Road to the Future

National Science Foundation
United States Department of Agriculture
American Forest and Paper Organization

Sponsored Workshop

Defining the Opportunities, Challenges, and Research Needs for NanoBiomaterials Derived from Lignocellulosics
**Workshop Program Objectives:** This workshop is directed at developing a roadmap for new structural and non-structural opportunities for using nanoscale lignocellulosic-derived biomaterials. The workshop will:

1. Examine how recent advances in nanoscience and engineering can be employed or adapted to lignocellulosics
2. Identify new and important opportunities for nanoscale lignocellulosics as structural and nonstructural materials
3. Identify fundamental research and development challenges, knowledge gaps, and research needs related to:
   a. Capturing identified opportunities for nanoscale lignocellulosics as structural and nonstructural materials
   b. Designing efficient lignocellulosic extraction and utilization technologies for nanostructured materials
   c. Developing controlled assembly methodologies for nano lignocellulosics structures and their interactions with other nanosystems.

Lignocellulose in woody plants is one of nature’s most abundant materials and wood-based lignocellulose at the macroscale level is one of our most used and ubiquitous materials. However, to-date, the intrinsic self-assembling nanoscale structure of wood lignocellulose as well as the versatility of its three key biopolymers: cellulose, hemicellulose, and lignin have been largely overlooked in nanoscience and engineering. This workshop will address this oversight and provide a research pathway by which these lignocellulosic biopolymers will become the cornerstone of innovative structural and nonstructural nanoscale biomaterials that will contribute to the next generation of nanobiocomposite materials based on nature’s preeminent renewable and sustainable resource.
**Workshop Itinerary:**

**Thursday, September 22, 2005 at IPST@GT**

7:30 – 8:30 am  Program coordination meeting for Working Group Chairs and Co-Chairs *(IPST@GT Rm 177)*

8:00 – 8:45 am  Morning Registration/Continental Breakfast/ Set-up Posters *(IPST@GT Members Lounge (first floor))*
Welcome -- Dr. Jorn Larsen-Basse, NSF

8:45 - 9:00 am  Professor/Vice Provost C. Liotta   Welcoming Comments *(IPST@GT Seminar Room-first floor)*
Dr. Art J. Ragauskas   Opening Remarks
Dr. Jorn Larsen-Basse   Workshop Outcomes and Deliverables

Key Note Speaker: Richard W. Siegel, Ph.D.
Robert W. Hunt Professor, Materials Science and Engineering
Director, Rensselaer Nanotechnology Center, Rensselaer Polytechnic Institute

Cross Roads of Nanotechnology and Biotechnology Sustainability and Research Needs for 2050 With a World Population of 9 Billion.

Abstract: Great strides are being made worldwide in our ability to assemble nanoscale building blocks to create advanced hierarchical materials and devices with novel properties and functionalities. This rapidly growing effort has been enriched and accelerated over the past several years by the confluence of interest in matter at the nanoscale in physics, chemistry, and biology and by research funding from the U.S. National Nanotechnology Initiative and similar national and international efforts around the world. A perspective on the intersection of nanotechnology and biotechnology and its implications for research and society in the coming years will be presented based upon specific examples from our work in our NSF-NSEC at Rensselaer. Several examples from recent research results will be presented including investigations of functional nanoscale materials that could find commercial use in a variety of structural, electrical, environmental, and biomedical applications. The opportunities and challenges facing the worldwide nanotechnology and biotechnology research communities in moving forward in a sustainable world with a growing population will be considered.

Program Speakers and Round Table Discussion

- Lori A. Perine Executive Director Agenda 2020 Technology Alliance, American Forest and Paper Association
  - Forest Products Industry Needs, Challenges, and Opportunities
Professor Alaine Dufresne, EFPG-INPG, Cedex, France
• Research Challenges in NanoLignocellosic Chemistry and Engineering

Professor Robert Pelton, Depart. of Chemical Engineering, McMaster University, Hamilton, Ontario, Canada
• Challenges of Integrating Nanotechnology with Biotechnology

Professor Kristiina Oksman, Dept. of Engineering Design and Materials Norwegian University of Science and Technology, Trondheim, Norway
• Cellulose Nanocomposites, Challenges to Overcome

Professor Paul Gatenholm, Department of Materials and Surface Chemistry, Chalmers University of Technology, Göteborg, Sweden
• Engineering of cellulosic fibers with xylan nanoparticles

