

ProSafeBeef 4th Annual General Assembly

**Aberystwyth, Wales, UK
5-7th October 2010**

ProSafeBeef hosted a conference on *“Improving the quality and safety of beef and beef products for the consumer in production and processing”* summarising the most recent research findings from the project.

The annual meeting included oral and poster presentations outlining recent project outputs in the areas of risk assessment, pathogen control, novel beef products and processes and consumer attitudes to beef safety and novel technologies. On Wednesday 6th of October there was a half day beef industry workshop displaying technologies and innovations arising from the project, with practical demonstrations, presentations and

an opportunity for stakeholders to interact with the researchers. The conference took place in the William Davies Building, Institute for Biological, Environmental and Rural Sciences, Aberystwyth University.

The next newsletter, due out by the end of 2010, will have a special focus on this *ProSafeBeef* event and will report on the emerging research and technologies presented at this conference.

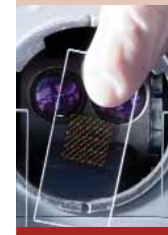


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System for predicting beef quality



Dr Jean-François HOCQUETTE

Director of the Herbivore Research Unit, INRA-Centre de Clermont-Ferrand

Dr Jean-François Hocquette, Director of the Herbivore Research Unit at the INRA Research Center of Clermont-Ferrand, and leader of ProSafeBeef Workpackage 3.4, describes the research work he is involved in on predicting beef quality.

Prediction of the sensorial quality of beef offered to consumers raises a number of scientific questions which have been the subject of many studies in various

countries over the past few decades. Many different approaches, whether genetic, biological, zootechnical, technological or socio-economic have been developed to better understand consumer expectations and meet them as best as possible.

The Meat Standards Australia system

The Meat Standards Australia (MSA) system to predict beef quality for the consumer has been developed since 1996 by Australian beef professionals under the auspices of MLA (Meat and Livestock Australia), which is a semi-public organisation involving public authorities and professionals entrusted with development activities in Australia to promote ruminant production. Based on thousands of sensory analyses by consumers, the MSA system predicts the quality level (mainly with respect to tenderness) of each part of the carcass, depending on how long it is aged and the cooking method chosen. Statistical analyses were carried out to identify the critical control points of beef palatability indicated in individual muscles, and to identify a specific cooking method from animal characteristics before and after slaughter and also from ageing time. The success of this programme is notably

due to standardisation of the protocols and the accumulation of large amounts of data over the years, which have been the subject of powerful statistical analyses in order to establish general laws allowing the main factors concerning beef quality to be identified.

Various other countries have tested, or are testing, the MSA programme: Korea, USA, Japan, Northern Ireland and particularly the Republic of Ireland, where the researchers are coordinators of the ProSafeBeef programme. The individuals questioned in France recognize the quality factors of the MSA system. It is relevant, complete, significant and original in its conception, innovating towards the suggested segmentation of the beef market, without being prescriptive in regard to the factors that affect beef quality. It is also credible, flexible and open ended, but it does have some limitations. It was developed in Australia at the farmer and abattoir level, but the final delivery of precise quality grades to consumers is still lacking. Its adaptability to France

would be difficult due to the complexity and the specificity of the French beef industry and market. However, the program is uniquely innovative and deserves consideration. It could facilitate awareness, and could induce the essential changes for the preservation and development of the European beef sector.

European beef quality data

Besides this approach, French scientists and professional partners together with European partners of the ProSafeBeef programme have gathered all the data that has been accumulated on animals and muscle biology over many years. The BIF-Beef (Biology which is Integrated and Functional for Beef) data warehouse, a large volume database of documented data, proposes to link the available phenotype data relating to muscle tissue characteristics and beef quality. As of March 5th 2010, the BIF-Beef data warehouse contained 296,140 measurements (including 15,764 measurements related to animal growth) for 637 variables. Measurements were obtained on eight muscles from 5,175 animals (females, young bulls, steers) belonging to 20 different breeds, in various experiments conducted over a period of more than 10 years. Pooling this data showed just how difficult it is to combine data from different sources. For the same variable, there are two major and distinct sources of

