The Department of SUSTAINABLE BIOMATERIALS
Volume 8 — Spring 2013

Sustainable Biomaterials Newsletter

Hello from the Department of Sustainable Biomaterials:

We recently had graduation and summer is finally here. The weather has been a tough battle this year, and Blacksburg had an unexpected snow storm in late April that dropped between 4 to 6 inches of snow. It was the latest snow I remember in my 22 years in the area. This always renews the conversation of "global warming," "a changing climate," or "it's just the weather and there isn't much we can do about it." The good thing about this discussion is that it does highlight the importance of people's influence on their environment and what we can do to minimize any negative impacts from our actions. Our department focuses on many of these issues through our teaching, research and extension efforts. Whether it is new products from renewable materials, reduced waste through efficient manufacturing processes, or energy from wood residues, our students are taught that they individually can make a difference through the education they receive at Virginia Tech and our department.

We have a large graduating class this year with many already having jobs lined up to start the next step in their lives. Students from our program begin their careers as management trainees, quality control technicians, sales people, research assistants and production supervisors to name a few positions. We had new firms interviewing this year, which hopefully is a sign of the improving economy. Companies have also been on campus looking for summer interns. This is a great way for them and the student to evaluate each other and it provides a great experience for the student. If you have an interest in working with an intern, please contact us. On a personal note, I have started exit interviews with our graduating seniors to get an overall evaluation of their time in our program. To date, the responses have been very positive and most would return and do it again. I believe that says a lot for our faculty and their efforts on being great instructors. Of course, the student's success outside of Virginia Tech will be the real measure of accomplishment.

This issue highlights our students' internships and study abroad activities for the past semester. The Center for Packaging and Unit Load Design developed an internship program so that our students can work part-time throughout the year in their testing facility. We had students from Virginia Tech and Purdue University looking at natural resource issues in Costa Rica with Henry Quesada. Bob Bush and Earl Kline traveled with students to Ireland to work with the University of Galway in Letterfrak, Ireland. Dr. Barry Goodell was invited to speak in Tanzania and we have a number of visiting scholars in the department this year. If you have any questions regarding items in the newsletter, please feel free to contact me.

Sincerely,
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Not Your Average Internship

Interns Jason Hoepker (standing) and Zachary Shiner test pallets outside the Center for Packaging and Unit Load Design

Through its research, Virginia Tech's Center for Packaging and Unit Load Design makes packaging systems as safe and efficient as possible. What would you say if you were offered an internship working for the Center for Packaging and Unit Load Design? Think it sounds boring? Think again. "You can't judge a book by its cover," Zachary Shiner, a junior from Exton, Pennsylvania said of his internship. "Every package is different."

Last summer, Dr. Laszlo Horvath, director of the Center for Packaging and Unit Load Design, hired one freshman, one sophomore, and one junior as interns at the center. Dr. Horvath's strategy was to hire young students who could gain as much experience as possible. The summer internship transformed the students from packaging novices to packaging know-it-alls.

Students Jason Hoepker and Zachary Shiner essentially knew nothing about packaging and unit load design before beginning the internship. "I had no idea what was going to come of it," said Hoepker, a sophomore from Haymarket, Virginia.

Dr. Marshall White, founder of the Center for Packaging and Unit Load Design and professor emeritus at Virginia Tech, gave the students a crash course in pallet design. After an exhausting two days, the students had learned an entire semester's worth of knowledge. "I was afraid he would expect me to know more, but I just kept an open mind and learned a lot, and it ended up not being a problem at all," Shiner said. "It was really exciting to see their transformation over the summer," Horvath said.

Rosemary Masser, a senior from Frederick, Maryland, was hired as a junior and had taken most of the packaging courses before beginning the internship. Although Masser knew the basics, she gained practical knowledge through her experience as an intern. Masser came to Tech studying engineering, but was always interested in design. "It

[Packaging and Unit Load Design] combined the engineering principles I wanted and the design aspect," Masser said. "I can tailor my [packaging] projects to marketing and design." Every product produced in the world will be packaged somewhere along the supply chain. "The world is so global now. We buy a lot of products far away from our home, and somehow those products need to get where we are," Masser said.

