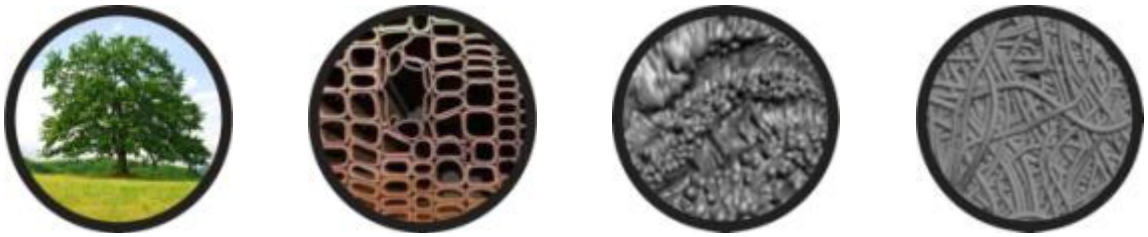
TAPPI
people resources solutions

Access to Knowledge, Access to Networks.



TAPPI: Supporting the Development of Standards for Cellulose Nanomaterials

Colleen Walker, Ph.D.
TAPPI

World Nieh, Ph.D.
U.S. Forest Service

December 5, 2013

Today's Presentation

- TAPPI – who we are
- TAPPI Standards
- Nature's Nanomaterial
- Progress to date on developing standards

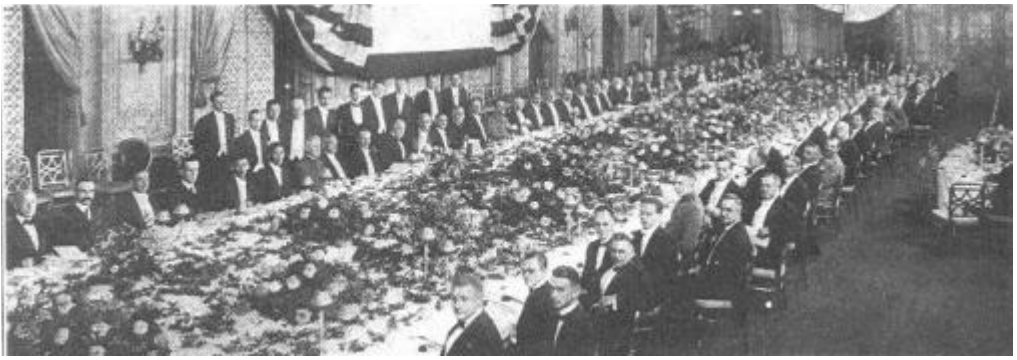
An International Association

- TAPPI members are engineers, scientists, researchers, academics and management professionals in the pulp, paper, packaging, tissue, and allied industries.
- Established in 1915, TAPPI has over 7,000 members from 66 countries
- Headquartered in Peachtree Corners, Georgia

A Foundation in Standards Development

ANSI-NSP 189-2013

- Developing standards for nearly 100 years
- Recognized and used every day around the world
- Standards are developed by international consensus