12:00 – 2:00 Lunch (IPST@GT Members Lounge: First Floor)

Professor/Director IPST@GT J. Frederick Welcome Comments
Dr. Jorn Larsen-Basse: Overview of NSF’s role in Supporting Nanotechnology in the Nation

Poster Session & Working Groups Assignments

Workshop Working Groups

Group 1: Novel Isolation/Directed Production of Nano-lignocellulosic Structures
Group 2: Engineering Functionalized Nano-lignocellulosics
Group 3: Structure and Design of Nano-lignocellulosic materials
Group 4: Education - Environmental Challenges and Opportunities
Group 5: Metrology for Lignocellulosics

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Note: All Chairs and Co-Chairs are asked to attend a pre-conference meeting the first morning of the workshop from 7:30 -8:30 to review our role as Chair and co-Chairs. There is also planned a brief post conference to wrap-up and review workshop issue
2:00 – 5:30  Breakout Sessions
    -  Working Groups retreat to address program assignments

5:30 – 6:30  Report of Working Groups *(IPST@GT Auditorium)*

6:30  Reception  *(IPST@GT Members Lounge: First Floor)*

7:00  Dinner

7:30  Dinner Speaker: Richard Murphy, Department of Biological Sciences
      Imperial College London, London, England
      Sustainability and its Role in Nanotechnology - Forest Products Industry
      *(IPST@GT Members Lounge: First Floor)*

Friday, September 23, 2005 at IPST@GT
8:00 – 8:45 am  Continental Breakfast *(IPST@GT Members Lounge: First Floor)*

8:45 – 9:00  Workshop Status: Drs. Rials; Ashurst, Cullinan; Wegner *(IPST Auditorium)*

9:00 – 12:00  Work Group retreat to breakout sessions *(IPST@GT Rms 272, 316, 472, 572)*

12:00 – 1:00  Lunch *(IPST@GT Members Lounge: First Floor)*

1:00 – 1:40  Speaker: Mark E. Meaney, Director and Associate Professor Department of Health
             Care Ethics, Executive Director, Center of Health Care Ethics and Emerging
             Technologies, Rueckert-Hartman School for Health Professions, Regis University
             Presentation: Nanotechnology: International Opportunities in
             Education, Safety and Environment *(IPST@GT Auditorium)*

1:45 – 3:00  Work Group Sessions *(IPST@GT Rms 272, 316, 472, 572)*

3:00 – 4:00  Report from Working Groups *(IPST@GT Auditorium)*

    Workshop Summary and Program Conclusions *(IPST@GT Auditorium)*

4:00 -  Program Review by Working Group Chairs
       and Co-Chairs *(IPST@GT President’s Conference Rm)*
Working Group Assignments

Each working group for the proposed workshop will be guided by a chair and co-chair and they will be directed to address the following program topics:

I. IDENTIFY KEY OPPORTUNITIES/APPLICATIONS OF NANOTECHNOLOGY IN ASSIGNED TOPIC AREA

Session Purpose: Identify unique synergies of nano and wood science. What are the primary opportunities and benefits to society? How could nanotechnology fundamentally change the “new” forest products industry (FPI) to manufacture nanostructured products, including novel biomaterials, functional smart nanobiostructures?

   How can nanotechnology change the wood-based products that are produced?
   How can it change manufacturing processes in the FPI?
   What are the fundamental concepts for manufacturing forest products on the nanoscale? How can it enhance productivity, save energy, improve environmental performance, improve sustainability, and benefit national competitiveness and rural economies?
   What are the engineering/manufacturing challenges?
   What are the public benefits of government support for R&D in this area?

II. GOAL STATEMENT & SUPPORTING OBJECTIVES FOR TECHNOLOGY AREA

Session Purpose: Goal Statement:
   Objective: Imagine that the goal has been successfully completed: What will you need to have done to achieve this goal?

III. IDENTIFY BARRIERS

Session Purpose: Identify problems – that is, to identify the barriers/ challenges to achieving the goals.

IV. R&D AND RELATED NEEDS

Session Purpose: Identify solutions and technical roadmap needed.

V. LINKAGES AND IMPLEMENTATION: “TOP-5 ANALYSIS”

Session Purpose: Develop additional detail on the top-priority R&D needs to help justify and focus research/educational path forward.
Workshop Outcome

The final report will provide a multidisciplinary national/international vision of the challenges, opportunities, and benefits of separating and synthesizing novel cellulose, lignin, and hemicellulosic nanoscale materials as designed by the program participants.