The three interns gained a variety of experience during their summer internship. While interns at other companies grabbed coffee and made copies, the Packaging and Unit Load Design interns conducted research, took field trips, and gave the lab its very own makeover.

One of the best parts of the job for Shiner is that it's hands-on. "The things you get to do are exciting. It's not just any old job," Shiner said. Hoepker agrees. "I enjoy doing testing way more than sitting at a desk," he said.

If you're wondering why you should care about the interns' research, let's just say that without these students, your food would be quite moldy and your brand new laptop might arrive with a broken screen. For a large part of the summer, Hoepker, Shiner, and Masser tested the mold on pallets for a pallet manufacturer located in Wisconsin.

"If you have mold on a pallet, it can easily spread onto the product," said Hoepker.

Students have been involved with every part of the research, including development of a testing procedure for mold. They ranked the pallets on how moldy they were and then measured the moisture content for each pallet.

"The pallets get shipped in trailers…if someone is driving across the country…it can be a long time before anyone opens that trailer," Shiner said.

A company can lose time and money if it turns out that the pallets or products have grown mold during the journey from point A to point B. The students found that trailers with good ventilation systems can effectively prevent growth on pallets.

The interns travelled from Blacksburg to Richmond for the East Coast Sawmill and Logging Equipment Exposition (EXPO), America's leading trade show for the forest products industry. At the EXPO, the interns explained what the Center for Packaging and Unit Load Design at Virginia Tech is all about. They also answered questions about packaging science for curious attendees. In Richmond, the three students learned about how a tree becomes a pallet as well as how pallets are built and recycled.

"We learned a lot, and it helped get the name of the program out there," Hoepker said of the EXPO.

Target wouldn't be the bargain shopper's paradise it is without its massive warehouses to package and organize merchandise. Hoepker, Shiner, and Masser toured Target's 1.5 million square-foot warehouse in Stuarts Draft, VA. The warehouse is one of the largest buildings in Virginia. By touring the warehouse, the interns learned about Target's racking systems, package tracking process, and overall operating procedure.

"I was able to apply the knowledge I learned in classes and see it actually being used," Hoepker said of touring the Target warehouse.

During the tour, the students saw furniture that they had previously tested and found problems with. "We were able to see the tests [that] we did during the summer impacting the real world," Masser said.

The tour of the Target warehouse also gave students a chance to network. During an engineering EXPO at Virginia Tech, Masser saw the tour guide from the Target warehouse field trip. The tour guide told Masser there was no need to wait in a long line of hopeful employees. She automatically gave Masser an interview.

Student intern Rosemary Masser (standing) and Dr. Laszlo Horvath run tests in the lab at the Center for Packaging and Unit Load Design

"The man who interviewed me was the manager from the Target warehouse we toured and knew Dr. Horvath by name when I mentioned him. It was nice to have that connection," Masser said.

If the students learned one real-life skill during their internship, it was organization. With a little push from Dr. Horvath, students completely revamped the lab at the Center for Packaging and Unit Load Design.

"When we first got there this summer, some of the rooms were completely filled with boxes and you could barely open the door," Hoepker said of the lab.

The students transformed the lab into a neat freak's heaven.

The team adopted the principles of Lean Manufacturing, which target every type of waste in an organization, including excess materials and wasted time. First, they used the 5S principles to removed broken and unnecessary items from the lab and categorize equipment into tools they used daily and tools only used occasionally. They installed new shelf systems and painted all the machines. Masser drew out a map of the new lab for the team to reference while reorganizing.

Students taped off sections in the lab for each machine, labeling specific sections with different colors of tape. They drew shadows around all the tools hanging on the wall. With the shadowing system, it is obvious which tool has been removed, and it is easy to it put back in the correct place. The three interns even wrote detailed instructions for running tests so that they get done quickly.

The interns also created task boards. "We have a task board that shows which tasks need to get done on the particular day. You put your initials if you finish or start it," Shiner said.

Overall, students found the internship helpful for future jobs. Masser had no trouble answering even the toughest questions in job interviews. When asked in an interview to talk about a task she had to immediately implement, she jumped right into talking about having to find quick solutions to problems during her internship. Students developed time-management skills while on the job.

"Everything was scheduled. We would have one week to complete tests…and we had to think ahead of time," said Masser.

