Cellulose and Renewable Materials Division Newsletter

A Division of the American Chemical Society

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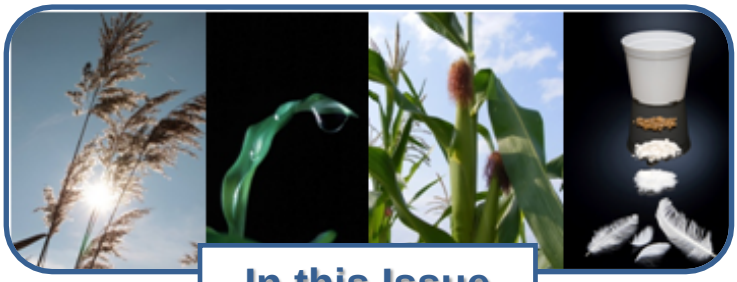

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Member Highlight

The Fibril Angle is beginning a new feature highlighting the work of one member of the ACS Division of Cellulose and Renewable Materials. This first installment showcases ***Dr. Emily Cranston*** *of McMaster University in Hamilton, Ontario, where she has been an Assistant Professor since January 2011.*

Emily Cranston

Emily, can you tell us a little bit about your background? Where did you do your undergraduate and graduate training? What originally got you interested in working with cellulose and bio-based materials?

I did my BSc in Chemistry at McGill University with a focus on Bio-organic Chemistry – I grew up in Halifax, Nova Scotia (small town, east coast Canada) and so moving to a big exciting city like Montreal was the main draw for me. I did my first independent research project with Prof. Robert H. Marchessault (recipient of the 1976 ACS CELL Anselm Payen Award) characterizing synthetic biodegradable plastics. To this day I'm still a characterization fanatic! I continued my studies at McGill University, completing a PhD in 2008 in Materials Chemistry. The work was done in the Pulp & Paper Research Centre and my mentor was Prof. Derek G. Gray (recipient of the 2013 Marcus Wallenberg Prize, 1993 ACS CELL Anselm Payen Award and the "godfather" of cellulose nanocrystals). What really sealed-the-deal for me was my first ACS National Meeting full of cellulose experts – young, old, fundamental, applied, chemists, physicists, biologist, engineers… but they mostly knew each other by first name and gave great feedback after presentations. It felt like an exciting and important place to be.

Can you talk about your experience putting together the Sustainable Nano-Biocomposites group? How have you gone about recruiting students to work with you?

Building a research group is a ton of fun but a wise man once told me that the best thing a supervisor can have is a good student, and the second best thing is no student. I took this to heart and carefully recruited strong students that I wanted to work with and that would have fun with each other. I think happy lab culture and a positive work atmosphere is vital; the students spend a lot of time together, sharing their successes and their failures, and even the most brilliant students need a good support system to finish a PhD.

In terms of recruiting, at first I was fostering relationships with the brightest students in my courses at McMaster, hoping they would stay on for graduate school. I hired a lot of summer students, mostly with scholarships. By my third year at McMaster, I realized that some really top-notch students from around the country were applying to work in my group. I think it takes time and cannot be pushed.

A great way to recruit students and grow as a supervisor is to co-supervise students. That way I can do research in new areas better and faster than I could on my own and I get to experience other professor's styles. I don't always agree but seeing options is helpful. Currently, I have seven graduate

students and three are co-supervised. There are also somewhere between two and five undergraduate students working and volunteering in the lab during the year – and that's about all I have room for!

A Canadian research group in their most preferred habitat (outside the lab, of course)

Your group's work on cross-linked cellulose hydrogels and aerogels have both been highlighted this past year in C&EN. How are these materials made, and what applications do you foresee for them?

A cellulose aerogel supported by a dandelion

The chemically cross-linked cellulose gel work was done by my student Justin (Xuan) Yang – he tries dozens of ideas a week and then brings the best ones to discuss with me. Justin modified cellulose nanocrystals so that they could crosslink through hydrazone bonds and made injectable polysaccharide hydrogels reinforced with cellulose nanocrystals- that was the first step. These hydrogels are useful for biomedical applications like drug delivery and tissue scaffolding. Justin also found a way to make aerogels based on the same crosslinking technology using only cellulose nanocrystals and no other polymers. These are the lowest density nanocellulose aerogels reported to date and they absorb any liquid and bounce back even after being compressed over 85%! We imagine using these materials anywhere that lightweight, elastic, insulating, porous materials are used, or as separation aids (we can easily separate water from oil), cleanup kits (they absorb up to 170 times their own mass in liquids without disintegrating) and we're working on using the aerogels as templates for other materials.