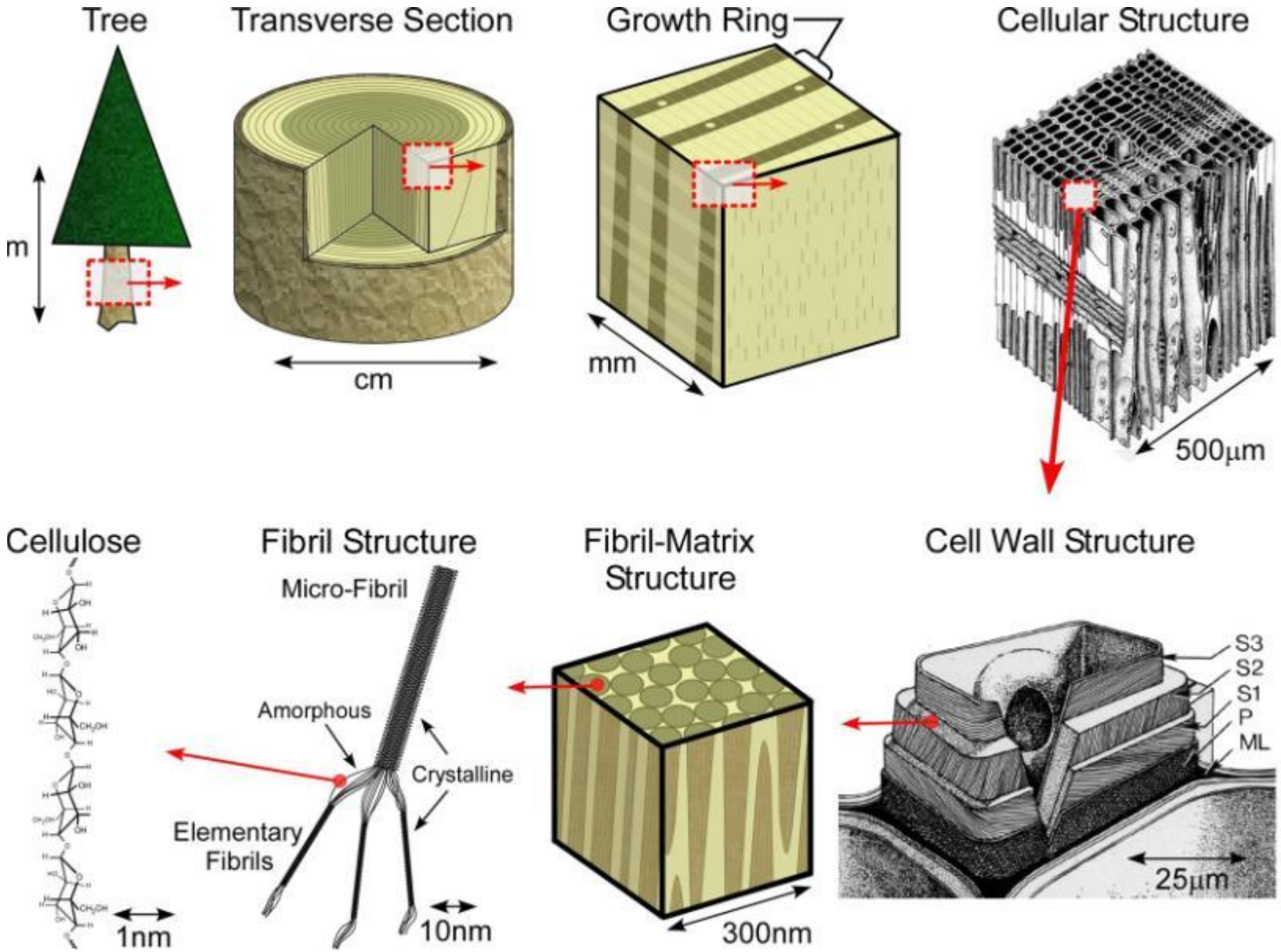
- TAPPI has 240 Standards & 300 Technical Information Papers (TIPs)
  - Raw material and fiber properties
  - Properties of pulp and paper – brightness, strength
  - Properties of coated papers
  - Corrugated boxes and their production
  - Nonwoven materials
  - Standards on safe practices
  - Training standards

Collaboration

- TAPPI is an ANSI-accredited Standards Development Organization
- To date, 78 TAPPI Standards have been approved as American National Standards

- TAPPI has been the ISO TAG (Technical Advisory Group) administrator for TC-6 Pulp, Paper, and Board since 2002.
- TAPPI is a member of the ISO TC 229 TAG

Nature's Nanomaterial: Cellulose



Properties of Cellulose Nanomaterials

- Birefringent & Liquid Crystallinity – can be used to produce color films without pigments
- High Elastic Modulus – as stiff as steel
- High Tensile Strength – 10X stronger than steel
- Low Thermal Expansion – 100x lower than steel
- Transparent – produce films with 80-90% transparency
- Barrier Properties – control of oxygen transfer
- Highly Biodegradable