Shiner says he learned how to think in a new way. "Most of the problems we get…don't have a clearly defined solution," Shiner said. "You [have to] come up with original ideas." Their ideas, like their internship, are certainly original, and you can expect more from these three.

Shiner continues to work about five to six hours per week at the Center for Packaging and Unit Load Design during the school year. This summer, he hopes to work for a packaging company and has already had an interview with Packaging Corporation of America. Masser will move to Atlanta in June to begin working at Manhattan Associates, a company that builds custom software for stores like Walmart and Target. Hoepker took a break from school this semester to work at the Center for Packaging and Unit Load Design 40 hours per week and will be hiking the Appalachian Trail from March until August.

Dr. Horvath has faith in the students as well. "They already have knowledge to go out to companies and start producing value for them," Horvath said of the interns.

The internship program will be further expanded in the summer of 2013 to provide experience to five students at the Department of Sustainable Biomaterials. The summer interns will have an opportunity to gain additional experience related to continuous improvement, standards, management, and leadership as part of the Sustainable Packaging Designer Trainee program starting from Fall 2013.

Students and faculty from Virginia Tech and Purdue University travel to Costa Rica

Assistant professor Henry Quesada from Virginia Tech and associate professor Eva Haviarova from Purdue University joined efforts to organize a student field trip to Costa Rica and to collaborate with the Costa Rican Forestry Office in delivering educational activities during the Spring break.

Students from both institutions signed for the course Global Issues in Sustainability. This 3 credit-hour class has as a goal to study issues impacting the sustainability of natural resources such as the forest, water, and wild life in a global context. The course includes a one-week field trip to Costa Rica where students participate in a series of experiential learning activities to understand and gain knowledge on how private businesses, government institutions and local

universities work together to promote and educate current and future generations in the sustainable use of natural resources.

In this opportunity, nine students from Virginia Tech and five from Purdue University signed up for the class. The itinerary included visits to Costa Rica Tech where students had lectures and experienced first-hand a variety of ecofriendly projects such as crocodile and butterfly farming, impact of tropical forests on climate change, and best practices for wild life management. Students also learned from practitioners about waste management during their visit to Ecotermales, a hot-spring water resort, that manages 100% of its waste (solid and liquid). During the last three days of the field trip, students were exposed to the use of wood as a renewable material and how a large corporation working under forest stewardship council (FSC) certification develop and manage plantations, process plantation timbers, and export finished-wood products to green markets in western Europe. Other activities included visits to: a turtle hatchery, zip-lining, volcanoes, hydro- and wind-power energy projects, and a wild-life refugee.

Students listen to biologists Jose Rojas and Oliver Castro from Costa Rica Tech during their lecture on the importance of tropical forest

Students listen from Herrold Vega, CEO and owner of Ecotermales, about waste management techniques such as composting.

During the second week, professors Haviarova and Quesada participated in various educational activities in cooperation with the Costa Rican Forestry Office and Costa Rica Tech. In March 19, Dr. Quesada delivered an 8-hour workshop in cost allocation for furniture makers in Sarchi, a region where more than 600 small-furniture shops produce high-quality furniture for the local and export market. On March 22, Drs. Haviarova and Quesada along with Dr. Rado Gazo, also a faculty at Purdue University, delivered a seminar entitled Sustainability and Wood in celebration of the International Day of Forests where more than 75 people attended. Dr. Quesada also delivered a graduate seminar on principles of life cycle analysis (LCA) in March 21 to students of the Modern Manufacturing Systems master program at Costa Rica Tech.

Should you have any questions or comments, please contact Dr. Quesada at quesada@vt.edu

VT students show their Hokie spirit at Irazu Volcano.

Participants listen to speakers from Virginia Tech and Purdue University during the celebration of the International Day of Forests in San Jose, Costa Rica.

Ireland, VT Education Abroad

A photograph taken by Robert Bush during a recent Education Abroad course in Letterfrack, County Galway, Ireland was selected as a finalist in the *VT Education Abroad 2013* Photo Contest. It will be displayed, along with other selected photographs, at the XYZ Gallery (223 North Main Street, Blacksburg) from April 16-21, 2013.

