

Sustainable Biomaterials Newsletter

Hello from the Department of Sustainable Biomaterials:

The first week of classes is always exciting on campus. Although we can no longer find a place to park our cars, the students bring their youthful enthusiasm to campus that makes working at a university so special. We are excited about the changes occurring in the department and the next time I write I should be able to officially say we have two new degree programs, Sustainable Biomaterials and Packaging Science. We are only waiting for SCHEV approval and that hopefully will occur this fall. Our student population has grown to over eighty students, with almost forty in our new Packaging Science program. We also have ten new graduate students entering for the fall, which brings our graduate population to over forty students including those that are in the Macromolecular program. We placed just about all of our graduating students last spring, which continues to demonstrate a strong demand for our programs.

Our faculty met this August to plan for the upcoming year. We spent the morning having each faculty member describe their programming efforts, including teaching and research. It always amazes me the breadth of our research program. We have faculty working with cellulose derivatives to make bones heal faster or replace bones, testing new cross laminated beams to open new markets for wood, and trying to improve steel's performance by implanting cellulose nano-tubes. The afternoon session was spent establishing some clear goals to work on for the year. My old business training has me a strong believer in Management by Objectives (MBO).



Department of Sustainable Biomaterials Faculty

In this issue you will learn about “sciencering” from Barry Goodell, we had some great student interns working in our engineering and packaging laboratories for the summer, Professor Emeritus Wolfgang Glasser continues to mentor students across the Atlantic, we had numerous visitors to the Department this summer, and Dr. Henry Quesada is finishing up an international marketing project that recently brought him to China. We have also added something new that will become a regular feature of the newsletter, the highlights of our department's extension program. We are committed to our land grant mission and our extension specialists in the department are leaders in their wood products and biomaterials programs.

We are excited about a new academic year and if you are close to campus, please stop in. If you have any questions regarding anything in the newsletter or about our programs, please feel free to contact me.

Sincerely,

Bob Smith

Department Head

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“Scieneering” Students Complete a Successful Summer of Research



Virginia Tech undergraduate students Beck Giesy (left), and Veronica Kimmerly “forge welding” steel strips to learn more about how carbonized wood fiber might be incorporated into the steel. This portion of the work was performed in the campus’ Kroehling Foundry as part of a summer “Scieneering” experience.

Virginia Tech sponsors a very successful program each year to teach undergraduates more about research in a program known as “Scieneering”. This summer, two high ranking Virginia Tech students, Beck Geisy and Veronica Kimmerly, worked with Professors Barry Goodell, Scott Rennekar (Sustainable Biomaterials Department) in collaboration with Dr. Alan Drushitz (Materials Science and Engineering Department and Director of the VT Kroehling Foundry on campus). Beck and Veronica conducted research on ways to produce carbon nanotubes from wood fiber and attempted to incorporate carbonized wood fiber into steel. They had some great success in getting carbonized wood fiber to persist at temperatures up to 850 degrees centigrade. Further they have clear evidence that some of the carbon from the wood was incorporated into the steel. More work will be needed before carbon nanotubes are actually produced in the steel but the two undergraduate students learned a lot, and they helped to make the summer a productive education and research time in the SBIO department.

Visit by Verso Paper Corp. Manager, Dr. Sean Ireland

Dr. Sean Ireland, Manager, New Technologies and Market Ventures. Verso Paper Corp. visited with SBIO faculty and student members at Virginia Tech on August 14 and 15, 2013.

Ireland spoke about the development of new products, and in particular, products containing nanocellulose and new applications of these materials. Faculty members presented their research which ranged from topics on the production of nanocellulose for use in medical scaffolds to the use of lignin residues as a feedstock for green biopolymer production. Ireland also toured the Cheatham Hall and Brooks Laboratory, Packaging Systems and Design facilities, as well as the ICTAS facilities on campus for nano characterization and fabrication.

SURF Scholar Studies CLTs



Catherine Jucha, a sophomore entering the Sustainable Biomaterials program this fall, participated in the SURF (Student Undergraduate Research Fellowship) activity this summer through the Fralin Life Science Institute. Catherine worked in the Wood Engineering laboratory investigating the mechanical properties of cross-laminated timber (CLTs), in particular the rolling shear of the cross-ply. Catherine presented a poster and talk entitled “Mechanical Properties of Cross-Laminated Timbers”. Catherine presented her results on August 3, 2012 at the Inn At Virginia Tech. Drs. Hindman and Bouldin served as mentors.