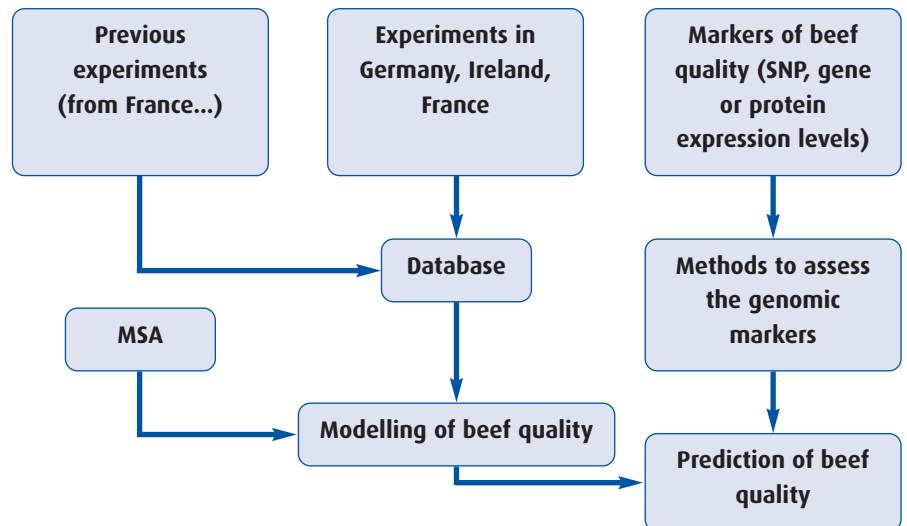


dissimilarity: (i) different modes of expression (per g tissue or per g dry matter) or different scales (ii) different measurement conditions (shear force is a very good example of this type of problem since it can be measured at different days after slaughter on raw beef or after cooking either using a grill at 55°C, or in a water-bath at 80°C).

It is now becoming clear that researchers need frames of reference for the measurement of meat and muscle quality, using standardised and reproducible methods. This underlines the need for an ontology system to better define the phenotypic variables of interest. An international initiative entitled "Animal Trait Ontology" has commenced to help address this. The INRA Research Centre has begun to create a consortium that represents the relevant livestock communities to develop, maintain, and update relevant ontologies. One of the goals of this consortium is to make the comparison of information between species and between laboratories easier. Besides these limitations, work has been conducted using the data in the BIF-Beef database analysing the relationships between flavour and intramuscular fat content.

Predicting the quality of beef

Beef is characterized by a high and uncontrolled variability of its quality which is one reason for consumer dissatisfaction. Therefore, the beef industry is in search of muscular markers to predict the ability of animals to produce high quality beef. Thanks to the development of genomics, some recent research has allowed the identification of markers for muscle growth potential of bovines, for marbling and tenderness of beef, and for traceability of grass-based systems. New tools (DNA or protein chips) have been developed, or are in development, to assess a large number of these markers simultaneously. The results obtained so far highlight how genomics research has made huge



Overview of the research conducted in ProSafeBeef (workpackage 3.4) on the prediction of beef quality

progress in recent years, particularly in cattle. In genetics, the completed bovine genome sequence together with the release to market of high-throughput genotyping chips will help the discovery of genetic markers for beef quality and the development of marker-assisted selection and of "genomic selection". For further information see the article 'Functional genomics and new markers for beef production' in this issue.

Meanwhile, physiologists have published lists of muscle genes that are regulated by farming-related factors or are correlated to meat quality. All of the most important genes have been listed, and a private French company proposes to analyse bovine muscles to better predict beef quality from gene expression.

The difficulty is that beef tenderness is a complex trait that is the result of complex and multifactorial processes. In practice, genomic markers of beef quality (DNA markers or gene expression levels) are often breed-specific and highly dependant on rearing practices, animal type (steer, bulls or females) and environmental conditions. However, the expression of heat shock proteins or those linked to specific muscle metabolic pathways (proteolysis, fat metabolism, etc) was often found to be associated with beef tenderness.

In conclusion, research work to predict beef quality has developed by three main approaches, which it is possible and desirable to bring together:

1. "Omics" techniques will make it possible to establish many interactive associations between breeds, rearing practices and the quality of beef, thanks to the vast number of genes, proteins or metabolites analysed simultaneously.
2. Modelling and integrative biology approaches are developing rapidly, and sometimes result in decision-aid tools that can be used at beef chain level, as is the case in Australia.
3. Modelling can also be used in genetics and physiology for a better understanding of muscle biology in order to better predict beef quality from muscle characteristics (muscle fibres, connective tissue, intramuscular fat, proteolysis during ageing, etc).