Virginia Tech's Center for Packaging and Unit Load Design has an Active Spring

Virginia Tech's Center for Packaging and Unit Load Design (CPULD) has had an active spring so far. In March, the CPULD director Dr. Laszlo Horvath presented at multiple industry meetings.

Horvath spoke at the Institute of Advanced Learning and Research in Danville, NC March 5. At the event, he talked to representatives of plastic and packaging manufacturers about the latest developments at the CPULD. During Horvath's presentation, Danville companies were introduced a new research area where natural fibers are used to reinforce plastics for various packaging applications. The new concept will influence the way pallets are designed and used. His presentation can be watched at the following link: http://ialr.org/index.php/ialr/business-development/the-network.

Horvath spoke again at the annual Industrial Truck Association (ITA) spring meeting March 12 in D.C. At this year's meeting, Dr. Horvath addressed the General Engineering Committee, a committee of engineers who develop forklifts and other modes of unit load handling devices. The committee gained insight into the world of pallets, with which they often come into contact. Horvath discussed the newest trends in pallet design and the latest research at Virginia Tech's

CPULD. He also introduced the Physical Internet Initiative which will have a great influence on the way how materials will be handled in the future.

Both events provided great opportunities for the Center for Packaging and Unit Load Design and Virginia Tech to be involved with the latest developments in the packaging and material handling industries.

Goodell in Tanzania

Dr. Barry Goodell was an invited keynote speaker to World Wood Day - 2013 in Tanzania, Africa during the week of March 21st 2013. He represented North America and presented the talk, *The Future of Wood and Biofiber: How Wood as a Biomaterial Contributes to a Sustainable World.*

Goodell also moderated one of the 6 theme sessions of the meeting, "Conservation and Plantation", and he served as a judge in the African Wood Carving event.

Dr. Barry Goodell (center), Professor, Department of Sustainable Biomaterials with some of the speakers and organizers from the World Wood Day – 2013 meetings.

The meetings were held in Dar es Salaam in Karimjee Hall, and they were well attended by participants from around the globe with the primary theme of the conference being *Wood in Africa: Cultural Distribution, Historical Utilization, and Future Sustainability.*

The date of the meeting was officially designated and recognized as the International Day of Forests by the United Nations General Assembly, and 2013 is the first year of recognition. World Wood Day was celebrated on the same day as the International Day of Forests to raise the awareness on how wood plays a key role for a sustainable future. The idea for world wood day was first advocated in 2009 by International Wood Culture Society along with partners and friends. The idea behind World Wood Day is a cultural approach to realize the concept wood is good. To celebrate the initiation, World Wood Day works in concert with Forest Day to bring wood, together with forests, into people's life.

Dr. Goodell greatly appreciates the support of the International Wood Culture Society and their partners and friends to make the trip possible.

Japanese Scientists Visit the Sustainable Biomaterials Department to Talk About the Bioconversion of Waste Lignin to Useful Products.

Dr. Masaya Nakamura and Dr. Yuichiro Otsuka from the Forestry and Forest Products Research Institute (FFPRI) in Tsukuba (Science City), Japan visited the Department of Sustainable Biomaterials April 19 – 23, and met with several faculty and students in the Department and across campus. Dr. Nakamura is Team Leader in the Department of Industrial Microbiology at the FFPRI and his colleague Dr. Otsuka is a Senior Researcher in the Department of Biomass Chemistry of FFPRI. Both focus on the bioconversion of lignocellulosic biomass to produce new biobased polymers and energy. Dr. Otsuka gave a campus-wide seminar sponsored by Macromolecules and Interfaces Institute and ICTAS on a new method for bioconversion of waste lignin materials into a useful monomer. Yuichiro also showed how his lab was converting that monomer into a variety of useful bio-Polyetheylene, bio-Polyurethanes, and bio-Epoxy resins. The title of his talk was: "Production of 2-pyrone-4,6-dicarboxylic Acid as a Novel Polymer-Based Material From Low Molecular Weight Lignin by Metabolic Engineering of Microbial Functions".

In addition to the discussion of scientific research and future collaborations Dr. Otsuka also spent time on a "scouting" trip to see the Blacksburg area and look at apartments, as he will return next Fall with his family for a one year sabbatical working with Professor Barry Goodell.