5th European Symposium on Enzymes in Grain Processing

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The 5th European Symposium on Enzymes in Grain Processing (esEGP5) was hosted by the Institute of Food Research (IFR) of Norwich, UK, at Norwich City Football Club, March 31–April 2, 2008. This series of symposiums, launched in 1996 by the Netherlands Organization for Applied Scientific Research (TNO), consolidated its position in the field through successive symposiums held by VTT (Helsinki, 1999), Katholieke Universiteit (KU), Belgium, Leuven (Leuven, 2002), and the National Institute for Agricultural Research (INRA-Nantes) (Nantes, 2005). These meetings provide a forum for researchers and technologists across academia and industry to share in recent progress, facilitate the exchange of ideas, and shape the future directions for the use of enzymes in the processing of grains.

The symposium was attended by 110 participants from across Europe, the United States, Canada, Japan, and Chile. We had seven technical sessions covering 36 talks (including 10 plenary lectures) and three poster sessions covering 40 poster presentations.

The opening of the symposium was chaired by Craig Faulds and Nathalie Juge on behalf of the Scientific and Organizing Committees, while words of welcome to the delegates were offered by David White, the director of IFR. Alphons Voragen (Wageningen University, the Netherlands) kindly offered to share with us his last working day of a very successful career by providing a valuable insight into the development of enzymes in grain processing over his career in the keynote address titled "Could it be Enzymes?"

Session 1: Cereal Breeding, Quality, and Protein Profiles

The first session was cochaired by Alison Smith (John Innes Centre [JIC], Norwich, UK) and Christophe Courtin (KU Leuven). Sam Millar (Campden & Chorleywood Food Research Association, UK) gave a plenary talk on new quantitative trait locus (QTLs) for wheat processing quality attributes as targets for wheat breeders for specific end-uses such as bread and pastry manufacturing. Christine Finnie (Technical University of Denmark [DTU]-Biosys, Denmark) delivered a plenary talk on the proteomics of barley seed tissues, especially the aleurone layer, and how isolated aleurone tissue can be used in a cell-culture-type approach to isolate and identify hydrolytic enzymes involved in germination. Further oral presentations were given by Sylviane Comparot (JIC) on altered starch from barley and its properties, Peter Koehler (Deutsche Forschungsanstalt fuer Lebensmittelchemie [DFA], Germany) on the degradation of storage proteins during grain germination, and Birte Svensson (DTU-Biosys) on the structural basis of inhibition of cereal thioredoxin, a ubiquitous redox protein involved in the modulation of enzyme activity and stability.

Session 2: EU Project Dissemination Session

Roger Fenwick (international coordinator at IFR) ably chaired this session on four EC-funded activities, describing the projects in terms of the larger European science arena. Pekka Lehtinen (VTT, Finland) described the Sixth Framework Program (FP6) integrated project in a presentation titled "Exploiting Bioactivity of European Cereal Grains for Improved Nutrition and Health Benefits (HEALTHGRAIN)." Keith Waldron (IFR) gave an overview of the FP6 Specific Targeted Research Project (STREP) in a presentation titled, "Reducing Food Processing Waste (REPRO)." Johanna Buchert (VTT, Finland) described the role and structure of the COST Action 928 in "Control and Exploitation of Enzymes for Added-Value Food Products." Kristiina Kruus (VTT, Finland) introduced the concept behind the Seventh Framework Program (FP7) project (under negotiation) DISCO in her presentation "Targeted Discovery of Novel Cellulases and Hemicellulases and Their Reaction Mechanisms for Hydrolysis of Lignocellulosic Biomass."

Session 3: Tools to Elucidate Plant Structure

Cochaired by Birte Svensson (DTU-Biosys) and Henk Schols (Wageningen University), this session explored new and emerging tools for cereal researchers. Rob Field (JIC) gave a plenary on the use of glycochip-based microarrays in identifying novel protein interactions and the complexity of de novo synthesis of a RG-II molecule involving 11 different sugars and 20 different glycoside linkages. The subsequent oral presentations were given by Sandra Hinz (Dyadic, the Netherlands) on Chrysosporium lucknowense as a microbial factory for the production of new hydrolytic enzymes for industrial applications and Brigitte Chabbert (INRA Reims, France) on differences in methods used to synthesize lignin-carbohydrate model compounds.