What is one of the biggest challenges you face as an early career professor? What is one of the joys you get from your job?

The challenge is trying to do your best at every task (teaching, research supervision, securing funding, service) when there simply are not enough hours in the day. Even though my colleagues and mentors are positive and care about my success, it remains entirely up to me to do well. Sometimes the details of developing a course outline or ordering a lab fridge, for example, can seem impossible because you're really on your own. It is important to me to honestly self-assess my progress; am I providing the best educational "service" that I can and are my students profiting fully and going on to do successful things? So far the answer is "yes" but I'm watching myself very closely…

The biggest joy is watching my students make an impact. Publishing a great paper, winning a presentation award, expertly defending their theses – these things make me a really proud "lab-mom".

An accurate (I'm told) model of the Sustainable Nano-Biocomposites Laboratory

In what time you can find for them, what are some of your outside interests?

In my free time I love to travel and eat – especially the combination of the two! My boyfriend and I really enjoy skiing but wish we were a little closer to the mountains. I have a lovely cat who supports my long hours at the computer by knocking things off my desk and chewing on student papers. To keep myself as grounded as possible and to ensure I take some time to breathe, I try to get to yoga classes regularly and have been known to guide mini yoga-breaks in my classes.

Perspectives

About the *Metamorphosis* of the CELL Division: A personal reflection on the transition from the *meter* to the *nano-scale*.

Wolfgang Glasser,
Professor Emeritus
Sustainable Biomaterials Department, Virginia Tech

Wolfgang Glasser at the 2010 Anselme Payen Award Banquet

The **Cellulose and Renewable Materials** Division of ACS (our CELL Division) has undergone significant changes in the past half century, the time period during which I had the good fortune of being associated with it. This change can be measured on many scales; and for me, it has paralleled most closely the distance-scale. Whereas the divisional membership represented most prominently scientists from the forest products and wood fields (the meter-scale) in the 1950's, it became focused mainly on pulp- and paper and cellulosic textiles issues (the millimeter-scale) in the 1970's. The transition to the macromolecular and interfaces topics coincided with the onset of biorefining and biobased materials (the micron-scale) in the late 1980's and 1990's before becoming overtaken by the nano-sized molecular aggregates and composite structures of cellulose in the new century.

This *metamorphosis* was reflected on many levels. I remember heated debates in the early 1970's on divisional name changes from wood to pulp & paper (delignification) and textiles (cotton) between Ed Gillsepie and (later) Roger Rowell of the Forest Products Lab, Ed Jahn and Tore Timell of Syracuse, Irwin Pearl of Appleton, David Goring and Henry Bolker of Paprican, Kyosti Sarkanen of the U' Washington, Roy Whistler of Purdue, and Ingemar Falkehag of Westvaco. The resulting designation of *Cellulose, Paper and Textile Division* lasted almost 40 years before the focus swung to molecules and nano-structures.

The American Chemical Society with its CELL Division has not always been the natural home to major conference events. In fact, the *metamorphosis* from the *Cellulose Conferences* of SUNY Syracuse to the *Wood and Pulping Chemistry Conferences* of Paprican (and later other, mostly European pulp and paper institutions) took several decades before CELL seized the field through its focus on molecular concerns. This transition was also reflected in the changes through which the scientists of the field communicated in writing. The prominent journals of the early years, like the Forest Products J., Wood Science, Mokuzai Gakkaishi and Holzforschung, were gradually replaced (or supplemented) by pulp&paper journals (TAPPI J., Svensk Papperstidning, Paperi ja Puu, Das Papier) if one wanted to be read and cited, before journals with emphasis on molecular issues (especially the J. Applied Polymer Science, Polymer, Macromolecules in the early years followed by Biomacromolecules, Cellulose, Carbohydrate Polymers and Industrial Crops and Products) gained in popularity.