The final report will contain the follow sections:

1. Statement of Workshop Purpose
2. Introduction
3. Motivation and General Background
4. Research Enablers
5. Fundamental Research Challenges and Opportunities
6. Research Recommendations
7. Education Recommendations
8. Conclusions
9. Acknowledgments
10. Supporting Information

Conclusion

The workshop will establish the fundamental research and educational needs for the conversion of wood derived biopolymers into unique nanomaterials. The final report will become the roadmap for the next revolution in the development innovative nanobiomaterials derived from nature’s preeminent natural resource and yielding sustainable, environmental friendly nanomaterials that exhibit exceptional performance properties while contributing to economic and societal development.
Speaker’s Bio:

Robert W. Hunt Professor, Materials Science and Engineering and Director, Rensselaer Nanotechnology Center, Rensselaer Polytechnic Institute. E-mail: rwsiegel@rpi.edu; Website: http://www.rpi.edu/

Dr. Siegel is the Robert W. Hunt Professor of Materials Science and Engineering and founding Director of the Nanotechnology Center at Rensselaer Polytechnic Institute. He is also Director of the National Science Foundation Nanoscale Science and Engineering Center for Directed Assembly of Nanostructures.

He was graduated from Williams College in 1958 with an AB degree in physics and received an MS degree in physics in 1960 and a PhD degree in metallurgy in 1965 from the University of Illinois in Urbana. After two years of post-doctoral materials research at Cornell University, Dr. Siegel served from 1966 to 1976 on the faculty of the State University of New York at Stony Brook in the Department of Materials Science. He was a research scientist in the Materials Science Division at Argonne National Laboratory from 1974 to 1995, serving for most of that time as group leader in the areas of metal physics and defects in metals and as a research program manager.

Dr. Siegel has been a visiting professor in Germany, Israel, India, Switzerland and Japan and has been active in local, national, and international professional organizations. He is currently a member of the Nanotechnology Technical Advisory Group of the US President’s Council of Advisors on Science and Technology. Dr. Siegel chaired the World Technology Evaluation Center worldwide study on nanostructure science and technology during 1996-98 that led to the US National Nanotechnology Initiative in 2001. He was also past chairman (1992-96) of the International Committee on Nanostructured Materials.

Dr. Siegel has authored more than 230 publications and several patents (9 issued, 8 pending) in the areas of defects in metals, diffusion, and nanostructured metal, ceramic, composite, and biomaterials. He has presented more than 430 invited lectures around the world and edited ten books on these subjects. He is a founder and Director of Nanophase Technologies Corporation, and was recognized for this effort by a 1991 US Federal Laboratory Consortium Award for Excellence in Technology Transfer. Dr. Siegel is an Honorary Member of the Materials Research Societies of India and Japan, and a 1994 recipient of an Alexander von Humboldt Foundation Senior Research Award in Germany. In 2001, he was named a RIKEN Eminent Scientist in Japan. Dr. Siegel also received a 2003 Deutsche Bank Prize “Pioneer of Nanotechnology – Nanomaterials” in Germany.
Lori A. Perine
Executive Director
Agenda 2020 Technology Alliance
Forest Products Industry Technology Alliance

Lori A. Perine was named Executive Director of the forest products industry’s technology alliance, Agenda 2020, in September 2004. She ensures strategy development and operations of the Alliance, which defines the industry’s technology vision and establishes partnerships to execute related collaborative research, development and deployment.

Perine is a long-time champion for technological innovation, global competitiveness, and math and science education. A former Deputy Associate Director for Technology at the White House Office of Science and Technology Policy, she was instrumental in advancing R&D programs and partnerships in energy efficient transportation and housing technology, applications of information technology to advanced manufacturing, and pre-competitive technology development. She successfully collaborated with industry, academia, and Congress to gain support for federal R&D initiatives, and worked closely with the President’s Information Technology Advisory Committee and the President’s Committee of Advisors on Science and Technology.

Upon leaving the White House, Perine was President and CEO of a private consulting firm, applying her expertise internationally to forge strategic partnerships and identify opportunities for technological innovation. She assisted the Electronic Industry Alliance in developing its policy strategy on offshore outsourcing and innovation, and created a roadmap of international priorities for the National Science Foundation’s initiative to deploy an enhanced cyberinfrastructure for science and engineering research and education. Perine also advised APEC-TEL on public-private collaboration for technology and analyzed public-private sector roles in innovation for Russian business and government leaders. Other engagements have included assisting the formation of a private equity fund investing in innovation to re-engineer mid-market companies and overseeing the development of e-government technology prototypes by an international industry consortium.

