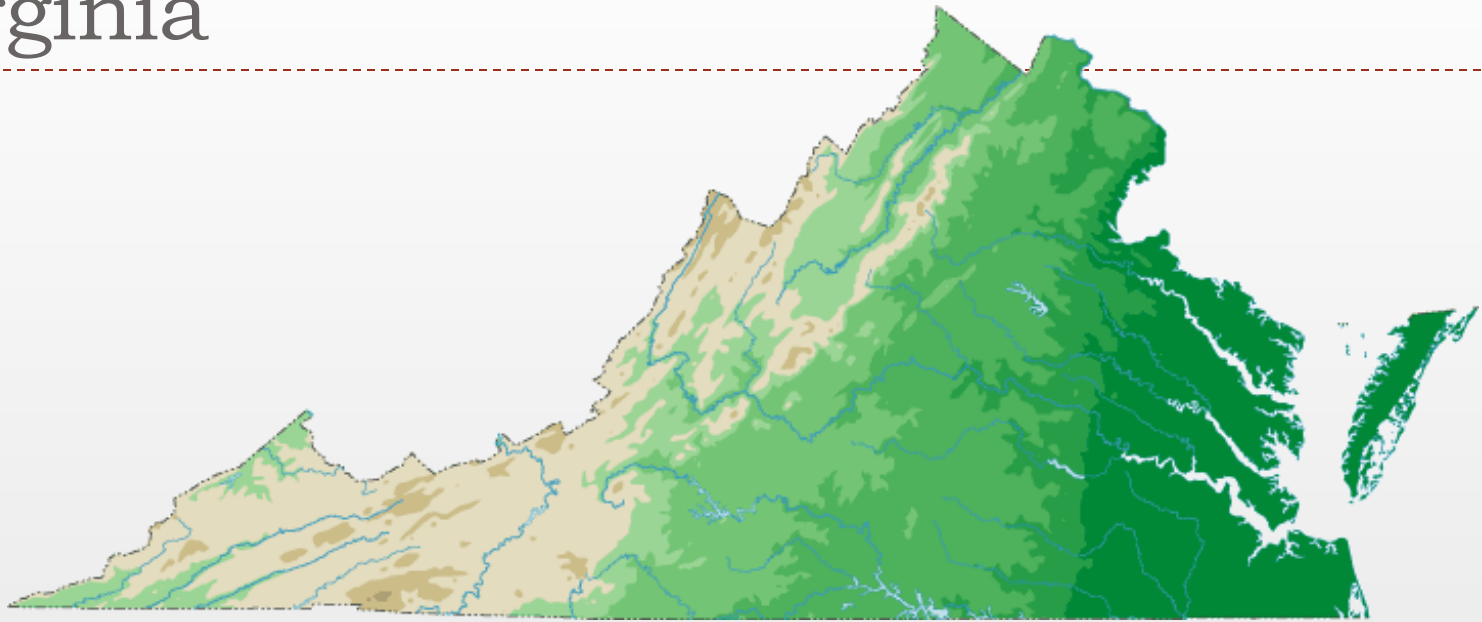


The Changing Roles of Biomaterial Science Education and its Impact on Virginia's Industry

Bob Smith

The Department of Sustainable Biomaterials
College of Natural Resources and Environment

Virginia



- ▶ Bob Smith – Dept. of Sustainable Biomaterials overview
- ▶ Scott Rennecker – Biomaterial Science teaching/research
- ▶ Charlie Becker – Virginia Dept. of Forestry perspective
- ▶ David Nutter – Economic Development/Legislative perspective

Discussion

- ▶ The Department of Sustainable Biomaterials
- ▶ The Changing Landscape
- ▶ The Future

Biomaterial Science

What is it?



- ▶ The material science after the tree (or other biomaterial) is harvested.