The metamorphosis from the meter- and millimeter-scales to the micron- and nano-focus involved as well major institutional changes. The early research centers with focus on wood and pulp & paper, which had established deep roots in our fields of science, in the USA and in all major developed countries (esp. in Scandinavia and Canada), waned and gave way to governmental and academic institutions more directly focused on pressing societal issues, such as bioresources, biofuels, bioprocesses, etc. This change was catalyzed in part by the 1973-oil embargo of OPEC that revealed major industrial vulnerabilities in the US. I hold this revelation, along with the beginning concerns over global warming, responsible for the initial focus on non-conventional bioresource conversion technologies to fuels and chemicals that helped the micron- and nano-side on the chemical sciences to grow. By request of President Ford, the *Committee on Renewable Resources for Industrial Materials (CORRIM)* of the National Academy of Sciences evaluated between 1973 and 1975 whether the fossil resources used by the chemical industry could be replaced by renewables. (The answer was "no sweat" using WW II technologies.) The *Solar Energy Research Institute* (SERI, later renamed *National Renewable Energy Laboratory*, NREL), started under President Carter, and the private effort at bioresource fractionation using organic solvents found their start during this time. I credit especially the *General Electric Corp.* for starting the industrial development of organosolv fractionation (by founding the *Biological Energy Corporation, BEC*, that later became Alcell and then Lignol). It was this initial effort at efficiently extracting both polysaccharidic- as well as aromatic chemical resources from biomass (i.e., "fractionation"), in concert with the distribution effort of organosolv lignin (along with lignin derivatives) by *Sigma/Aldrich*, that has become the basis for most of biorefinery process schemes.

Whereas many biorefinery-activities have targeted small molecules from plant bioresources, primarily ethanol and mixed (distillable) hydrocarbons, the interests of the growing community of CELL members as well as industry seem to continue to revolve around macromolecular- and nano-science issues. And this development is for what ACS and CELL are the most accommodating hosts. Whereas Division membership hovered at around 1000 members for many years and briefly dipping below even 500-600, and whereas the number of symposia and symposium audiences ranged typically on the order of 3-4 and 15-30, respectively, membership today has reached the level of 2000 with more than 300 papers being presented in CELL symposia at the past five national spring meetings of ACS.

The future is bright for bioresource-based products and processes that are tailored according to the guiding principles of natural materials rather than those of fossil carbon-based technologies. And this reflects also on the roots of the CELL Division in wood, pulp & paper, textiles, and chemicals and products based on chemically modified and regenerated cellulose.

Personally, I can't wait to see other bioresource-derived polymers to join cellulose and its derivatives as the basis for structural materials. I am convinced that the best years for the *Cellulose and Renewable Materials Division* and its members are still to come.

Editor's note: Professor Glasser is being honored with a special symposium within the CELL Division program at the upcoming ACS Spring Meeting in Denver. The symposium, titled "Advances in Lignocellulosic Materials and Chemistry: A Tribute to W.G. Glasser," will take place Sunday, March 22, and Monday, March 23.

Letters from the Division

A Joint Letter from the Chair-Elect, Chair and Immediate Past Chair
Marie-Pierre Laborie, Sheila Murphy and Lucian Lucia

First of all, we want to take this opportunity to wish all our members a happy and prosperous New Year. We look forward to meeting many of you at the Spring National Meeting in Denver, Colorado. Thanks to the great work of our Program Chair Chip Frazier, it looks to be a very exciting meeting. Our Anselme Payen symposium this year will honor Prof. Dr. Thomas Rosenau, and we will also have the great pleasure to welcome back among us Wolfgang Glasser for the symposium to be held in his honor.

We would like to take a few moments to reflect on 2014. This was a very good year for the Cellulose and Renewable Materials (CELL) Division. Our membership continues to grow helping to energize our division and ensure a cutting edge technical program.

The CELL division had a successful year in obtaining a couple of Innovative Project Grants from the American Chemical Society (ACS) Committee on Divisional Activities (DAC). Dr. Kevin Edgar, in collaboration with Dr. Lai-Xi Wang, Division of Carbohydrate Chemistry (CARB) and supported by the National Research Council (NRC) successfully obtained support for the co-sponsored symposium "Frontiers in Glycoscience" due to take place at the Denver meeting. Similarly, Dr. Nicole Labbé successfully obtained support for the 3rd International Conference Frontiers in Biorefining Conference this past October in St. Simons Island, GA.

Chair-Elect (2013 – 2014): Marie-Pierre Laborie

Marie-Pierre Laborie

The success of the CELL division in 2014 is due solely due to the activities of its members and we thank you for your participation. In these thriving times for our division, however, it became clear to me that I would not be able, for personal reasons, to serve our division in all its fairness as the Chair at the beginning of this New Year. I presented my resignation to Lucian Lucia as of Dec. 31, 2014. While I regret not being able to take on this great mission at this time, I trust that our division continues to thrive with new leadership already in place. Elections were indeed held in November 2014, and we were pleased to welcome our incoming CELL officers.