SBIO Grad Cole Burch ('13) Wins in Vegas

Recent Wood Science/Sustainable Biomaterials graduate Cole Burch took home second place honors in the national Association of Woodworking and Furnishings Suppliers (AWFS) 2013 Fresh Wood Student Competition in Las Vegas. Cole's entry, a hand-crafted Shaker blanket chest, was the final result of an independent study project. This project involved research about the design, quality, and construction aspects of Shaker furniture and an analysis of the similarities and differences of materials, tools, and methods available today vs. those originally used.

Cole used his research from literature, magazines, and observation to test both modern manufacturing methods as well as traditional craft methods to determine which would perform best in terms of function, quality, and aesthetics observed during the Shaker period. Ultimately, a balance of both modern and traditional methods were combined to complete the winning blanket chest. For Cole to achieve the distinguishing “custom” look of the chest required hand cutting of the dovetail construction. “Having never hand-cut dovetails of this magnitude, the four dovetailed corners presented a challenge in both layout and execution. I spent many hours gathering information and then testing methods to make sure high quality cuts could be repeated consistently before making the final corner pieces,” Cole stated.



The winning Shaker blanket chest.

The AWFS 2013 Fresh Wood Student Competition is the largest of its kind, and highlights exemplary design and construction achievements by students. Students must complete a rigorous application process to submit information that concisely documents the project. From this information, Cole was one of 41 finalists selected from over 130 entries to showcase his work in Vegas. His work was reviewed and judged by a panel of internationally acclaimed design and woodworking professionals. While Cole was personally honored by his Fresh Wood Competition win, a surprise honor came later when Thomas MacDonald, host of Rough Cut – Woodworking with Tommy Mac, made an offer to purchase the blanket Chest.

Congratulations Cole!



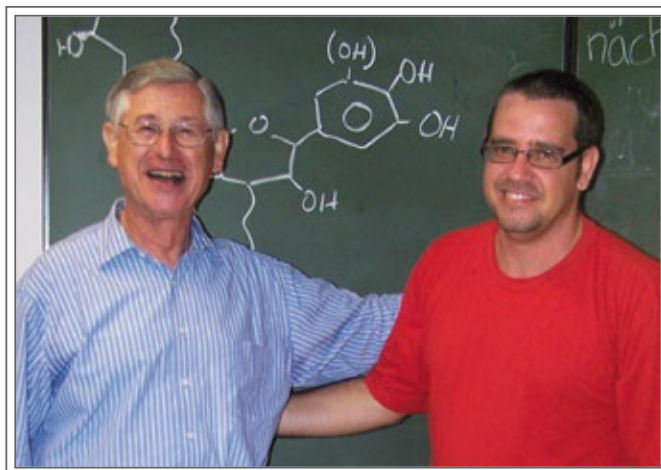
Cole Burch (left) with winning chest and project advisors David Jones (center) and Dr. Earl Kline (right).



Tommy Mac unsuccessfully making an offer to buy Cole's blanket chest.

EP 13168572.9 Filed by University of Freiburg, Germany

The University of Freiburg, Germany, recently filed a (European) patent on **hydroxypropylated condensed tannin derivatives** that is based on work done by PhD-candidate Danny Garcia-Marrero under the supervision of Wolfgang Glasser, Prof. emerit.(2001) of Virginia Tech and Prof. Marie-Pierre Laborie (VT-Wood Science '02 under the supervision of Prof. C. E. Frazier). Prof. Antonio Pizzi (U' Nancy, France) is listed as fourth member of the inventor-team. The novel tannin composition involves the chemical modification of abundant pine bark extracts that helps control the cure properties of tannin in phenolic resins in a predictable manner. The work represents a continuation of many years of research on tannin chemistry (Garcia-Marrero and Pizzi), adhesion science (Laborie) and biopolymer (especially lignin) modification (Glasser). The research project was started when Glasser was visiting Professor at the University of Freiburg in 2012. Garcia-Marrero and Glasser were featured as great-grand father-son team in the latest issue of the CNRE (Spring 2013) College magazine. The work has also resulted in so far two publications.



Wolfgang Glasser (L) and his third-generation protégé, Danny Garcia-Marrero.

SBIO Hosts Youth Conservation Camp



John Bouldin giving instructions to a YCC student to conduct a wood strength experiment.

On July 16, fifty five (55) 9th – 12th grade high school students from the Youth Conservation Camp (YCC) visited the Brooks Forest Products Center to better understand how the Department of Sustainable Biomaterials use science, engineering, and technology to responsibly conserve our natural resources. Students learned about how trees are the source of many of the products that make our lives better each day. They also had some learning fun with hands-on activities to see the difference between red oak and white oak, how strong wood is, and how to laser engrave wood.