漢代造紙工藝流程圖



Nothing New



105 BC, Ancient Paper Making in China



  **SUSTAINABLE**
  BIOMATERIALS




Virginia Tech Dept. of Sustainable Biomaterials

- ▶ Established in 1979 as Wood Science and Forest Products
- ▶ People
 - ▶ 5 tech. and administrative staff
 - ▶ 15 tenure/tenure track faculty
 - ▶ 2 professors of practice
 - ▶ 40+ graduate students/post docs.
 - ▶ 80+ undergraduates
- ▶ Degrees; BS, MS, MF, and PhD
- ▶ 2012 became the Department of Sustainable Biomaterials



Mission: *To provide the highest quality education to students and conduct leading-edge research in sustainable biomaterials to meet society's needs while protecting our environment. Our program focuses on the development of future leaders in the sustainable utilization of forest-based and other renewable natural materials.*

Vision: *To be the leader in education, research and outreach in the sustainable management and use of our natural resources to meet society's needs.*



▶ Undergraduate Program ▶ Graduate Program

- ▶ Sustainable Biomaterials*
- ▶ Packaging Systems and Design*
- ▶ Biomaterial Science – in development.

- ▶ Business
- ▶ Manufacturing
- ▶ Engineering
- ▶ Polymer and Biomaterial Science
- ▶ Packaging Systems and Design

Careers in: Production management, research, green building design, packaging engineering and design, international sales, marketing, supply chain management, etc.

We still place nearly all graduating students from our program.



* Pending SCHEV approval



The Changing Landscape



Driving Forces

- ▶ Perceptions
- ▶ Students
- ▶ Faculty
- ▶ Industry
- ▶ Sustainable future

Perceptions of the College

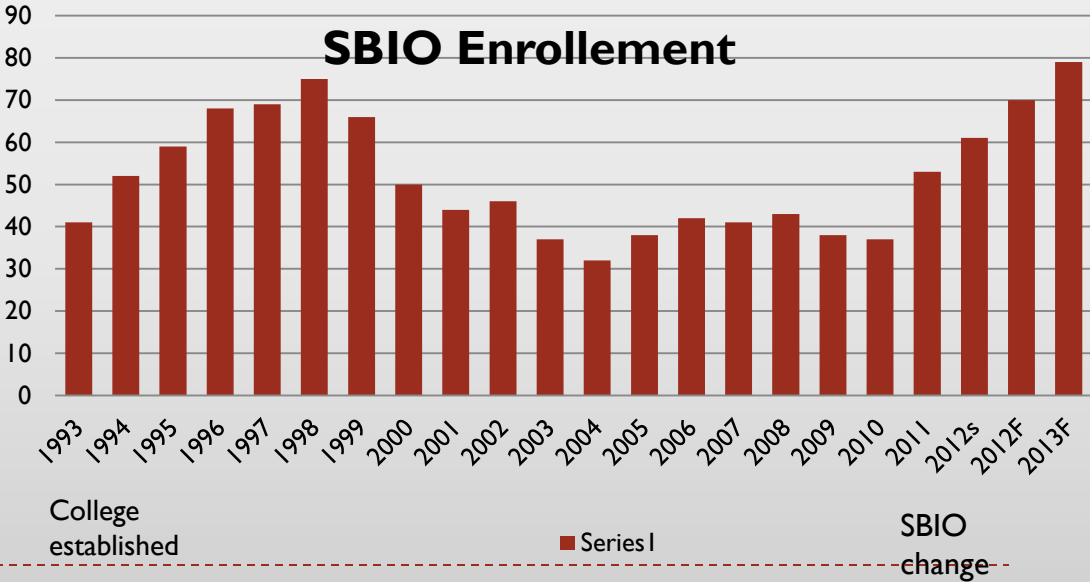
Stakeholders (n=700)

Non-CNRE Students (n=50)



In general we were viewed on/off campus as a traditional forestry program producing good foresters.