With this new election and as per our bylaws, our 2015 Chair-Elect, Sheila Murphy, shall be stepping in early on (but with tons of experience) as Chair of our division. Sheila has been such an outstanding volunteer for our division in the past years that without a doubt CELL is going to keep its rising trajectory. As for now, I wish to thank Sheila, Lucian and everyone on the CELL executive committee for the enthusiastic and constructive work, continuing support and always enjoyable time together. I also thank all of our members for allowing me to serve you, our division and our scientific community over the past few years. I look forward to seeing many of you at upcoming meetings.

Lucian Lucia

Immediate Past Chair (2013 – 2014): Lucian Lucia

I wish to express my (selfish) melancholy at losing Marie-Pierre, a stalwart and trusted stanchion of our Division. She has been a luminary in all of her work with us and it was with deep regret that I accepted her resignation late last year. I will always support her in everything she does while we work with ACS and the Division to follow our By-Laws for the smooth transition of her replacement, Sheila Murphy, and the next (newly elected) Chair-Elect. Our Division has a very bright future in the hands of Sheila who has also been a star in the constellation of our Division.

Chair (2015 – 2016): Sheila Murphy

Sheila Murphy

As the newly elected Chair Elect I was looking forward to working in support of Marie-Pierre as Chair of our division. Marie-Pierre has been a long established member of CELL who has worked tirelessly in support of our division. While Marie-Pierre's insights and enthusiasm will be missed for now, I am sure this is not the last time we hear from her.

As noted in the division Bylaws we are in the process of electing a new Chair Elect for 2015 as I transition to the position of Chair. I know that I have a hard act to follow as both Marie-Pierre and Lucian have played key roles in the success of our division. I look forward to the challenge and know that Lucian, as Immediate Past Chair, and all of our division officers will help to ensure a smooth transition. That said, the life and soul of our division is not generated from these positions; it comes from our common interests and collective interactions. Our Technical Program serves as a focal point for networking and sharing of our technical interests. The Denver meeting will be no exception.

I reach out to each of our members that will attend the National Meeting to join us in the open Business Meeting, Wednesday 25th March after the technical discussions. Details of this meeting will be published once room allocations have been finalized. This meeting is an opportunity for members to participate in the future organization of our activities. Members who cannot attend the meeting but would like to suggest activities or symposia, or to provide feedback or concerns about the division are welcome to email myself, or the secretary (Michael Santiago) and we will bring these subjects up to the meeting.

I look forward to an active and productive term of office serving you, our members, for the benefit of our division.

2015 ACS Spring Meeting – Division Events

For a description of symposia being organized and sponsored by the Division of Cellulose and Renewable Materials at the ACS National Meeting in Denver, CO, please visit the division's website at http://cell.sites.acs.org/springprogram.htm.

Monday, March 23, 7:00 pm – Organ Recital

Come see the Anselme Payen award winner and your Division of Cellulose and Renewable Materials colleague perform organ music at the Cathedral Basilica of Immaculate Conception. The cathedral is less than a mile from the Colorado Convention Center. (See map on page 9.)

Organ Recital

The Cathedral Basilica of Immaculate Conception
401 E Colfax Ave.
Monday, March 23rd, 7 p.m.

Thomas Rosenau - Vienna, Austria
plays
J.S. Bach, L. Boellmann, C. Franck,
and L.J.A. Lefebure-Wely

Tuesday, March 24, 6:30 pm – Anselme Payen Award Banquet

The Division of Cellulose and Renewable Materials Anselme Payen Award Banquet will be held at Coohills Restaurant (www.coohills.com), located at 1400 Wewatta Street in Denver. The highlight of the evening will be the presentation of the 2014 Anselme Payen Award to Dr. Thomas Rosenau. Please join us on this joyful occasion as we celebrate with Dr. Rosenau and our fellow CELL division members.

Coohills restaurant is walking distance from the Convention Center and focuses on local, regional and farm-fresh ingredients. This is a ticket-only event; tickets can be purchased through the ACS National Meeting registration process for $65/ticket.

To purchase a banquet ticket, please go to the Social Events section of the National Meeting & Exposition registration package. Scroll down to Tuesday, March 24, and check the CELL Anselme Payen Award Banquet to purchase a ticket. Your tickets will be issued with your registration documents. Please bring the ticket for entry to the event. If you require help purchasing the tickets please contact Peney Patton (acs_cell@hotmail.com).