Deployment of innovative technologies has been consistent theme in Perine's professional career, which initially focused on international energy efficiency, planning and management. She has served as a World Bank energy program manager and a management consultant to deploy new technology in the petrochemical industry. As an economist at the National Institute of Standards and Technology advancing to the position of Senior Policy Advisor for Technology to the U.S. Secretary of Commerce, she was responsible for promoting advanced research and adoption of technology to achieve economic growth and broad societal benefits.

Ms. Perine undertook doctoral studies at the Wharton School, received an M.S. in Energy Management and Policy from the University of Pennsylvania and was graduated magna cum laude from Bryn Mawr College with an A.B. degree in Mathematics. She studied Applied Mathematics at the École Polytechnique Fédérale de Lausanne in Switzerland, under the auspices of the IIE/Fulbright-Hays Program. She is asked regularly to serve on the governing bodies of local civic, arts and business organizations. Current affiliations include the board of the City Club of Washington and the Diocesan Council of the Episcopal Diocese of Washington. Perine has been recognized as one of the 50 Most Important African Americans in Technology and honored as a National Role Model for minorities in science and technology.
Name: Alain DUFRESNE
Citizenship: French
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         Institut National Polytechnique de Grenoble
         BP 65, Domaine universitaire, 38402 Saint Martin d'Hères cedex, France
Tel.: 00-33-4-76-82-69-95
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E-mail: Alain.Dufresne@efpg.inpg.fr

MAIN FIELD OF RESEARCH – SPECIALTY
Processing and characterization of heterogeneous polymer systems

ACADEMIC AND PROFESSIONAL CAREER:
1986-87 Master in Solid State Physics
         Paul Sabatier University, Toulouse, France
1987-88 Master in Chemical Engineering
         Polytechnic Institute, Montreal, Canada
1988-91 PhD Thesis in Electronic
         National Institute of Applied Sciences, Toulouse, France
         Title : A Study of the Interface/Interphase in DGEBA-DDA/Glass Beads Model
         Composites by Thermostimulated Creep
1991-92 Post-Doc Position
         Polytechnic Institute, Montreal, Canada
1992-93 Assistant Professor
         National Institute of Applied Sciences, Lyon, France
1993-2001 Assistant Professor
         Joseph Fourier University, Grenoble, France
1997 Priv. Dz. Habilitation in Research
         Joseph Fourier University, Grenoble, France
2001-2003 Professor
         Joseph Fourier University, Grenoble, France
Since 2003 Professor
         National Polytechnic Institute, Grenoble, France

PUBLICATIONS
Publications: 76
Book chapters: 06
Patents 02
Communications 110
Name: Anne Kristiina Oksman

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Phone (mobile): +47 91 89 73 22
Phone (work): +47 73 59 38 26
E-mail: kristiina.oksman@ntnu.no

Education

- MSc Mechanical Engineering, Luleå University of Technology, Sweden 1991
- PhD, “Improved Properties of Thermoplastic Wood Flour Composites”, Luleå University of Technology, Sweden 1997

Employments

- Professor at Norwegian University of Science and Technology, Department of Engineering Design and Materials, Trondheim, Norway, 2002-present
- Researcher and project manager at SICOMP, Piteå, Sweden, 1997-2002
- Post graduate student at Luleå University of Technology, Division of Wood Technology, Skellefteå, Sweden, 1992-97
- Visiting scientist at the Forest Products Laboratory, Madison, USA, 3 months, 1996
- Teacher in Material Science at Studiecentrum, Skellefteå, Sweden, 1994-95
- Assistant researcher, University of Oulu in Finland, 6 months, 1991
- Research engineering, Luleå University of Technology, Material Science, Luleå, Sweden, 1990
- Summer employment at paper manufacturing industry, Assi Kraftliner, Piteå, Sweden, 1989
- Summer employment at car painting company, Br Jussis Autolack, Luleå, Sweden, 1988
- Summer employment at paper manufacturing industry, Fiskeby AB, Mariestad, Sweden, 1985-1986
- Boat building at Mölnlycke Marin (Maxi boats), Lugnäs, Sweden, 1979-1981
- Assembling refrigerators and freezers at Electrolux AB, Mariestad, Sweden, 1976-1977

Kristiina Oksman has been active in natural fiber composites work for 13 years, working on mechanical properties, characterization and processing of natural fiber composites. Currently K. Oksman has 5 PhD students on the field natural fiber and bionanocomposites. She has more than 40 papers and conference proceedings contributions in the field of natural fiber composites and she has been active in organizing conferences nationally and internationally. She has experience in project leading in national and Nordic projects.