Students

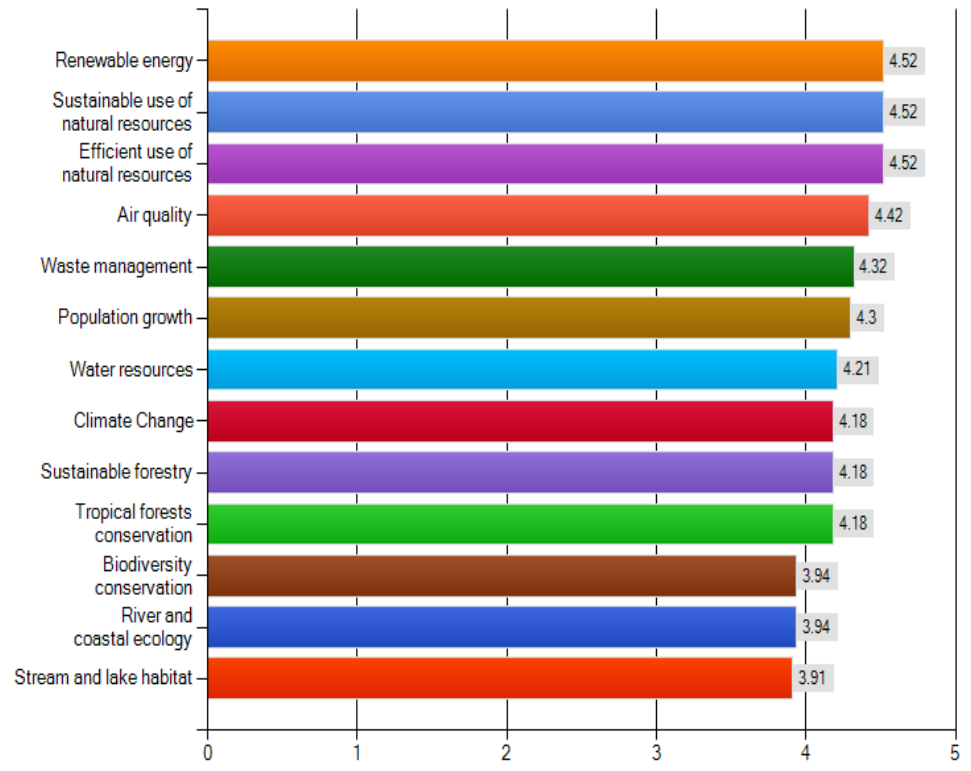


Important Natural Resource Issues

Students

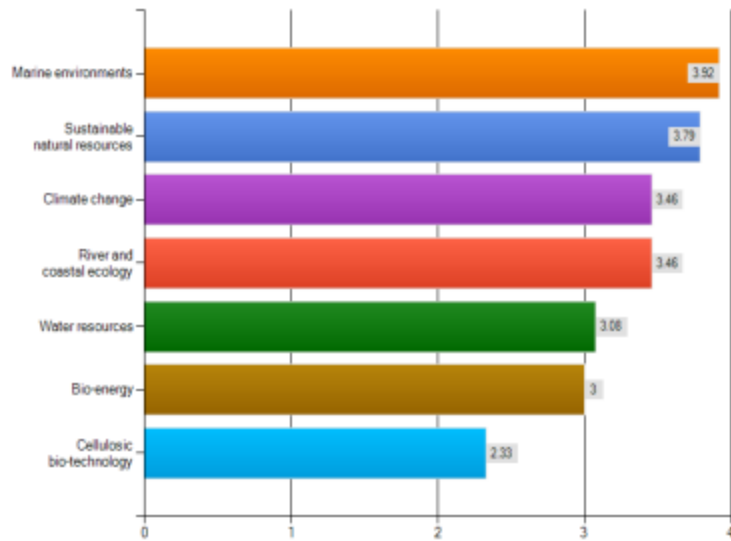
- ▶ Programs must adapt to meet the needs of a changing student population. We must be relevant to them.
- ▶ 80% of incoming students in VA come from an urban/suburban area. Not a lot of natural resource background.
- ▶ We surveyed students on campus on important natural resource issues.

Please rate the importance of the following natural resource and environment issues facing society today.