These three approaches come together in that genomic data enriches the integrative approaches, and the integrative approaches, based on multiple-criteria models, are best able to meet consumers' expectations, and hence to reconcile the economic, social and quality requirements.

Functional genomics and new markers for beef production

Dr Jean- François Hocquette, Director of the Herbivore Research Unit at the INRA Research Center of Clermont-Ferrand describes his work on functional genomics and muscle markers that can be used to predict meat quality.



The INRA Research Center of Clermont-Ferrand

The quality of beef depends on both *post mortem* factors linked with ageing and cooking, as well as the muscle characteristics of the live animal, which are determined by gene expression. Beef quality is often highly varied and uncontrolled, which frequently causes consumer dissatisfaction. As a result, the beef industry is in search of muscular markers that can be used to predict the ability of animals to produce high quality beef. Techniques that examine gene functions and interactions can be used to study gene expression in muscle to identify these markers.

Markers of marbling, tenderness and muscle growth potential

Gene markers that can identify an animal with a high potential for accumulating intramuscular fat (therefore producing marbled meat) have been found in certain Japanese and Australian breeds. The expression of other genes, such as the genes *NAT1* and *ICER* associated with intramuscular fat

content, has been investigated in a variety of breeds that have not previously been thought to play a role in fat accumulation within muscles.

Although tenderness is regarded as a high priority quality attribute for beef, there is still no simple, reliable and reproducible reference technique to predict it. The expression of genes coding for anti-apoptotic proteins, such as *DNAJA1* and *HSPB1*, has been found to be low when the *post mortem* tenderness of meat is high.

Therefore, a high expression of these genes would have a negative impact on the *post mortem* tenderization of meat, as their increased expression may slow down the processes of cell death, and as a result, meat ageing. However, it may be that there is not one marker of tenderness for all breeds, as the expression of potential markers has been shown to differ between breeds.

Some European countries, including France and Belgium, are more concerned with genetic selection of cattle in favour of high muscle development rather than marbling and tenderness, which leads to increased meat production and produces leaner carcasses.

Traceability of grass-based systems

The traceability of an animal's production system is one of the many factors becoming increasingly important to beef consumers. The impact of two different production systems, pasture and maize silage indoors, has been investigated on muscle gene profiles in cattle.

Cattle grazing in pastures were found to have muscles with more oxidative characteristics and a lower expression of selenoprotein W, compared to those fed maize silage indoors. It is not yet known what metabolic function selenoprotein W has, however it is likely to be involved in protection against oxidants.

Studying gene expression in muscle has revealed that unsuspected genes may be potential molecular indicators of muscle mass and sensory attributes or marbling of meat. Modifying these indicators could increase beef quality. Various tools in biotechnology, such as a DNA or protein chip, are being developed to routinely and simultaneously assess all the genes known so far to be involved in beef quality. As well as this, work is also underway to look for genetic mutations (Single Nucleotide Polymorphisms (SNPs)) in these genes.

A large amount of data will be obtained through studying these genes, which will then need to be stored in appropriate databases and interpreted by association with phenotypic observations, in order to make the most of this data. Australian researchers have developed the most comprehensive, predictive meat quality grading system, the Meat Standards Australia (MSA) system, available to date. For more information on this, see article 'System for predicting beef quality' in this issue. The creation of an equivalent system is an objective of the ProSafeBeef project.



ProSafeBeef technology transfer training session

Tenderness development factors and improving added-value

This training session took place in Warsaw, Poland, on 16th-17th July 2009. Twenty-five participants from 18 meat companies attended the training session. The trainers were representatives from IRTA and ADIV. Professor Ryszard Kowalski, (*ProSafeBeef* partner from the Agricultural University of Poznan, and the local contact for the project) gave a presentation of the *ProSafeBeef* project to the attendees.

The program included both theoretical and practical components. On the first day, attendees heard presentations focusing on basic meat technologies, the impacts of the slaughtering process on beef meat tenderness, and the methods and techniques to optimize tenderness of beef muscles. This was followed by a muscle profiling demonstration on a beef forequarter and hindquarter on day two. It is hoped the information given will help the attendees improve the quality of their beef meat products, especially the ones they export.