Cliff Haven Church Blog

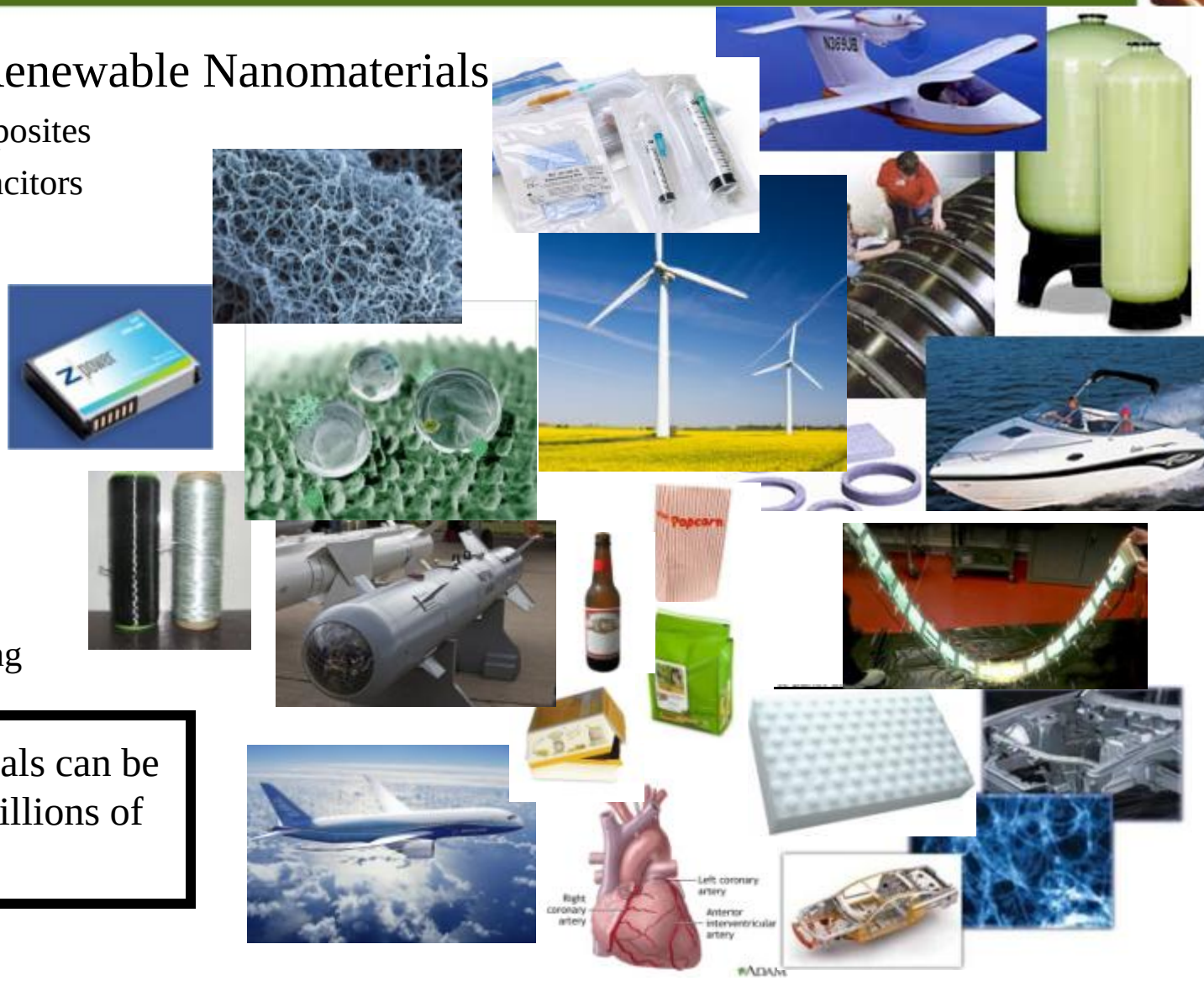
TAPPI
people resources solutions

ANSI-NSP 089-2013

Cellulose Nanomaterials

Opportunities For Renewable Nanomaterials

- Light Weight Nano Composites
- Batteries and Super-Capacitors
- High Efficiency Filters
- Reinforced Polymers
- Bio Plastics
- Nano Coatings
- Sensors
- Flexible Displays
- Photonic Devices
- Nano Membranes
- Multifunctional Packaging



Cellulose Nanomaterials can be produced in tens of millions of ton quantities

Progress to Date

- Held International Workshop in June 2011
  - Canada, U.S., Finland, France, Japan, Brazil, Norway, Switzerland, UK, and Sweden represented
  - Developed "The Roadmap for the Development of International Standards for Nanocellulose"
- Launched a TAPPI Committee: International Nanotechnology Standards Coordination Committee (INSCC)
  - Manages Roadmap updates
  - Facilitates communication among different standards-developing organizations around the world
  - Hosts an annual workshop at the TAPPI International Conference on Renewable Nanomaterials

ANSI-NSP 089-2013

Terminology Standard

TAPPI WI-3021 "Standard terms and their definitions for cellulose nanomaterial"

Lead: World Nieh, U.S. Forest Service

SSIG: ~ 60 members, 12 countries

- Terms structured according to core terms within ISO TC 229:
  - Nanoscale, nanomaterial, nano-object, nanostructure, nanostructured material, nanofiber
- Cellulose nanomaterials terms:
  - Cellulose nanomaterial, cellulose nano-object, cellulose nanostructured material, cellulose nanofiber, cellulose nanocrystal, cellulose nanofibril

Standard currently out for ballot

EH&S Standards

Environmental, Health and Safety Standards Working Group

Lead: Jo Anne Shatkin, Vireo Advisors

Team: ~ 20 members, 5 countries

- Have compiled existing relevant standards, guidelines and methods (over 150), and narrowed to 30 most relevant
- Identified the highest priority to be measuring cellulose nanomaterials in the air in the workplace:
  - sample preparation, instrumentation, measurement metrics, quality assessment, and reporting.

Next Steps

- Compile and review occupational exposure measurement sample preparation standards and test methods

Thank you!

Learn more:

www.tappinano.org

Colleen Walker

cwalker@tappi.org

World Nieh

wnieh@fs.fed.us