To get to Coohills from the Convention Center, you can either walk (approx. 1 mile) or use the free shuttle that travels up and down the nearby 16th Street pedestrian mall. The shuttle is known as the "Free MallRide." The restaurant is next to the old railroad bridges along Cherry Creek and directly across Speer Boulevard from the Pepsi Center. (See map on page 9.)

Directions to Coohills via 16th Street Free MallRide Bus:

- After exiting the Convention Center, cross 14th Street and continue 2 blocks northeast to 16th Street
- Take the Free MallRide bus (bus picks up roughly every 5 minutes) and get off at Wynkoop Street
- From 16th street, turn left on Wynkoop Street and walk southwest 1 block to 15th Street
- Turn right on 15th Street and walk 1 block northwest to Wewatta Street
- Turn left onto Wewatta Street
- As you walk southwest down Wewatta Street, the restaurant is on your left

Directions to Coohills via walking up 15th Street:

- After exiting the Convention Center, cross 14th Street and continue 1 block northeast to 15th Street
- Take a left on 15th Street
- Walk northwest about 3/4 mile on 15th Street to Wewatta Street
- Turn left onto Wewatta Street
- As you walk southwest down Wewatta Street, the restaurant is on your left

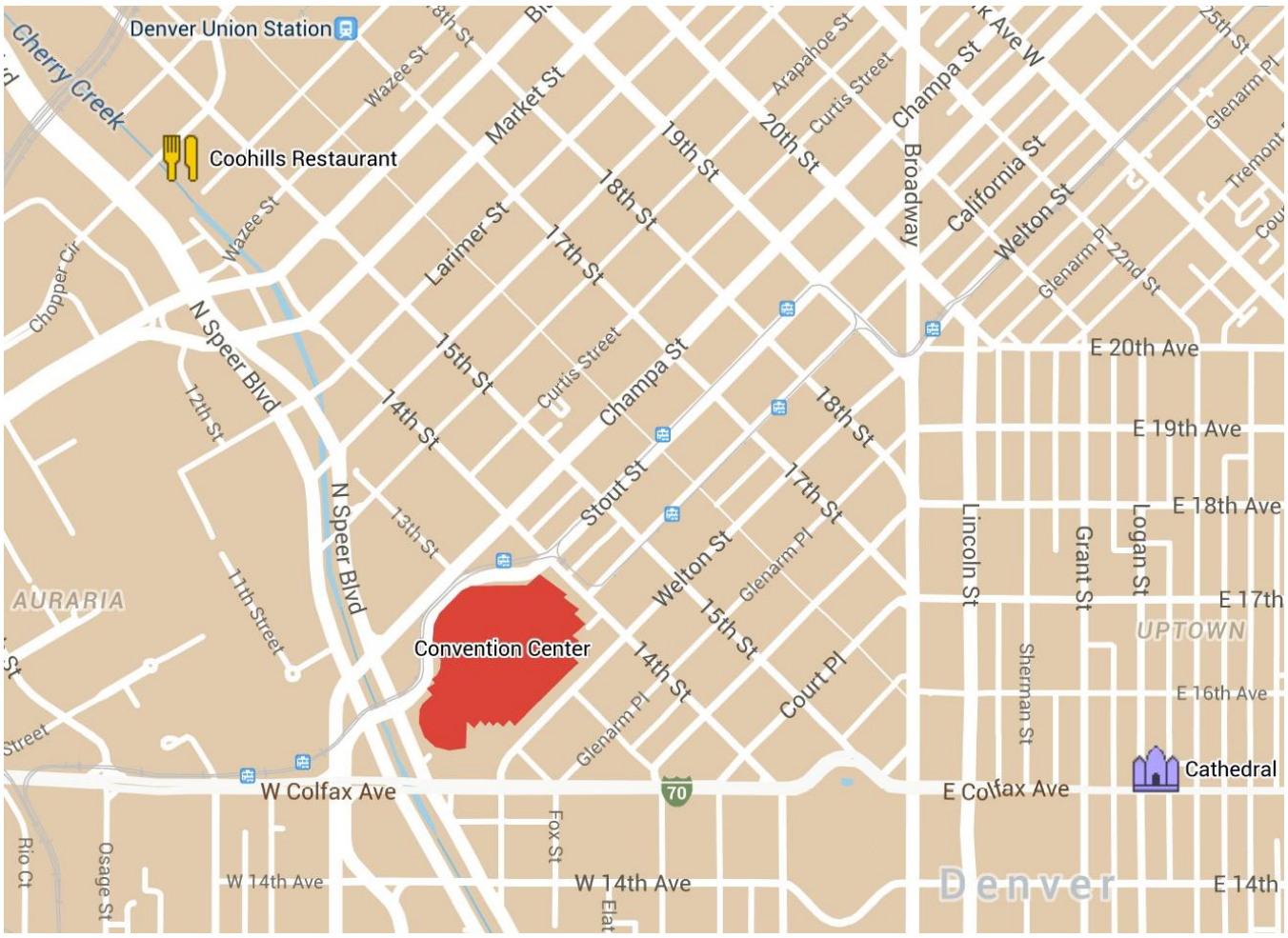
Wednesday, March 25, afternoon session – ACS Award for Affordable Green Chemistry