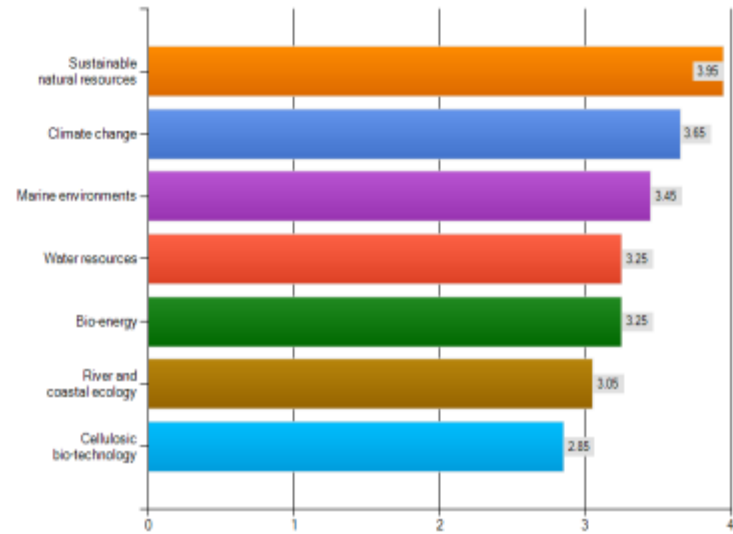
Student's rating of new academic program expansion

The college is investigating a number of new academic programs to expand our undergraduate education. Please rate how you may be interested in each.



CNRE Students

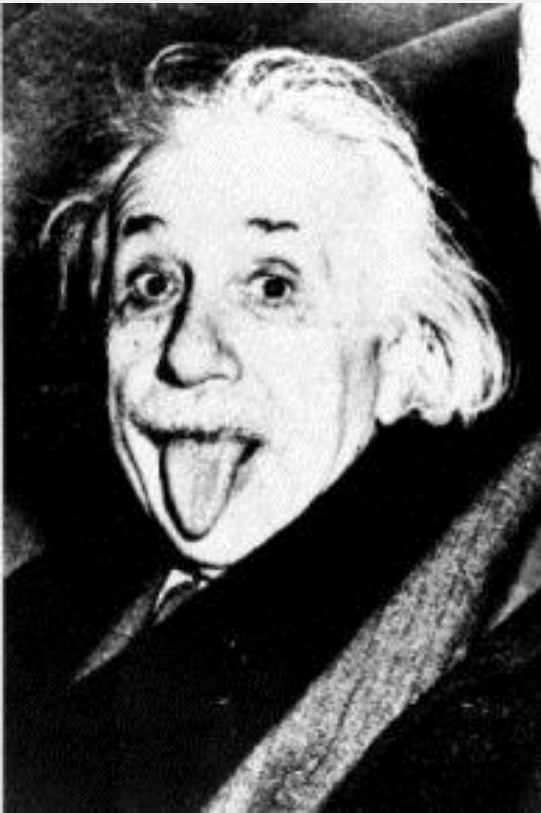
The college is investigating a number of new academic programs to expand our undergraduate education. Please rate how you may be interested in each.



University Study Students

Traditional

Wood Technologists
Wood Chemists
Wood Anatomist
Wood Preservation



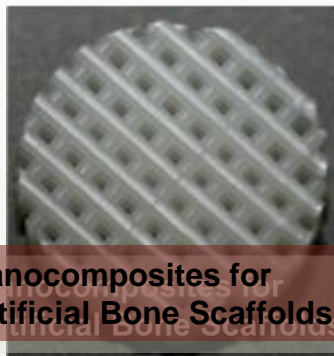
Disciplines (2013)

- ▶ Civil Engineers
- ▶ Industrial Engineers
- ▶ Organic Chemists
- ▶ Physical Chemists
- ▶ Business Management
- ▶ Marketing
- ▶ Wood Anatomists
- ▶ Packaging Scientists
- ▶ Wood Scientists