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Delegates sitting in the Barclay Stand, Norwich City Football Club.

Session 4: Enzyme Structure-Function Relationships

The largest of the sessions was split into two parts, the first of which was cochaired by Nathalie Juge (IFR) and Rob Field (JIC). Harry Gilbert (University of Newcastle, UK) opened this session with a plenary lecture that reviewed the structure and function of carbohydrate-binding modules (CBMs) present in hydrolytic enzymes, focusing on CBM35, which has the property to recognize side-chain substituents of polysaccharide backbones. Further oral presentations were given by Jean-Guy Berrin (Université Paul Cézanne, France) on Penicillium xylanases and their resistance to proteinaceous inhibition, Annick Pollet (KU Leuven) on the discovery of a new arabinoxylan binding site on the surface of family 11 xylanases, Ellen Fierens (KU Leuven) on the structural basis for the interaction of xylanases with a thaumatin-like xylanase inhibitor, and Maija Tenkanen (University of Helsinki, Finland) on the use of arabinose-degrading enzymes in preparing films from cereals.

The second part of this session, chaired by Craig Faulds (IFR) and Johanna Buchert (VTT, Finland), started with a plenary lecture by Stuart West (Biocatalysts Ltd., UK) on feruloyl esterases and their uses as bread improvers, destructuring agents for bioenergy production, and flavor production. Also in this session, we had oral presentations from Peter Biely (Slovak Academy of Science, Slovakia) on a novel glucuronyl esterase, Laurice Pouvreau (Wageningen University) on the inhibition of enzyme activity and glucuronarabinoxylan breakdown by acetyl groups, and by Marc van der Maarel (TNO/Groningen, the Netherlands) on how Aspergillus niger breaks down starch and utilizes the glucose for growth. This session was closed by a plenary lecture by Jan Delcour (KU Leuven), who reviewed the history of research on starch-gluten networks in bread quality and exposed his current view on the basis for the interactions involved upon bread storage, an excellent introduction to the following sessions.

Session 5: Application of Enzymes in Grain Processing (Baking and Brewing)

The first of the application sessions was cochaired by Christophe Courtin (KU Leuven) and Peter Koehler (DFA). Henrik Lundkvist (Novozymes) delivered a plenary talk on how lipases make handling dough easier while strengthening structure and providing improved volume, softness, crumb structure, and antistaling qualities in the final product. Oral presentations were given by Lutz Popper (SternEnzym, Germany) on sulphydry oxidases as an alternative to glucose oxidase in reducing rancidity and other off flavors in baked goods requiring long fermentation or lamination steps, Inge Cellus (KU Leuven) on obtaining a protein hydrolysate from brewers' spent grain with foaming and emulsification properties, and Jim Robertson (IFR) on the sequential enzymatic production of feruloylated oligosaccharides and peptides from spent grain. The session, as well as the day's program, was entertainingly rounded off with a plenary talk from Charlie Bamforth (University of California–Davis, USA) on the history of beer production and future concepts of beer-type alcohols to meet consumer demands, which pointed out that beer is the ultimate "no carb" drink since the carbohydrates should be all converted to alcohol.