The Division of Cellulose and Renewable Materials is honored to be hosting a special symposium recognizing the recipients of the 2015 ACS Award for Affordable Green Chemistry. The award recipients are John Frye (Pacific Northwest National Laboratory), Todd Werpy (Archer Daniels Midland), and Alan Zacher (Pacific Northwest National Laboratory). The symposium will feature talks by John Frye and Todd Werpy.

Wednesday, March 25, 5:00 pm – CELL Division Business Meeting

The division will be holding its business meeting Wednesday evening at the Convention Center (room to be announced). All division members are welcome and encouraged to attend. This is a chance to let the executive committee hear your thoughts and ideas for the division. Refreshments will be served.

Colorado Convention Center area map



Coohills Restaurant is located at 1400 Wewatta Street.

The Cathedral Basilica of Immaculate Conception is located at 401 E. Colfax Avenue.

Upcoming Conferences

Canadian Chemistry Conference and Exhibition, June 13 – 17, 2015
Ottawa, Ontario
Website: http://www.csc2015.ca/
This conference will include a special symposium titled Frontiers in Cellulosic Materials that will bring together researcher from across Canada and around the world that are developing new chemistry and materials based on cellulose. Abstract deadline is February 16th.

TAPPI International Conference on Nanotechnology for Renewable Materials, June 22 – 25, 2015
Atlanta, GA
Website: https://www.eiseverywhere.com/ehome/99299

EPNOE International Polysaccharide Conference, October 18 – 22, 2015
Warsaw, Poland
Website: http://epnoe2015.ibwch.lodz.pl/

International Paper Physics Conference and 9th International Paper and Coating Chemistry Symposium, October 29th – November 1, 2015
Tokyo, Japan
Website: http://psl.fp.a.u-tokyo.ac.jp/distributions/IPCCS-IPPC/IPCCS-IPPC-TokyoPaper2015.pdf

International Carbohydrate Symposium, July 17 – 22, 2016
New Orleans, LA
Website: http://carb.sites.acs.org/ics2016.htm
See the special note below from the conference chair, Al French:

"July 17 – 22 2016, the 28th International Carbohydrate Symposium will be in New Orleans, with extensive involvement of CELL folks. Past Past Chair of CELL Al French is the Chair, and CELL's new Chair, Sheila Murphy is Program Chair for the meeting. Our Niki Labbé and Nikki Brown are serving on an advisory committee related to the meeting. The Louisiana Section and both the CARB and CELL Divisions will help sponsor the event, and the ACS Conference Management will be providing much of the infrastructure. The meetings have been in the USA four times already, most recently in San Diego in 1998. The most recent meeting was in Bangalore India, and the 2012 and 2010 meetings were in Madrid and Tokyo. The January timing of the Bangalore meeting was unusual, but the Tokyo and Madrid meetings each had almost 1000 attendees. We plan nine plenary lectures plus the Whistler Award (a $20,000 prize in 2014) talk. There will be some 200 other lectures in parallel sessions, plus as many posters as are acceptable. The venue will be the Marriott Hotel right next to the French Quarter, which can hold the entire meeting. Subjects will include Synthesis, Glycomedicine, Glycopharmacology, Structure, Polysaccharides, Utilization, Molecular Recognition, Biofuels, Glycomaterials, Chemical Glycobiology, Glycoinformatics, The Glycome, and Carbohydrate Enzymology. Besides the "world class" lectures, there will be a social program with an opening reception, cultural night and a banquet in Mardi Gras World. There will be an accompanying persons program, and Wednesday afternoons are free so attendees can take optional tours of nearby attractions such as plantation homes, swamps and some technically interesting places as well."