Muscle profiling demonstration

Good practices in slaughterhouses

This training session, held on 29th and 30th September 2009 in Belgrade, Serbia, was given by trainers from France (ADIV) and Norway (NOFIMA) and local partner Professor Sava Buncic (University of Novi Sad) and his three PhD students who are working on Pillar 2 topics (reduction of beef carcass contamination).



Belgrade, Serbia

Twenty delegates attended this two-day event. The first day focused on the impacts of the slaughtering process on beef meat quality with presentations on beef meat quality factors, impact of the slaughtering process on beef meat

tenderness, methods and techniques to optimize the tenderness of beef muscles, and safety qualities and slaughtering processes. The second day focused on ways to stop or reduce contamination of beef carcasses and included

presentations on equipment and process choices, risk analysis in the framework of the HACCP concept, workers know-how, cleaning methods and research and methods of carcass decontamination. Although there was no practical demonstration during this training session, a specific demonstration day to present techniques to measure or to reduce contamination in slaughterhouses should be organised next year.

ProSafeBeef partners are invited to contact Catherine Souty-Dametto by email (catherine.dametto@adiv.fr) if they would like to propose a training session to be organised in their country.



Training Exchange Programme

From Poland to New Zealand

As part of ProSafeBeef, students working on the ProSafeBeef project at the many universities involved in the project are given the opportunity to undertake a student exchange placement. Here, Kinga Wiczorek, a student who has completed this exchange talks about her experiences.



Kinga Wiczorek

What was your background prior to going on the exchange programme?

I am a microbiologist working at the Department of Hygiene of Food of Animal Origin of National Veterinary Research Institute in Pulawy, Poland, with responsibility for microbiological examination of food of animal origin. My main interest and experience is detection, identification and differentiation of *Campylobacter* spp. by standard and molecular methods, especially polymerase chain reaction (PCR)-based techniques. I also have experience in a range of molecular biological methods, including DNA extraction and purification methods, PCR, typing methods such as Pulsed Field Gel Electrophoresis (PFGE), cloning and sequencing.

What is your role in the ProSafeBeef project?

My role involves the detection of *Listeria monocytogenes*, *Salmonella* spp., *Campylobacter* spp., and VTEC in the food chain using the ISO standard

methods with some modifications and molecular approaches. I also worked on the identification of putative virulence genes, determination of susceptibility of the recovered strains using MIC methods and Sensititre® system and molecular serotyping of *L. monocytogenes* and VTEC isolates.

Where did you visit during your exchange?

I attended the Institute of Environmental Science and Research (ESR), Christchurch Science Centre, Christchurch, New Zealand.

What did you do on your exchange programme?

The objectives of my training period were to:

1. Generate more knowledge and experience regarding the molecular methods for typing.
2. Characterization of bacterial isolates such as *Campylobacter* spp., *Salmonella* spp. *Listeria* spp., and VTEC.
3. Examine relationship between bacterial isolates from New Zealand and Poland.

What did you learn from the programme? How do you feel this will help you in your future career?

This training gave me a great opportunity to improve my laboratory skills and knowledge about molecular typing methods used for food-borne bacteria, especially *Campylobacter* spp. During my training period I generated

more knowledge and experience regarding the molecular methods for typing of *Campylobacter* and detection of several genotypic pathogenic markers as well as determination of a clonal relationship of the isolates tested. The molecular procedure of differentiation of *Campylobacter* – the P-BIT typing system, may be used for a routine diagnosis as well as determination of a clonal relationship of these thermotolerant bacteria, important from food safety and consumer health protection points of view. I would like to implement this new method in my laboratory for determining the relatedness among isolates and molecular epidemiology analyzes. I am also planning to use this method for investigation of the route of the infection with these microorganisms, important from both food safety and consumer health protection points of view. The findings could be very useful for reinforcing the importance of the adequate cooking of meat and good hygiene to avoid cross-contamination. I hope that this kind of information is especially important for meat producers and consumers because infection with food-borne pathogens in meat represents a substantial risk to human health.

Opportunities for new exchange programmes

Proposals for training and exchange programmes within ProSafeBeef can now be made at any time. If you would also like to enjoy the benefits of an exchange programme please contact Catherine Souty-Dametto by email (catherine.dametto@adiv.fr) for further details.