For 36 years, the Virginia Association of Soil and Water Conservation Districts has sponsored the week long YCC summer event. The event sponsors students to spend one week learning about Virginia's resources through hands-on experiences to help them gain a deeper understanding and respect for the environment and our natural resources. Photos of the 2013 YCC activities can be seen online at the Virginia Association of Soil & Water Conservation Districts' Facebook page.



YCC students see how much a piece of wood will bend before it breaks.

Visiting Professors, Scholars and new Graduate Students in the Goodell lab.



Professor Fangli Sun,
Zhejiang A&F
University, China

Professor Lijun Liang,
Vice President of Jixian
Honors College, Zhejiang
A & F Univ.

Professor and Head,
Dr. Nami Kartal, Istanbul
University, Turkey

Professor Dr. Makoto
Yoshida, Tokyo
University of Agricultural
and Technology, Japan

Alison (Yun) Qian,
New Graduate Student
- and ICTAS Doct.
Scholar: Bioconversion

Lam Thieu, New Graduate
Student - Vietnamese
Education Fund support.
Biopolymer Synth.

Atanur Satir, New
Graduate Student - (not
pictured). CNTs in
Metals

Yiming Zhang, New
Graduate Student - self-
funded. Nanocellulose
Composites?

Other visiting Scholars and Sabbatical Scientists for 2013:

- Dr. Yuichiro Otsuaka - FFPRI, Japan
- Mr. Omar Antonio Noriega - Univ. Lorena, Sao Paulo, Brazil.
- Professor Tomonori Sonoki, Hirosaki University, Aomori, Japan (spring 2014)
- (Dr. Grv Alfredsen - Norway. Mr. Caglar Ackay, Duzce Univ. Turkey have already departed.)

Barry Goodell welcomed several new people to his lab recently.

Dr. Nami Kartal, Head, Department of Forest Biology & Wood Protection Technology and the Chair, Division of Forest Industry Engineering Forestry Faculty, Istanbul University in Turkey is visiting for a 2-month stay to conduct research on the extraction of copper from preservative-treated wood as part of remediation efforts to prevent copper from leaching into the environment after treated wood disposal.

Professor Makoto Yoshida visited the Goodell lab after attending Gordon Conference meetings in New Hampshire on Cellulosomes, Cellulases & Other Carbohydrate Modifying Enzymes. Dr. Yoshida discussed his interest in a polysaccharide monooxygenase enzyme system for deconstruction of lignocellulose, and applications to biorefinery processes.

Also arriving in August were new graduate students to the Goodell lab group:

Lam Thieu – Lam will work toward a PhD on production of biopolymers such as polyester derived from natural monomers.

Alison (Yun) Qian – Alison will work toward a PhD on the deconstruction of lignocellulose feedstocks and the biosynthesis of monomers for useful biopolymers and biofuels.

Yiming Zhang – Yiming will work toward an MS degree, focusing on the use of nanocellulose to enhance the properties of aerospace composites.

Atanur Satir – Atanur will conduct research as part of his MS degree on the in-situ production of carbon nanotubes from wood and bamboo fiber within steel to produce a unique high-strength metal matrix composite known as a Covetic material.

Dr. Henry Quesada Travels to China as Part of a Marketing Research Project

From June 30 to July 7, 2013 Dr. Henry Quesada, assistant professor at the Department of Sustainable Biomaterials at Virginia Tech, traveled to China to attend the 2013 International Furniture Fair in Chengdu. The trip is part of the research project “Analysis of Factors Impacting the International Value Chain of Hardwood Products: A Comparison between Asia and Western Europe” funded by the U.S Department of Agriculture. The goal of the project is to examine value chains in mature markets for American hardwoods. In many of these markets there is a high demand for low-valued added products such as hardwood logs and only a small portion of higher value-added products such as



Dr. Henry Quesada meets with Sungem Int. Lumber representatives during the 2013 International Furniture Fair in Chengdu, China

kiln-dried lumber, dimension lumber, veneer, and furniture is imported from the U.S. The research specifically is looking into cultural, technical, logistics, and economic aspects that drive importers to prefer low value-added rather than high-valued added products.

Chengdu is located about 1,100 miles west of Shanghai and it is considered the most important city in Western China with a total population of 14 million people (fourth largest city in China). The city has developed into a friendly and welcoming investing destination for international companies. Already an important furniture cluster, local producers are focusing more on the production of solid wooden furniture for the local market given the increasing economic power of the middle class in China. The biggest problem for local furniture producers continues to be the lack of local supply of high quality hardwoods, hence; producers have turned their eyes to American hardwoods as a reliable source of raw materials.