Professional Roles

Session Chairman:
8th International Conference of WoodFiber-Plastic Composites, Session 4B: Nanocomposites, May 23-25, 2005 Madison, Wisconsin, USA.

ACS National Meeting, Division of Cellulose and Renewable Materials, Symposium on Cellulose based Nanocomposites, 16-17 March, 2005, San Diego, USA.

Progress in WoodFibre-Plastic Composites, May 10-11, 2004, Toronto, Canada
7th International Conference of WoodFiber-Plastic Composites, May 19-20, 2003, Madison, Wisconsin, USA.

EcoComp-2001, An International Conference on Eco-Composites, 3-4 September 2001, Queen Mary, University of London, UK.


Fifth International Conference on Fronties of Polymers and Advanced Materials and NATO Advanced Research Workshop Polymers and Composites for Special Applications, June 21-25, 1999, Poznan, Poland.


Committee of experts:


Board member:

The Foundation for Scientific and Industrial Research at the Norwegian Institute of Technology (SINTEF) Materials and Chemistry, Strategic area of Materials, Norwegian University of Science and Technology (NTNU), Tresenter, Norway.
Robert Pelton - Curriculum Vitae
McMaster Centre for Pulp and Paper Research
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Professor:  Department of Chemical Engineering,
Canada Research Chair in Interfacial Technologies
Founding Director of McMaster Centre for Pulp and Paper Research,
Scientific Director SENTINEL – The Canadian Network for the Development and Use of Bioactive Paper
Associate Faculty Member of Chemistry Department.
Consultant A number of industrial and legal clients
Member Scientific Advisory Board, ECOSYNTHEITIX Inc.
Member Fundamental Research Committee of the Pulp and Paper Fundamental Research Society

TAPPI Fellow
Winner, Synergy Award 1996, for best collaborations with industry (Dorset)

Pelton directs one of the world’s leading academic group investigating polymer applications in paper technology

Some Technological Achievements
1.  Invented poly(N-isopropylacrylamide) Microgels
I was the first to prepare poly(N-isopropylacrylamide) microgels which are uniform colloidal suspensions of particles whose water content is a sensitive function of temperature (Colloids and Surfaces, 20, 247-256 (1986)). At least ten international research groups are working with poly(N-isopropylacrylamide) microgels, and a French drug company has developed medical diagnostic tests using these materials as supports. My review of this technology[Adv. Colloid Interface Sci., 2000, 1-33] has become my most cited paper (63 in 2 ½ years).

2.  A New Theory Predicting the Effects of Fillers on Paper Strength
I developed a new theory which predicts the influence of filler size and shape on the mechanical properties of paper (Li, Collis and Pelton, 2003). An innovative delamination technique was used to verify the theory. We were awarded the Jasper Mardon Memorial Prize for the best papermaking paper in 2002.

3.  Polymer Enhanced Brownstock Washing
This patented technology, conceived by me and implemented by Pei Li, a PDF, has been demonstrated in mill trials and described in the literature. Fundamental work by Hrymak, Lappan and De has confirmed the postulated mechanisms and produced quantitative mathematical models which have been validated by experiments. This work has been well received at conferences in Sweden, the US and Canada. Dorset Industrial Chemicals has been successfully marketing a product based on this work since 1991. A Synergy Award was received for this work.

4.  Demonstrated the Role of Polymer Compatibility in Fiber/fiber Bonding in Paper
Paper is remarkably strong because of the strong bonds which form between overlapping cellulose fibres. The traditional paper physics literature has almost entirely focused on the role of hydrogen bonding. In 1993 (Nordic Pulp and Paper Res. J., 1, 113-119) I postulated that considering fibre bond formation in terms of hydrogel adhesion and polymer compatibility was a more useful approach. These ideas were confirmed by Jin Zhang [115], my Ph.D. student funded by SCA, a Scandinavian paper company interested in our ideas. Considering fibre/fibre bonding as problem in polymer compatibility is a new paradigm with significant implications for the properties of paper strength enhancing polymers – we are currently pursuing these opportunities.