Upcoming events: dates for the diary

Food and Beverage Test Expo

8th – 10th February 2011

Cologne, Germany

The Food and Beverage Test Expo will be held from the 8th to the 10th February 2011, at the Koelnmesse exhibition centre in Cologne, Germany. This trade fair will provide information on a full range of test and evaluation technologies, solutions and services, ranging from nutritional analysis and food composition, authenticity and origin testing, to microbiological testing, GMO detection, allergen testing, vitamin testing, food irradiation testing, residue and contaminant testing at all levels.

For more information please visit:
<http://www.foodtestexpo.com/index.php>

Food Integrity and Traceability Conference

21st – 24th March 2011

Queen's University, Belfast, Northern Ireland.

The Food Integrity and Traceability International Conference will be held from the 21st to the 24th March 2011 at Queen's University Belfast. The conference will focus on three key themes: reviewing recent progress in delivering safe and authentic food to the consumer; identifying the greatest current and emerging threats to the integrity of the agri-food supply; and delivering new analytical means of verifying the integrity of the agri-food supply chain.

For more information please visit:
<http://www.qub.ac.uk/sites/ASSET2011/>

57th International Congress of Meat Science and Technology (ICoMST)

7th – 12th August 2011

Ghent, Belgium

The 57th International Congress of Meat Science and Technology (ICoMST) will be held from the 7th to the 12th August 2011 at Ghent University, Belgium. ICoMST is the annual forum for the international exchange of new scientific ideas in meat science and technology. The key theme of the 2011 ICoMST is 'Global challenges to production, processing and consumption of meat'.

For more information please visit:
<http://www.dda.ulg.ac.be/documents/pdf/57thICOMST.pdf>

62nd Annual Meeting of the European Association for Animal Production

29th August – 1st September 2011

Stavanger, Norway

The 62nd Annual Meeting of the European Association for Animal Production (EAAP) will be held on the 29th August to the 1st September 2011 in Stavanger, Norway. The conference programme will cover all aspects of scientific achievement within animal production, including animal genetics, physiology, nutrition, management and health.

For more information please visit:
<http://www.eaap2011.com/>

7th International Conference on Predictive Modelling of Food Quality and Safety (ICPMF7)

12th – 15th September 2011

Dublin, Ireland

The 7th International Conference on Predictive Modelling of Food Quality and Safety (ICPMF7) will be held from the 12th – 15th September 2011 in Dublin, Ireland. This conference will bring together leading academics, research scientists and food professionals who are currently developing and using simulation and optimisation tools to enhance the quality and safety of food. It will highlight the diversities, commonalities and future challenges that we face as predictive modellers in food. The conference will include plenary sessions by high profile international speakers, opportunities to present original research and a comprehensive social program. A separate optional workshop will also be held on the 16th September 2011, following the conference, focusing on predictive modelling applications and the use of powerful software tools.

For more information please visit:
<http://www.eventelephant.com/pmf7>

A note from the dissemination team

Welcome to the 6th ProSafeBeef Newsletter!

Project partner British Nutrition Foundation (UK) and Coordinators Teagasc Ashtown Food Research Centre (Ireland) lead dissemination practices within the project. Due to phenomenal interest in the project and our work this year we have increased the number of annual newsletters to three keeping all partners, stakeholders and interested parties updated on the progress and exciting knowledge's and technologies emanating from the project, together with news and key events related to the European beef industry.

Perhaps you can help us achieve this goal by informing us of any interesting news stories or research findings relating to the *ProSafeBeef* project. If you want to spread the word about the work you are involved in within *ProSafeBeef* (research, training, events, meetings...) or have some interesting research findings or experiences working on the *ProSafeBeef* project. We would love to hear from you! With your help we can make the newsletters and *ProSafeBeef* website even more interesting and informative!



BNF team: (left to right) Áine O'Connor, Sarah Coe and Laura Wyness

Please contact Laura Wyness at the BNF (l.wyness@nutrition.org.uk).

ProSafeBeef, Advancing Beef Safety and Quality through Research and Innovation: European Framework Programme 6: (FOOD-CT-2006-36241)

More Information

For more information on ProSafeBeef please visit our website at www.prosafebeef.eu or contact Robert Mooney, Project Manager, at robert.mooney@teagasc.ie.

ProSafeBeef is an Integrated Project coordinated by Dr. Geraldine Duffy at Teagasc, Ashtown Food Research Centre, supported under the 6th Framework Programme of the European Union. It involves 41 leading research and industrial organisations working in 18 different countries. *ProSafeBeef* is a five year project which commenced on March 1st 2007.



Ashtown Food Research Centre