During his trip to Chengdu, China, Dr. Quesada had the opportunity to interview local furniture manufacturers and lumber brokers and ask fundamental questions related to the importation of American hardwoods and other species from other countries. Current importers of American hardwood products indicated that the most important factor when selecting a new supplier from the U.S. is consistent quality and second factor is the price. Other important aspects that Chinese importers consider when buying from American hardwoods suppliers are packaging, availability of species, and customer support. Most importers also indicated that more information about American hardwoods is needed, as local furniture producers know little about American species properties, dimensions, and grading systems.

If you would like to learn more about international marketing opportunities for Appalachian hardwood producers, please contact Dr. Henry Quesada at quesada@vt.edu

Continuing Education / Short Courses



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Wood Pallet Design and Performance

“Pallet Design in the 21st Century”

September 11-12, 2013

Cheatham Hall, Virginia Tech
310 West Campus Drive
Blacksburg, VA 24061

[Register Online](#)



Unit Load Design and Performance

“How to reduce shipping costs”

October 30-November 1, 2013

Cheatham Hall, Virginia Tech
310 West Campus Drive
Blacksburg, VA 24061

[Register Online](#)



Virginia Cooperative Extension

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Continuous
Improvement

SBIO Extension

Extension Highlights

The wood products industry in Virginia is a critical contributor to the economy of the state, an industry represented by more than 1,000 primary and secondary industries and over \$25 billion in economic impact

The Department of Sustainable Biomaterials (SBIO) at Virginia Tech is one of the U.S. leading academic programs in the field of renewable materials with focus on cellulosic materials such as wood products. Besides research and teaching efforts, SBIO has an important role in dissemination of new knowledge in the area of renewable materials through SBIO's three extension specialists.



Improving and increasing American hardwood exports

Thanks to a grant from the US Department of Agriculture extension specialist Henry Quesada and SBIO's Department Head, Robert Smith, have been able to visit wood products industries in Germany and China with the goal to understand factors that drive and inhibit the exports of American hardwoods from the Appalachian Region.

Outputs of the project have been disseminated through newsletters, web blogs (sim.sbio.vt.edu), and workshops. The last workshop was held in Indiana in late May 2013 and the last industry visit is schedule for September when Smith and Quesada travel to the 2013 Vietnam Wood tradeshow.



Dr. Quesada met with several Chinese furniture manufacturers during the 2013 Chendgu Furniture Show

Using lean thinking principles to save electricity

Cutting energy costs remains a way that many wood products firms can trim operating expenses while developing new business prospects and serving existing customers. Electricity represents the highest energy cost (62.5%) for wood products manufacturers.

The recommendation with the highest average savings per employee is: *"Analyze flue gas for proper air/fuel ratio"* with \$102.01/year savings.

The highest average savings per ft² is: *"Eliminate leaks in inert gas and compressed air lines/valves"* with \$5.05/year.

The recommendation with the lowest average payback period is: *"Reduced the pressure of compressed air to the minimum required"* with 0.29 years.

Extension specialists Henry Quesada, Brian Bond and Urs Buehlmann, and professor Earl Kline have been working on the implementation of lean thinking principles in order to reduce electricity consumption in wood products industries. Electricity metering technology was installed in three VA wood products industries where

consumption was monitored before and after lean thinking implementations. Preliminary results have been disseminated through newsletters, workshops, and web extension articles (sim.sbio.vt.edu).

Turning wood into electricity

Recently, SBIO acquired a portable power plant that uses wood chips as feedstock for generation of electricity. The power plant is capable of producing 10,000



watts per hour with an estimated input of 12 kilograms of feedstock per hour. The unit turns wood chips into syngas, a gas that is composed mostly of carbon monoxide and hydrogen. The syngas is filtered to eliminate undesirable substances and feed into a combustion engine. The engine powers a generator that can output 110 or 220 volts.

During the last months SBIO extension specialist Henry Quesada has conducted several demonstrations of the technology with the idea of motivating local industries and bioenergy researches in how to turn biomass into clean energy.

WORKSHOPS PRESENTED BY Sustainable Innovation Management

sim.sbio.vt.edu

Fourth Innovation Workshop

November 7, 2013 8:30 a.m. - 2:00 p.m.

Inspire and motivate students, research faculty, and local entrepreneurs into developing their ideas into successful commercial products.

Registration:
cpe.vt.edu/reg/ibmw/

Energy Reductions Using Lean Thinking

November 20, 2013 9:00 a.m. - 4:30 p.m.

Inspire and motivate students, research faculty, and local entrepreneurs into developing their ideas into successful commercial products.

Registration:
cpe.vt.edu/reg/erlt/