5. The First Quantitative Measurement of Floc Strength
The mechanical properties of aggregated colloids (called flocs) are important for many technologies including water treatment and papermaking. Because flocs are usually smaller than 50 micrometers, traditional mechanical strength measurements cannot be applied. Yeung and I developed a micromechanical approach [J. Colloid Interface Sci., 184, 579(1996)] for the first ever direct measurement of floc strength. Our initial papers [82, 95, 100,101, 106] have been widely cited by others and our technique has been copied.

Education:
Ph.D. Bristol University  Colloid Chemistry  1974-1976
M.Sc. U. of Guelph   Chemistry  1971

Employment History:
1990-present  Professor, McMaster University
1987-1990  Associate Professor,  McMaster University
1984-1987  Research Scientist  Union Carbide, Tarrytown N.Y.
1978-1984  Research Scientist,  PAPRICAN, Montreal
1977-1978  NSERC Industrial Post-doctoral Fellow, PAPRICAN
1972-1974  Research Scientist,  Uniroyal, Guelph

Consulting:  More than 30 chemical, paper companies and legal firms in the areas of papermaking chemicals, hydrogels, specialty polymers, consumer products, and surface science. Current Projects and Industrial Support - See http://www.papersci.mcmaster.ca

Professional Activities:
- Co-chairman, International Paper Chemistry and Coating Conference, Montreal June 2003
- Journal refereeing: more than 30 articles per year in polymer, colloid, and pulp and paper journals.
- External grant reviews - NSERC (Canada), NSF, UK and Australia.
- Lecturer in industrial short courses sponsored by PIRA, MIPPT, PAPTAC, APPITA and Tappi.

Memberships in Professional Organizations:
Paul Gatenholm  
Professor, Department of Materials and Surface Chemistry  
Chalmers University of Technology  
SE 41296 Göteborg, Sweden  
Phone: (4631) 772-3407; Fax: (4631) 772-3418  
Email: pg@pol.chalmers.se

A. PROFESSIONAL PREPARATION

Undergraduate Education
University of Stockholm (1976-1979) Chemistry B.S. 1979

Graduate Education
Chalmers University of Technology (1981-1985) Polymer Technology Ph.D. 1985

Post-doctoral Institutions 1
University of New South Wales, Sydney, Australia 1986-1987

Post-doctoral Institutions 2
Center for Bioengineering, University of Washington, Seattle 1991-1992

B. APPOINTMENTS
Virginia Polytechnic Institute and State University, Blacksburg, VA
Research Scientist, Department of Chemistry, 1997-present
Adjunct Professor, Department of Wood Science and Forst Products, 1997-present
Chalmers University of Technology, SE41296 Göteborg, Sweden
Professor, Biopolymer Technology, 2000-present

C. PUBLICATIONS AND Patents: +100

Relevant Publications
3. “Surface Properties of CTMP Fibers Modified with Xylans” Henriksson, Å. and Gatenholm P., Cellulose 2002 9, 55-64.

D. SYNERGISTIC ACTIVITIES
• Chair of Gordon Conference, The Chemistry of Polysaccharides
• Program Chair, The ACS Division Cellulose and Renewable Materials
• Editor of Book “Hemicelluloses; Science and Technology”, ACS Symposium Series
Richard Murphy is a Senior Lecturer in the Division of Biology at Imperial College London. He has a BSc (Hons.) degree in Botany with Zoology from King's College, London in 1978 and a PhD in Plant Science from Imperial College London in 1982. He has been a Research Fellow at the University of Canterbury, New Zealand, a visiting research scientist at the Forest Research Institute (now Forest Research) in Rotorua, NZ and a postdoctoral research associate at Imperial College. He has also worked at the TNO in The Netherlands.

His research background is in wood and plant utilisation with a special emphasis on the performance of wood durability treatments and the wood decay mechanisms of fungi. A special interest is also on the growth and management of bamboos. Since 1992 his research group has been using Life Cycle Assessment (LCA) on projects ranging from preservative treated wood products, coppice forest systems, coating systems for wood, bamboo construction, agro-fibre products, wood-plastic composites and bio-based packaging. He has authored/co-authored about 90 publications and conference papers.