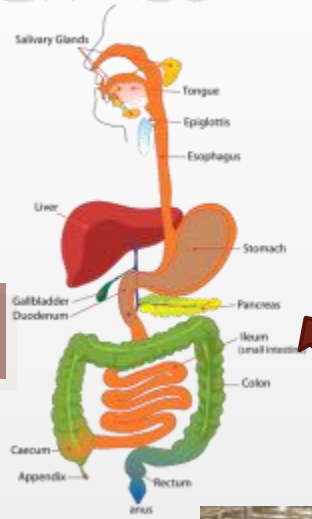


Cellulose Nanocrystal Mediated Drug Delivery

The Science



Nanocomposites for Artificial Bone Scaffolds



Lean Manufacturing



Syngas Generator using wood chips



Spent Brewers Grain



International Market Research



Packaging Research



Wood Engineering

Biomaterial Efforts

- ▶ Nanomaterials
- ▶ Drug delivery
- ▶ Biofuels
- ▶ Aseptic packaging
- ▶ Sustainable biomaterials
- ▶ New composites
- ▶ Bio-adhesives



The Importance of the Industry

- ▶ The forest products industry in Virginia is a very important part of the state's economy, contributing more than \$20.0 billion annually.
- ▶ An estimated 100,000 people are employed in the industry.
- ▶ Wood-based manufacturing industries are an important part of Virginia's industrial establishment and represent more than 20% of its production.
- ▶ It is vital for the economies of rural Virginia



Serving the Industry - Outreach

Continuing education

Industry, small businesses,
landowners and individuals

Technical assistance

Onsite technical assistance
In-office assistance
Agent assistance

Applied research

Bringing problems back from
the field

Economic Development

Technical assistance in planning
expansion/development and
training new workforce



The Industry

- ▶ Programs must continue to serve the needs of the current industry.
- ▶ Universities must adapt to meet the needs of the emerging biomaterial industry.
- ▶ Programs must be relevant to the needs of a changing society.
- ▶ Collaboration is vital to prepare students for the new biomaterial industry.

Changing Needs



Industry Participation at Virginia Tech



- ▶ Wood Based Composite Center
- ▶ Center for Forest Products Business
- ▶ Center for Packaging and Unit Load Design
- ▶ Center for Natural Resources Assessment & Decision Support

The Wood-Based Composites Center

A National Science Foundation Industry/University Cooperative Research Center

Since 1999, a multi-university partnership offering wood-based composites manufacturers and suppliers

- Pre-competitive, focused research at low overhead rates
 - ✓ Member-selected projects
 - ✓ Ongoing member involvement
 - ✓ Early access to results
 - ✓ Intellectual property protection
- Networking & relationships with faculty, students & industry professionals
- Significant leveraging of member fee dollars
- Preferential, prolonged access to student-recruits



The Center for Forest Products Business



- ▶ Established in 1991.
- ▶ Collaborative effort between industry, trade associations, state/federal government, and Virginia Tech
- ▶ Provide a competitive advantage for the forest products industry through supplying modern marketing and management information and training.

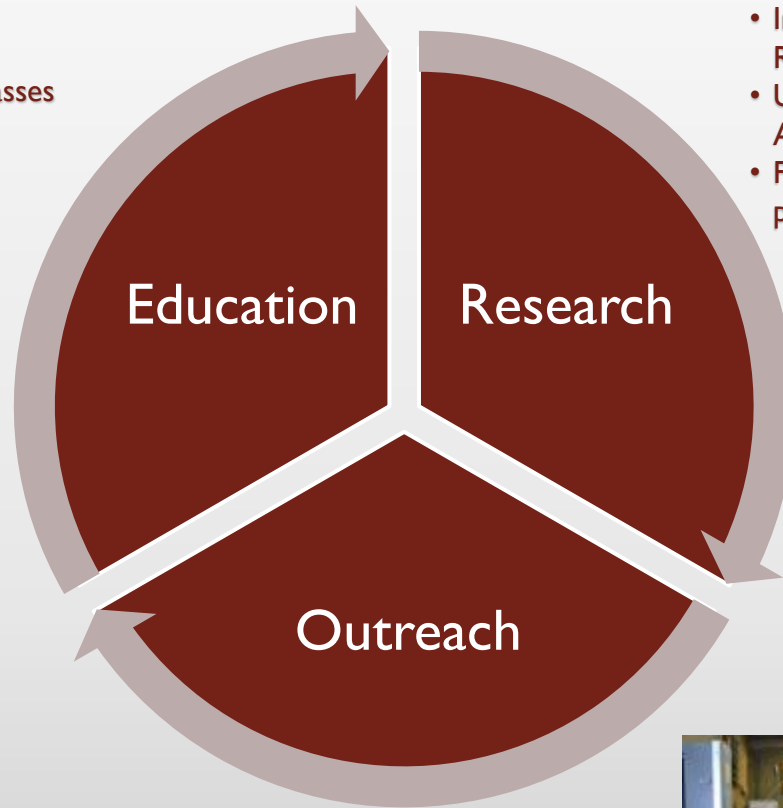
Mission: To help firms in the forest products industry improve the management of their operations and the marketing of their products.