Session 6: Application of Enzymes in Cereal-Based Industry (Bioenergy and Bioprocessing)

The emergence of new markets for grain processing, and thus the need for future enzyme development, was recognized in the last two sessions of the symposium. Session 6, cochaired by Alison Smith (JIC) and Craig Faulds (IFR), opened with a plenary talk by Colin Mitchinson (Genencor, USA) on what is meant by biofuels and its current development in the United States. Only a certain quantity of expected bioalcohol can be achieved from starch conversion to glucose and the remaining must come from the more recalcitrant cellulosic biomass. Better enzymes are required to prevent product inhibition, nonspecific binding, insta-

Jaime Eryaguirre (Chile) describes his poster to delegates from KU Leuven at the "Top of the Terrace," overlooking the football pitch.

bility, as well as to maintain a low cost. Oral presentations in this session included a talk from Mirjan Kabel (Royal Nedalco, the Netherlands) on the potential conversion of corn kernel arabinoxylan into alcohol and the molecular arrangements that restrict total hydrolysis and fermentation, Anne Meyer (DTU, Denmark) on the elaboration of a minimal mixture of enzyme activities for the breakdown of grain biomass using a pyramid matrix approach, and Vijay Singh (University of Illinois, USA) on how the environmentally polluting and toxic sulfur dioxide can be replaced by a process involving proteases in the wet-milling of maize, with no subsequent effect on starch yield.

Session 7: Application of Enzymes in Cereal-Based Industry (Functional Food Ingredients)

The final technical session of the symposium was cochaired by Birte Svensson (DTU-BioSys) and Jens Sorensen (Danisco, Denmark). Bob Rastall (University of Reading, UK) delivered a plenary talk on the prebiotic effects of wheat arabinoxylan and barley ß-glucans using an in vitro fermentation colon model. Other presentations included the production of calorie-free sugars, antioxidants and antimicrobial agents from starch using anhydrofructose dehydrogenases and a-1,4-glucan lyase (Shukun Yu, Genencor-Danisco, Denmark), improvements in gluten-free baking with buckwheat and oats using laccases, proteases, and oxidases (Stephano Renzetti, University College Cork, Cork, Ireland), and the results of a human 14-day intervention study on the prebiotic effects of arabinoxylo-oligosaccharides as supplement food ingredients (Christophe Courtin, KU Leuven).

Poster Presentations and Poster Prizes

Through the generous contribution of the Communications department of IFR/JIC, Norwich, two prizes were awarded for the best scientific and best communicated posters amongst the 40 displayed posters. The Scientific Committee awarded the scientific prize to Margherita Fais (JIC) for her poster titled "Glyconoparticles and SPR array imaging: towards improved ligands for a ricin sensor," which demonstrated how emerging techniques in chemistry could be applied to screen grains, grain products, and enzymes involved in grain processing. The communication prize was awarded to Emilia Selinheimo (VTT, Finland) for her poster titled "Enzymes as a tool to characterize cereal flavor and chemistry," which had a clear layout that highlighted the clarity of aims leading to the conclusions, acknowledgments of funding sources, the inclusion of a handout, lack of technical jargon, and clear relevance of the submitted abstract to the final poster.

Symposium Dinner

We held the symposium dinner at the Assembly House, a beautiful Georgian Grade I-listed building built in its current form in 1754 and located in the heart of the city. It was previously used as the House of Assemblies for the gentry of Norwich. On arrival, delegates were entertained over a glass of punch by a string quartet playing a variety of classical pieces. Further entertainment was provided in the form of a fire alarm after the first course, but it was proven to be a false alarm and dinner was quickly resumed. Each table had as a center piece a decoration of wheat sheaves corresponding to a variety with historical pedigree. For example, we had one of the oldest UK traceable varieties, Red Lammas dating from 1660s, and Yeoman, one of the first artificially bred varieties in the UK incorporating Canadian bread-making properties with a UK adapted variety.

Delegates enjoying the symposium dinner at the Assembly House, Norwich. The table decoration of wheat sheaves was provided by Mike Ambrose (JIC, UK). Each table had a different variety of wheat that had a historical story behind its development.

Participants were extremely enthusiastic with the technical program of esEGP5, which provided a multidisciplinary platform to those working on enzymes in grain processing and recognized the friendly and high-spirited atmosphere contained in the esEGP series. Several applications to host the next esEGP were submitted to the Scientific Committee, who reached a decision and announced that esEGP6 will be held in Denmark in 2011. Further information will be posted on the conference website, so keep checking http://www.ifr.ac.uk/esegp5/!

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