He has been a President of the Institute of Wood Science (IWSc) in the UK and a past Chairman of the International Research Group on Wood Preservation - Section 4 Processes. He was vice-Chairman of the EC COST action E9 on Life Cycle Assessment of Forests and Forest Products (1997-2001).

Example publications/presentations:-


Mark E. Meaney, Ph.D.: Director and Associate Professor, Department of Health Care Ethics
Executive Director, Center of Health Care Ethics and Emerging Technologies
Rueckert-Hartman School for Health Professions, Regis University
3333 Regis Blvd., G-5, Denver, CO 80220, (303) 964-5110 (w), mmeaney@regis.edu

Mark E. Meaney, Ph.D., is an ethicist, whose work has focused on emerging technologies, human
subjects research, and organizational ethics and corporate sustainability programming. Before joining
Regis University as Director, Department of Health Care Ethics and Executive Director of the Center for
Health Care Ethics and Emerging Technologies, Dr. Meaney served as Vice President of Programs and
Publications at the Midwest Bioethics Center, Kansas City, MO. He has also served as the Director of
the Center for Ethics in Health Care, Atlanta, GA.

Dr. Meaney has taught corporate responsibility and business ethics with the Legal Studies Department at
the Wharton School, University of Pennsylvania. He has held appointments with the Graduate School of
Management, Pennsylvania State University; the College of Health Professionals, Thomas Jefferson
University; and the School of Nursing, Seton Hall University. He held a joint appointment in applied
ethics with the Division of Medical Humanities, University of Arkansas for Medical Sciences, and the
Department of Philosophy and Religious Studies, University of Arkansas at Little Rock.

Currently, Dr. Meaney serves on the Board of Directors of the Colorado Nanotechnology Association
(CNTA), a state sponsored association for the promotion of nanotechnology in Colorado. He is also on
the Executive Committee of the Rocky Mountain Technology Alliance (RMTA), an association
sponsored by Colorado State University, Colorado Springs, to advance tech transfer.

In 2003, Aspen Publishers released his book on ethical issues in corporate compliance, Guide to
Professional Development in Compliance. Kluwer Academic Publishers published his latest work in
2004 on globalization, Capital as Organic Unity.

His consulting experience in organizational ethics and sustainable development covers a wide array of
industries including telecommunications, healthcare, engineering and construction, retail, distributors
and manufacturers, government contractors, transportation services, not-for-profits and government
agencies.

Dr. Meaney developed e-business compliance programming in a strategic partnership with the Internet
Healthcare Coalition. He conducted worldwide ethics and compliance assessments, ethics and corporate
social responsibility audits and related program analyses for both U.S. and non-U.S. based organizations
facing sanctions under the U.S. Federal Sentencing Guidelines. He implemented an integrated
ethics/compliance and sustainable development program for a multinational engineering and
construction company with offices in 50 countries.

Dr. Meaney has developed monitoring procedures for organizations in various industries. The focus of
this work is to identify risks and vulnerabilities with respect to harmful work conditions and other
human rights violations (within the United States and abroad) in accordance with the U.S. Department
of Labor, United Nations and ILO guidelines and standards.

Dr. Meaney has an extensive history in working with senior executives and Boards of public companies
in the design and implementation of corporate governance and sustainability programs as the starting
point for the company’s overall process of ethics, business conduct and compliance. He has developed and implemented ethics and ethical awareness training programs for organizations on a worldwide basis, including the design of interactive technology, desktop learning applications and train-the-trainer programs.

Dr. Meaney has worked with corporate counsel and ethics officers in the implementation of worldwide ethics and sustainability programs, including the design of corporate codes of conduct, downstream communications, ethics training and helpline/hotline management.

While at UAMS/UALR, he served on then-Governor Clinton’s Genetic Advisory Council. His client list includes: AMEC, plc; Tyco International, Inc.; Tyco Electronics, Inc.; Caremark Rx, Inc.; Laidlaw International, Inc.; Schering-Plough, Inc.; Greyhound Bus Lines, Inc.; American Medical Response, Inc.; the City of Philadelphia; EmCare, Inc.; SPIE Batignolles, Inc.; Laidlaw Educational Services, Inc.; the Health Care Compliance Association; the Healthcare Marketing and Communications Council; the Internet Healthcare Coalition; Laidlaw Transit, Inc.; the National Institute on Aging, NIH; the World Economic Forum; and the Stowers Institute.

Dr. Meaney earned his doctoral degree from Marquette University in 1991.