Activities:

- Educating students for employment in the industry
- Providing continuing education for forest products industry professionals
- Providing useful marketing intelligence

Center for Packaging and Unit Load Design

- Sustainable Packaging Designer Trainee
- Summer Internships / Annual Work Experience
- Support for in class activities / plant tours
- Industry relations
- iPad based education
- Six undergraduate level classes



- Industrial Affiliate and Federally Sponsored Research Program
- Undergraduate and Graduate Research Assistantships
- Focus on improving the efficiency of the packaging supply chain

- ISO / ASTM/ ISTA / ANSI Working Groups
- Member of Sustainable Packaging Coalition
- Bi-Annual Continuous Education Courses
- Industry Testing Projects



Center for Natural Resources Assessment & Decision Support

- ▶ Funded by corporations and NGOs, endorsed by USFS and VaDOF
- ▶ Goal is to produce the next generation of models and data to support strategic planning of sustainable wood/biomass supplies
- ▶ Integrates GIS & remote sensing, forest inventory, and agent-based modeling
- ▶ Starting in Virginia, but widespread application possible



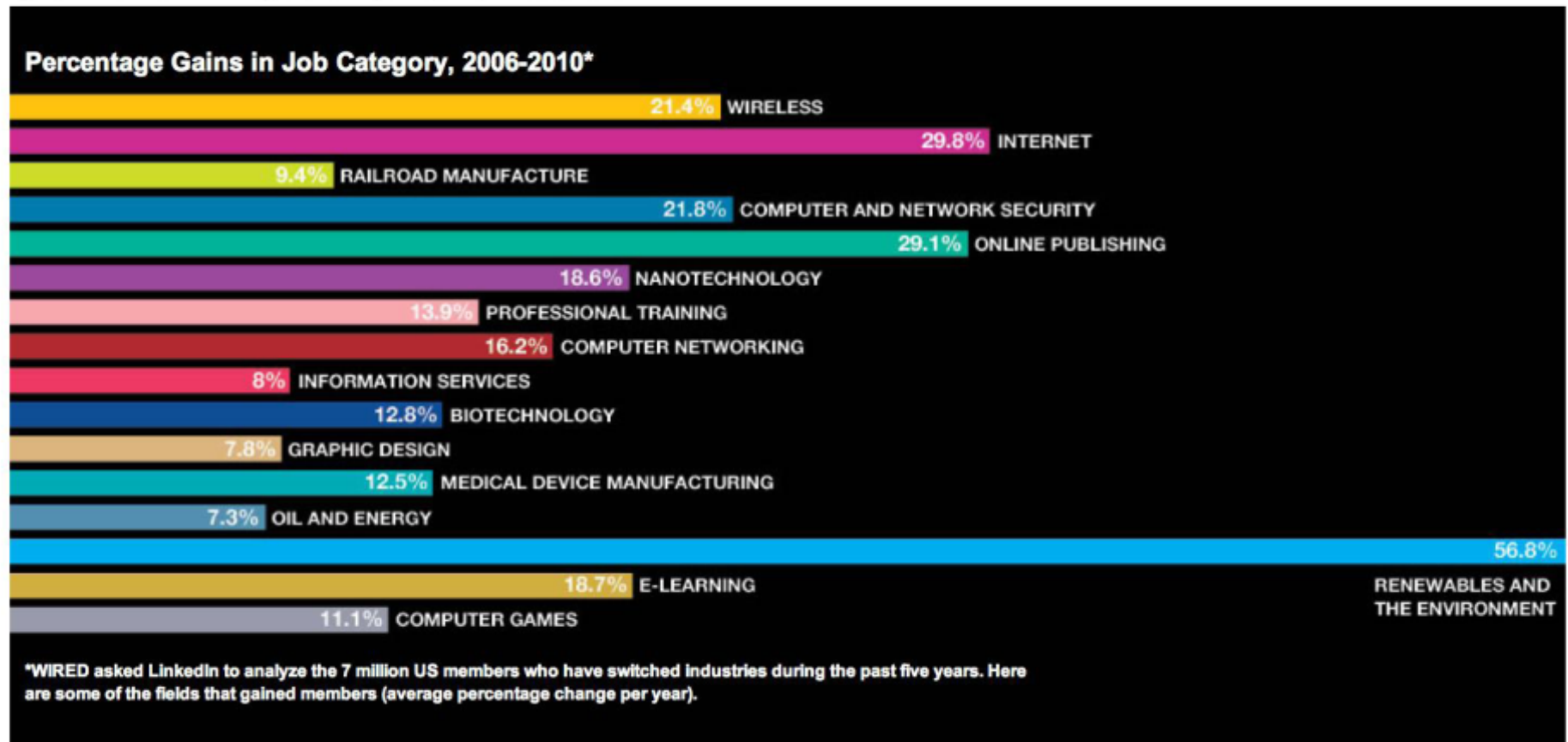
The future ain't what it used to be"! (Yogi Berra).



Job Growth

The Economic Rebound: It Isn't What You Think

By Adam Davidson [✉](#) May 31, 2011 | 3:56 pm | [Wired June 2011](#)



Wage Growth

10 Industries with the Fastest Wage Growth Forecast

Industries	Total 2011 Wages (\$ billion)	Wage Growth 2011-2016 (%)
Sustainable Building Material Manufacturing	8.295	22.7
VoIP	1.510	16.3
Remodeling	13.571	15.0
Home Builders	66.426	14.9
Investment Banking & Securities Dealing	20.895	14.1
Commercial Building Construction	87.436	12.1
Correctional Facilities	10.668	8.7
Remediation & Environmental Cleanup Services	5.270	7.9
Environmental Consulting	9.295	7.6
Generic Pharmaceutical Manufacturing	5.617	7.4

SOURCE: WWW.IBISWORLD.COM

Jobs and GDP Projections for Nano-enabled Products (all types of nanomaterials)

Year	Direct Jobs		GDP (Final Product Value)	
	United States	World	United States	World
2000	25,000	60,000	\$13 billion	\$30 billion
2008	150,000	400,000	\$ 80 billion	\$200 billion
2015	800,000	2,000,000	\$ 400 billion	\$ 1 trillion
2020	2,000,000	6,000,000	\$ 1 trillion	\$ 3 trillion

Source: National Nanotech Institute and NSF

Traditional



Who'd have thought that a natural fiber could help fight diabetes? Well actually, we did.

You gotta love nature. Example: Cellulose fiber, the most abundant, renewable carbohydrate found in nature, can be used to help prevent diabetes. Dow METHOCEL™ dietary fiber is made from natural cellulose. In tests, Dow scientists and the USDA found that adding a few grams of METHOCEL™ to a high-fat diet slowed fat absorption, potentially reducing the development of insulin resistance – a precursor to Type II diabetes. The availability of METHOCEL™ in the foods we buy will make it easy to get the fiber we need. Cutting our fat and sugar intake wouldn't hurt either. See how Dow is using the right chemistry to help protect our health at dow.com.

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- Lifestyle
- Communication
- Transportation
- Building



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Summary

- ▶ We must continue to serve the needs of the current industry, while adopting for the new biomaterials that will be developed.
- ▶ Successful Biomaterial programs need to be relevant to students, industry, research providers, faculty, and serve society.
- ▶ The program at Virginia Tech will continue to evolve as the needs of the industry and society change.
- ▶ Having qualified students require that we are relevant to meet the needs of the job market.